Foundations of Learning and Instructional Design Technology

Historical Roots and Current Trends

Richard E. West
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I am also grateful to the authors of the chapters, particularly those who authored new chapters for this book, because without quality content, there could have been no book.

Finally, I acknowledge the wonderful contribution of students in the Brigham Young University Instructional Psychology and Technology program who contributed author biographies, graphical elements, and other additions to the book. In particular, credit for the design of the book cover goes to Jon Thomas.
Introduction

Like most, I had a serendipitous beginning to my career in this field. I knew I loved to teach but did not know what subject. I loved to read and study theory as a literature major but did not want to spend my life writing another literary analysis of Chaucer. I loved to write as a former newspaper reporter and use visual design technologies to lay out newspapers but knew that was not quite right either. What was the answer? Luckily for me, a colleague mentioned instructional design, and I jumped feet first into a field that I knew very little about.

I’ve learned over the years that my experience is more common than not, as there is not “a proper way” (see Lloyd Rieber’s Peter Dean lecture, republished in this book) to come into this field. People with a wide rainbow of academic and professional backgrounds come into this field and leave to occupy a similarly wide variety of employment options. For this reason, many have called our field a “meta” field that is integrated into many other disciplines. For what could be more ubiquitous than the need to educate? And where there is education, there must be designers to create it.

Because we work in a meta-discipline, editing a book on the “foundations” of the field is very difficult. No matter how many chapters are included, inevitably there will be important topics left out. For this reason, curious readers are recommended to seek out any of the other excellent foundation textbooks available, including the following:

- Trends and Issues in Instructional Design and Technology [https://edtechbooks.org/-Rfx](https://edtechbooks.org/-Rfx) (Reiser and Dempsey)
- Foundations of Educational Technology [https://edtechbooks.org/-pX](https://edtechbooks.org/-pX) (Spector)
- The Instructional Design Knowledge Base [https://edtechbooks.org/-Eam](https://edtechbooks.org/-Eam) (Richey, Klein, and Tracey)

I repeat, this book will not cover everything a student in the field should know. No book will. What I do hope, however, is that this book will provide enough of an overview of the key topics, discussions, authors, and vocabulary in the field that you will be able to start navigating and understanding other books, articles, and conference presentations as you continue your educational journey. I also hope to spark an interest in studying more on any one of these topics that may be interesting to you. There are rich bodies of literature underneath each of these topics, just waiting to be explored.

What’s in a Name?

Scholars disagree on what we should even call our field. In the textbooks I mentioned above, our field is called educational technology, instructional design, and instructional design and technology. My academic department is called the Department of Instructional Psychology and Technology, although it used to go by the Department of Instructional Science. In this book I have sought for what I considered to be the most inclusive name: learning and instructional design technology (LIDT). I chose this also to emphasize that as designers and technologists, we not only affect instruction but also learners and learning environments. In fact, sometimes, that may be our greatest work.
Organization of This Book

This book reflects a suggested strategy for teaching new graduate students in the LIDT field. First, the book begins with definitions about what the LIDT field is. Second it surveys some key historical concepts that lay the foundation of the field, including an overview of learning theory and some brief history of the LIDT field and of the Association for Educational Communications Technology (AECT)—a main professional organization for the field. This section also provides some key concepts in design, programmed instruction, and instructional media.

The third section of the book focuses on current trends and issues, using the concept of “current” fairly liberally. Here we review topics such as the learning sciences, online learning, design-based research, K-12 technology integration, instructional gaming, and school reform. The fourth and fifth sections of the book I consider to represent the future of the field—or the future of you, the student just beginning your career! You are the future of the field, so this section of the book is dedicated to you. In it, you will find chapters related to successfully navigating graduate school, launching your career, and integrating yourself into the professional community.

Online vs. Print Version

Some people like to read online; others do not. For that reason this book is available as a pdf download and soon print on demand. However, the book is too large as a pdf download, so some chapters are only available in the online version. Usually I made this choice if a chapter was much too long (the national educational technology plan by the U.S. Department of Education) or if I felt the chapter was partially duplicated by another. Most of the core chapters remain in the pdf version, but be aware that there are additional readings available in the online version.

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Remixing Book Content

As an open book, my assumption was that other instructors might remix the content to fit their course. Readers may notice that there is a strong Brigham Young University influence in my version of the book, and other departments may want to emphasize their departments in versions of the book for their students. In fact, I believe it is good for students to become well acquainted with the foundations of their own department, and the current trending topics among their own faculty.

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Reflection

What do you hope to learn from this textbook? Write down any questions you have about the field and as you read through the chapters, note any answers you may have found or add any additional questions.

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I have enabled web annotation, commenting, and highlighting through Hypothes.is [https://web.hypothes.is/]. Sign up for a free account, and then notice the options in the upper right of the web book, which allow access to the Hypothes.is features.

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Contribute Chapter Resources

To contribute a resource to a chapter (e.g. multimedia element, quiz question, application exercise), fill out this survey [http://bit.ly/LIDTChapterResources].
List of Authors

Following is the list of authors for chapters in this book, with their most recent known affiliation.
I. Definitions and History

The ritual is a common one, every fall semester. Students knock on my door, introduce themselves as interested in studying Learning and Instructional Design Technology for a graduate degree, ask how they can prepare themselves. Should they study psychology for their undergraduate degree? Education? Sociology? Media and technology? Research methods? Design of some sort?

The answer would be, of course, yes! But this does not mean one must know everything to be successful in LIDT. Rather, this means that there are many successful and “proper” paths into our field. Lloyd Rieber explains this very well in his Peter Dean Lecture essay that is the first chapter of this section and book. I find that this essay often puts students at ease, explaining that whatever their path might have been, they belong in the field.

This section also includes several chapters on the history of the LIDT field. Because the field of LIDT could be defined broadly, any aspect of the history of education and learning could be considered a history of this field. However, there is generally consensus that the field of LIDT began in earnest with the development of digital technologies, programmed instruction, and systemic thinking, and then grew to include newer developments such as the learning sciences and evolving perspectives on teaching and learning. These points of view are reflected in these chapters, but students are encouraged to think about the history of the field more broadly as well. What perspectives are not included in these historical chapters that should be? What other theories, ideas, and voices helped to form a foundation for how we look at the field of LIDT?
The Proper Way to Become an Instructional Technologist

Lloyd Rieber

Editor's Note

In 1998, Rieber was invited to give the 1998 Peter Dean Lecture for AECT and later published his remarks on Rieber's own website [https://edtechbooks.org/-An]. It is republished here by permission of the author.


Prologue

I wrote this essay to support my Peter Dean Lecture at the 1998 AECT convention. The invitation to present this lecture came only several weeks before the scheduled presentation at AECT. Consequently, there was little time to put these ideas into written form for the ITFORUM discussion [http://it.coe.uga.edu/itforum] that traditionally follows this lecture. Interestingly, though the lecture and discussion have long past, I have not felt it necessary to revise the essay. Despite the fact that it lacks the “scholarship polish” of a refined work, I think it still captures well my thoughts and feelings that I initially struggled to organize and convey. I presented my essay and conducted the ITFORUM discussion in the spirit of sharing some ideas as works in progress. I think this is a style that takes full advantage of electronic media—to offer a set of ideas that lead to more questions than answers and to engage a group of thoughtful people in a discussion of the ideas to tease out what is and is not important.

The purpose of the Peter Dean Lecture, as I understand it, is to choose someone who has been around long enough to appreciate the struggles of the field and to give that person the opportunity to give a critical analysis of where we are and where we might go. This presents a nice opportunity, but a presumptuous one in my opinion, for the person chosen. Are my experiences and points of view a valid cross section of the field? Obviously not. Nevertheless, I used this opportunity to speak to some issues that interest and concern me, in the hope that they might trigger some reflection and comment—I still hope that is the case for those who now happen upon this essay.
Introduction

The inspiration for the topic of my AECT presentation and this essay comes from an article published by Robert Heinich in 1984 called “The Proper Study of Educational Technology.” At the time I first read the article (around 1986), its title rubbed me the wrong way. There was something unduly pretentious about it—that there was, in fact, a proper study of instructional technology (IT). When I first read the article, I must admit that I incorrectly interpreted it. Heinich warned strongly against the “craft” of IT which I wrongly interpreted as “art.” I have long been sensitive to our field disavowing the artistic side of IT and instead overemphasizing, I felt, its scientific aspects. Having just reread the article, I am very impressed with how forward looking Heinich’s thinking was at the time, especially regarding the role of research. The purpose of this essay, therefore, is not to take issue with Heinich’s ideas, but to use them to motivate another question: What is the proper way to become an instructional technologist?

Many would quickly argue that the proper way is to go to a university and get a degree in IT. This reminds me of the scene from the Wizard of Oz in which the wizard tells the scarecrow that he has as much brains as anyone else, but what he needs is a diploma to prove it. (L. Frank Baum was no stranger to sarcasm.) Of course, there is definitely a formal side to getting an education in our profession, but I believe that the best of our field have learned that our theories and models must be grounded in the actual context of the problem. More about this later. I have also long been struck by the many paths taken by people who now find themselves called instructional technologists. Our profession consists of individuals with an amazing diversity of backgrounds, goals, and education. It is also common for many people to say they didn’t even know the field existed until they were already a practicing member of it.

Take my background, for example. I started off my undergraduate education as an engineering student. In the summer of my freshman year, I traveled in Latin America working with several youth groups. The experience convinced me that I didn’t want to become an engineer, but instead I wanted to know more about the complexity of people and their cultures. I took several paths from there, at one point actually completing the paperwork to declare a major in anthropology. I came to the education field most unexpectedly. I eventually became an elementary school teacher—trained in a large urban university in the northeast of the USA, but got my first job in a very small rural school in the American Southwest (New Mexico). This was 1980 which, coincidentally, was about the time that desktop computers were introduced into mainstream education. I found myself thrust into a position where technology, education, and different cultures were rapidly mixing.
In a lot of ways, this was perfect position for a person like me. There were few formal ideas in force about how to use computers in education (at least in my district) and the school administration actually encouraged “early adopters” such as myself to explore different ideas and take some risks. I later discovered, when I entered graduate school, that many of the things I had learned on my own in those years about technology, instructional design, and learning theory actually had formal names in the literature (one example is the concept of rapid prototyping).

Elementary school teachers are, as a group, very sensitive to the student point of view (though don’t take this as an insult to other groups). It’s just that the complexity of domains (e.g. math, science, language arts, etc.) is not as demanding to the adult as they are to the student. Consequently, the adult teacher is somewhat freed from the demands of the content, but forced to consider what it must be like for a 10 year old to learn something like fractions. Most elementary school teachers are also faced with teaching a broad array of subjects, so the concept of integrating subjects in meaningful ways is familiar to us. ( Heck, I also taught music—the elementary school was one of the few places where my accordion was truly appreciated!) My education to become a teacher was heavily rooted in Piagetian learning theory, so it is easy to see how I came to use LOGO with students and to understand the facilitative role it demanded of teachers. In hindsight, I can’t think of a better place than the elementary school classroom for me to have received my first education as an Instructional Technologist. (“Holmes, my good man, what school did you attend to become an Instructional Technologist?” “Elementary, my dear Watson, elementary.”) I wonder how many of you have backgrounds exactly like mine. Few, I wager. So, while studying engineering and culture, traveling, followed by being an elementary classroom teacher in a context where technology was introduced with no training was the proper way for me to become an instructional technologist, I know it is a path not to be exactly duplicated by anyone.

**Instructional Technologist as Computer Scientist**

Heinich’s article discusses the frustration of IT being considered a service arm of education. Our role, to many people outside the field, is to “connect the pipes” and to fix the machines. The advent, growth, and semi-dependency of education on computing has reinforced this position in many ways. Let’s face it, most people outside our field equate us—and respect us—for our mastery of technologies such as the computer. So, perhaps the proper way to become an instructional technologist is first to become a computer wizard, that is, to master the tools first and to assume that the knowledge of how to apply the tool in education will come merely as a consequence. However, I like to point out that “A power saw does not a carpenter make.” Owning a power saw coupled even with the knowledge of how to use it safely to cut wood does not make one a carpenter. For example, consider the contrast between two carpenters who appear on American public television shows—Roy Underhill and Norm Abrams. For those of you not familiar with these two, Roy appears on *The Woodwright’s Shop*, a show dedicated to preserving carpentry skills practiced before the advent of electricity. In contrast, Norm Abrams, a self-professed power tool “junkee,” appears in *This Old House* and *The New Yankee Workshop*. Despite their different approaches and attitudes to the use of technology, I’m quite sure that both would thoroughly enjoy the other’s company and wile away the hours discussing what they both love best, namely, carpentry. However, despite my respect for Roy’s skills and philosophy, when I try my hand at even mid-size woodworking projects, such as building a patio deck or storage shed, you can bet that I prefer to use the power tools available to me. Likewise, in education, I prefer to take advantage of the opportunities that the available “power tools” afford, such as the computer. But underlying it all, is a profound core of, and respect for, the essential skills, strategies, and experiences akin to those possessed by the master carpenter.
Instructional Technologist as Philosopher

Has anyone else noticed how much of our literature in recent years has been devoted to philosophy? So, perhaps the proper way to become an instructional technologist is to become a philosopher and first unravel the mysteries of what it means to “be” and what it means to “know.” The field seems quite preoccupied with uncovering if there is a “real” world or whether reality exists solely in the mind of the individual. I have come to the conclusion that Instructional Technologists are not well equipped to handle philosophical problems such as these and question if it is a good use of our time.

The debate between objectivism vs. constructivism, though a healthy and necessary one, has also had the tendency for people to believe that there is a “right answer” to what their philosophy “should be.” It’s almost as though they were taking some sort of test that they need to pass. I suppose most just want to be associated with the dominant paradigm instead of digging down deep to better understand their own values, beliefs, and biases. I’ve also noticed it is in vogue to question others about their philosophical camp, not in order to enter into a dialogue of how one’s philosophy informs one’s design, but more to sort people in a convenient manner. (This resembles to me how Dorothy was questioned by Glinda: “Are you a good witch or a bad witch?” The answer, of course is “Why, I’m not a witch at all.”)

Don’t mistake my meaning. I believe strongly in each professional developing a strong philosophical stance (I myself have tried to do so in several places, such as Rieber, 1993). It’s just that we have tried, at times, to misapply the business of philosophy or to try to tackle philosophical questions that have remained unresolved for thousands of years. There are productive uses for philosophy in our field, but there is the danger of sliding into philosophical quagmires, or worse, trying to use philosophical positions to inappropriately judge people. (Click here for an example of a little exercise I like to use in some of my classes that gets at the importance of considering one’s philosophical points of view.)

Not being a philosopher, I have found it difficult to effectively raise and lead discussions on philosophical issues in my classes. I had always joked about wanting some sort of simulation that embedded these issues in a way that one could “experience” them rather than just talk about them. You know, something like ‘SimCity’ or ‘SimLife.’ Wouldn’t it be great, I thought, to also have a similar simulation to help one play with these complicated issues as well as understand what the educational system would be like 50 or 100 years from now if a major paradigm shift really took place today! Ha ha, it was a quaint inside joke. Well, one day I decided to put a working prototype of ‘SimSchool’
together for my next class. I have “shocked” Simschool [https://edtechbooks.org/-KmE] and offer it here for you to try out (of course, you will first need access to the web, have enough RAM, and be able to download and install the right plug-in from Macromedia, etc.). If you do take a look, don’t take it too seriously. This simulation has not been validated. It is just a little exercise to get my students to “try out” the philosophical implications on education, from my point of view. What is most useful is when people take issue with my interpretation and instead put forward how THEY would design SimSchool. These are the discussions that really matter.

**Instructional Technologist as Physicist or Mathematician**

Perhaps the proper way to become an instructional technologist is to first become a physicist or mathematician. Many of the leading scholars in the field began this way. Seymour Papert is a mathematician by training, Alfred Bork is a physicist. Sometimes I wonder if our field suffers from “physics envy”—we want desperately, it seems, to be considered a science. Well, I actually enjoy reading about theoretical physics (at least as far I can without knowing the mathematics).

One physicist I have become fascinated with is the late Nobel laureate, Richard Feynman. Some of you might know him due to his role on the committee investigating the Space Shuttle Challenger disaster. (My daughter was in first grade at the time. The whole school was gathered in the school’s cafeteria to watch the lift-off. I recall my daughter coming home after school telling us that it was her job to go find the principal to tell her that the “shuttle blew up.”) I have become interested in Feynman for lots of reasons, but of relevancy here was his apparent genuine concern about his teaching. While other physicists and mathematicians-turned-educators often come across to me thinking they know all the answers to the problems of education—I’m not saying Papert and Bork are like this ;)—Feynman remained quite reflective (not to mention baffled) by the entire teaching/learning process. In the preface to The Feynman Lectures, a set of well-known readings to introductory physics, Feynman expressed his frustration in not being able to meet the needs of students known not to be the brightest or most motivated (in other words, those like me). Rather than just blame the students, he publicly took his share of the responsibility.
I also liked the way Feynman talked about his teaching in a very reflective, almost constructivistic way. That is, he seemed to understand that teaching was a way for him to understand problems in new and important ways. He once wrote about turning down the opportunity to go and work at Princeton at the Institute for Advanced Study BECAUSE he would not have to teach. Here is an excerpt (go to https://edtechbooks.org/-ST for the complete quote):

I don’t believe I can really do without teaching. . . . If you’re teaching a class, you can think about the elementary things that you know every well. These things are kind of fun and delightful. It doesn’t do any harm to think them over again. Is there a better way to present them? The elementary things are easy to think about; if you can’t think of a new thought, no harm done; what you thought about it before is good enough for the class. If you do think of something new, you’re rather pleased that you have a new way of looking at it. The questions of the students are often the source of new research. They often ask profound questions that I’ve thought about at times and then given up on, so to speak, for a while. It wouldn’t do me any harm to think about them again and see if I can go any further now. The students may not be able to see the thing I want to answer, or the subtleties I want to think about, but they remind me of a problem by asking questions in the neighborhood of that problem. It’s not so easy to remind yourself of these things. So I find that teaching and the students keep life going, and I would never accept any position in which somebody has invented a happy situation for me where I don’t have to teach. Never.

While I don’t know how much his students may have learned, his willingness to admit how vital teaching was to his own professional development is refreshingly straightforward.

**Instructional Technologist as a Graduate of an Instructional Technologist Program**

I finally come to the time honored tradition of going to a university and getting a degree. The diploma becomes one’s “membership card” with all the rights and privileges therein to participate as a member of the profession (though it does not, of course, guarantee a job!). I feel I must tread lightly here so as not to be misinterpreted, especially considering I am a member of a university’s faculty. Nevertheless, I have long been frustrated with the way in which instructional technologists are educated at universities (notice my deliberate avoidance of the term “train”). There are many areas to be considered here, so I will only focus on one in any depth: The congruency between instructional
design as written and taught, and how it is actually done in practice. Related to this is the role played by theory and research in guiding, or even informing, practice.

One of the most problematic relationships in our field is that which exists between theory, research, and practice. The problem is shared by professors, researchers, students, and practitioners alike. That is, a professor who is unable (or unwilling) to connect theory with practice is just as guilty as a student who avoids confronting or deems theoretical implications of practice. The textbooks make the relationship seem so clear and straightforward, yet my experience with actually doing instructional design has been messy and very idiosyncratic. Michael Streibel (1991, p. 12) well articulated what I had felt as I tried to reconcile instructional design as it was written and talked about versus how I had actually done it:

I first encountered the problematic relationship between plans and situated actions when, after years of trying to follow Gagné’s theory of instructional design, I repeatedly found myself, as an instructional designer, making ad hoc decisions throughout the design and development process. At first, I attributed this discrepancy to my own inexperience as an instructional designer. Later, when I became more experienced, I attributed it to the incompleteness of instructional design theories. Theories were, after all, only robust and mature at the end of a long developmental process, and instructional design theories had a very short history. Lately, however, I have begun to believe that the discrepancy between instructional design theories and instructional design practice will never be resolved because instructional design practice will always be a form of situated activity (i.e. depend on the specific, concrete, and unique circumstances of the project I am working on).

This idea that instructional design is largely contextual and relies so heavily on creative people working with unique problems resonates with me even more due to my experience of being the parent of a child with special needs. My son Thomas has mental retardation as well as a wide array of other problems, including language and behavior disorders (the term “pervasive developmental disorder” is used to vaguely characterize the diversity of the disability). There is a not so great movie titled “Dog of Flanders” involving a poor Dutch boy who desires to become a painter. One day he visits the studio of a master painter and is shocked to learn that this painter sometimes uses a knife to paint with. In response, the painter responds matter of factly that “I would use my teeth if I thought it would help.” There have been countless times I have felt the same thing about how I might improve my teaching or instructional design, despite of what I think I know about learning theory, etc.—I, too, would do just about anything if I thought it would help. My work with my son points to situations where the distinction between cognitive/behavioral or objectivist/constructivist
becomes quite gray and rather unimportant. Click here [#superhero] to play a shocked version of a simple game called “Super Hero”. I like to say that I designed this game with Thomas, not for Thomas. He has contributed to its construction in so many ways that I feel he deserves to be called a “co-designer.” I think this notion is useful to any designer. Work with end users to such an extent that you feel you owe them co-ownership of what you design.

My current interest in play theory is also an example of my struggle with how our field characterizes the interplay between research, theory, and practice. On one hand, my interest in play is derived by working with children and watching the intensity with which they engage in activities they perceive to be worthwhile. However, I also wanted to explain more thoroughly my own experiences of being so involved in activities that nothing else seemed to matter. My curiosity led me to themes I had first encountered when I was a “short lived” student of anthropology, namely games and their cultural significance. I also found out about Flow theory and saw how well it described the play phenomena.

I have come to see the story of the Wright Brothers’ invention of the airplane as a good metaphor for understanding the proper relationship between theory, research, and practice. That the Wright Brothers were technologists, inventors, and tinkerers is not questioned, but people do not realize that they were also scientists who asked the right questions about the theory of the day and crafted ingenious experiments to get at the answers. Most of all, people forget that they were also the world’s most experienced pilots at the time. They took their findings into the field and practiced what they studied. These experiences likewise informed their scientific side of the enterprise, culminating in a controllable aircraft. (Incidentally, it’s the “controllable” part of the invention that is the real genius of the brothers.)

In broaching the subject of the adequacy of graduate programs in preparing people to become instructional technologists, I hope I do not unleash the floodgate of individual criticisms or personal war stories. Instead, I wish us to look more broadly at the aims and goals of graduate programs as compared to what is needed or actually done in the field. For example, I think the distinction between education and training is useful here. I can’t name one technical skill I learned in a graduate course that I still use exactly as taught. Instead, all of the technical skills I now use were learned either on my own, through professional development, or by preparing to teach others (mostly the latter). In my opinion, universities are not supposed to prepare technicians to perform a specific job, but rather should prepare people for a life’s study. It is fair to ask how well we, at the University of Georgia, are doing. To our credit, I will tell you that our faculty has openly discussed among ourselves and with students what we are doing and whether there is a better way. I am proud to report that we will be trying a new approach at the Master’s level that we are referring to as a “studio-based approach.” We are also quite nervous about it because it represents an approach with which none of us have much experience. However, we all seem to agree that it will be an approach more closely (and honestly) aligned with our beliefs about how people learn and what people need.

Many issues on this topic remain, such as the proper role of research. (I see at least two, by the way. One is the traditional role of research contributing to the literature. A second role for research, though less recognized, is how it informs the researcher. The act of doing research becomes a source of ideas and invention, leading to a much deeper conceptual understanding of the topic or problem being studied. Even if the research itself goes wrong in some way, the researcher grows intellectually and emotionally from the experience. I’m not sure how to characterize this research purpose since it does not fit any traditional category (e.g. basic, applied, etc.), so perhaps we should just call it “constructive or reflective research.”) Another topic worth pursuing is the way universities assess
student achievement. This is not an indictment of testing per se, but I admit I find it strange that we still assign letter grades in most of our graduate courses. (That one should bring in the mail.)

Closing

So, what is the proper way to become an instructional technologist? Obviously, my position is that there is not one way and that we should value the diversity of the people who make up our profession. I also challenge each faculty member and student to stand back from their graduate curricula and question the purpose and relevance of the experiences that are contained there. However, this is all too easy, so I end by offering two lists. The first is one I posted on ITFORUM awhile back. It’s my way of “reverse engineering” what I do in language that people outside the field can understand (such as my parents):

I’m an instructional technologist……

- I help people learn new things.
- I solve problems in education and training, or find people who can.
- I use lots of different tools in my job; some are ‘things’ like computers and video, other tools are ideas, like knowing something about how people learn and principles of design.
- I know a lot about these tools, but I know I have to use them competently and creatively for the task at hand before they will work.
- I consider using all of the resources available to me, though sometimes I have to go and find additional resources.
- I am most interested in helping children, but many of my colleagues work with adults.
- I resist doing things only because “we’ve always done it that way,” but I’m also careful not to fall for fads or gimmicks.
- I always try to take the point of view of the person who is going to be using the stuff I make while I’m making it; that’s really hard, so I get people to try out my stuff as soon as I can to see what I am doing wrong.
- I’m not afraid to say, “Yes, that’s a better way to do it.”

Finally, here is a list of things I feel one needs to do to become, and remain, an instructional technologist and represents, I hope, the best of what we are doing in our graduate programs:

- Do Instructional Technology: Work with people; take a genuine interest in their interests; listen.
- Study the design process, study how people learn individually and collectively, and study media’s role in learning.
- Strive to understand the interdependency of theory, research, and practice.
- Learn the “how’s and what’s” of media.
- Play

I’m sure you can add to this list.

I hope you have been able to follow this roughly written essay. Here are a few questions, offered with the hope that a few of you will consider posting your thoughts to the list:

1. What is your story about how you came to be an instructional technologist? What is unique about it? I am especially curious about individuals who do not hold graduate degrees in
instructional technology.

2. How well prepared were you to face the problems you now encounter in your jobs?

3. Those of you who have a formal degree in IT, how satisfied are you as to how well you were prepared to do the job you now have? How well aligned were issues surrounding theory, research, and practice? I know that many non-American programs are not so reliant on course-driven models (and this is part of our redesign), so I am anxious to hear more about them.

4. What would you add to my list of things that characterize what Instructional Technologists actually do, as a profession?

5. What would you add to my list of what one needs to do to adequately prepare to become an Instructional Technologist?

Acknowledgements

I’d like to give Steve Tripp and Ron Zellner some credit for some of the ideas here, since some were derived from some long, enjoyable (and independent) conversations with them over the years.

Application Exercises

- Reflect on your experiences and how they have brought you to the field of instructional design. How are they similar to the paths described in this chapter and how do they provide you with a unique perspective on instructional design?
- Based on your individual goals, and what you understand of the field today, create your own list (see Rieber’s in the “Closing” section) outlining how you envision your role as an Instructional Technologist/Instructional Designer.

References


What Is This Thing Called Instructional Design?

Ellen D. Wagner

Editor's Note

The following is an excerpt from Ellen Wagner’s article entitled “In Search of the Secret Handshakes of Instructional Design,” published in the Journal of Applied Instructional Design [http://www.jaidpub.org/]. The title for this chapter comes from a portion of Wagner’s essay to better represent the portion of her article that is republished here.


Practitioners and scholars working in the professions clustered near the intersection of learning and technology have struggled to clearly and precisely define our practice for a long time—almost as long as technologies have been used to facilitate the creation, production, distribution, delivery and management of education and training experiences.

As a professional group, instructional designers—IDs—often bemoan the fact that it is hard to tell “civilians” what it is that we actually do for a living. Ironically this inability to clearly describe our work is one of the “secret handshakes” that unites us in our quest to better define our professional identity.

One of my favorite examples of this definitional challenge was described in a recent blog post by Cammy Bean, vice-president of learning for Kineo, a multinational elearning production company:

You’re at a playground and you start talking to the mom sitting on the bench next to you. Eventually, she asks you what you do for work. What do you say? Are you met with comprehension or blank stares? This was me yesterday:

Playground Mom: So, what do you do?

Me: I’m an instructional designer. I create eLearning.

Playground Mom: [blank stare]
Me: ...corporate training...

Playground Mom: [weak smile]

Me: I create training for companies that’s delivered on the computer....

Playground Mom: weak nod...“Oh, I see.”

I see that she really doesn’t see and I just don’t have the energy to go further. I’m sort of distracted by the naked boy who just ran by (not mine). We move on.

Is it me? Is it the rest of the world?


AECT has actively supported work on the definitions of big overarching constructs that offer people working at the intersections of learning and technology with a sense of identity, purpose and direction. Lowenthal and Wilson (2007) have noted that AECT has offered definitions in 1963, 1972, 1977, 1994, and 2008 to serve as a conceptual foundation for theory and practice guiding “The Field.” But they wryly observe that our definitional boundaries can be a bit fluid. For example, after years of describing what we do as “educational technology,” Seels and Richey (1994) made a case for using the term “instructional technology” as the foundational, definitional descriptor. Januszewski and Molenda (2008) returned us to the term “educational technology” as being broader and more inclusive. All seemed to agree that the terms educational technology and instructional technology are often used interchangeably. In discussing these implications for academic programs, Persichitte (2008) suggested that labels—at least the label of educational technology or instructional technology—do not seem to matter very much. And yet, I wonder—without precision—do we not contribute to the confusion about what it is that people like us actually do?

And what about this thing we do called instructional design? That seems to be an even harder domain to adequately define and describe. A definition of instructional design offered by the University of Michigan (Berger and Kaw, 1996) named instructional design as one of two components (the other being instructional development) that together constitute the domain of instructional technology. Instructional design was then further described in the following four ways:

**Instructional Design-as-Process:** Instructional Design is the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. It is the entire process of analysis of learning needs and goals and the development of a delivery system to meet those needs. It includes development of instructional materials and activities; and tryout and evaluation of all instruction and learner activities.

**Instructional Design-as-Discipline:** Instructional Design is that branch of knowledge concerned with research and theory about instructional strategies and the process for developing and implementing those strategies.

**Instructional Design-as-Science:** Instructional design is the science of creating detailed specifications for the development, implementation, evaluation, and maintenance of situations that facilitate the learning of both large and small units of subject matter at all levels of complexity.

**Instructional Design as Reality:** Instructional design can start at any point in the design process.
Often a glimmer of an idea is developed to give the core of an instruction situation. By the time the entire process is done the designer looks back and she or he checks to see that all parts of the “science” have been taken into account. Then the entire process is written up as if it occurred in a systematic fashion. [https://edtechbooks.org/-Lj](https://edtechbooks.org/-Lj)

Ten years later, Reiser & Dempsey (2007) defined instructional design as a “systematic process that is employed to develop education and training programs in a consistent and reliable fashion” (pg. 11). They noted that instructional technology is creative and active, a system of interrelated elements that depend on one another to be most effective. They suggested that instructional design is dynamic and cybernetic, meaning that the elements can be changed and communicate or work together easily. They posited that characteristics of interdependent, synergistic, dynamic, and cybernetic are needed in order to have an effective instructional design process. In their view, instructional design is centered on the learner, is oriented on a central goal, includes meaningful performance, includes a measurable outcome, is self-correcting and empirical, and is a collaborative effort. They concluded that instructional design includes the steps of analysis, design, development, implementation, and evaluation of the instructional design.

*Continue reading Wagner’s essay on JAID’s website.* [https://edtechbooks.org/-Jl](https://edtechbooks.org/-Jl)

**Application Exercises**

- Write a brief description of a real-world example of instructional design as a process, a discipline, a science, and/or a reality.
- Think of a time you were involved in the instructional design either as a teacher or learner. How did you work through each of these pieces? 1. Centers on the learner 2. oriented on central goal 3. includes meaningful performance & measurable outcome 4. self-correcting and empirical 5. collaborative

History of LIDT

Association for Educational Communications & Technology

Editor's Note

The following was originally published on https://edtechbooks.org/-kz.

Today, the field is fascinated with the instructional possibilities presented by the computer as a medium of communication and as a tool for integrating a variety of media into a single piece of instruction. Video has replaced the educational film, and television can be two-way and interactive.

At the turn of this century a number of technological inventions and developments were made that provided new, and in some cases, more efficient means of communication. In the 1920s, the motion picture passed through the stage of being a mere curiosity to a serious medium of expression, paralleling live theater. Its usefulness and influence on learning was explored. This educational research continued into the 1930s, when new instructional projects such as teaching by radio were implemented. Within 20 years both film and radio became pervasive communication systems, providing both entertainment and information to the average citizen.

The advent of World War II created many demands for a new skilled workforce. Media took a prominent place in educational and training systems attempting to fill such needs, and much research centered on the use of these media in a wide variety of teaching and learning situations. Media were among the innovations that made possible the changes and growth in the industrial complex that were so essential to the defense of the western world.

After the war, schools and industry alike attempted to settle back into the old, familiar methods of operation. Within a few years, however, the increase in the birth rate and public school enrollment forced a re-evaluation of the older and slower approaches to education. Again, media were employed, this time to upgrade the curriculum of the public schools.

With the late 1940s and early 1950s came considerable experimentation with television as an instructional tool. Industry was expanding and began to develop its own in-house educational systems. Simultaneously, a search was begun for more efficient and effective means by which such education could be accomplished.

Concurrent with the introduction and development of the study of instructional media, the notion of a science of instruction was evolving. The educational psychologists provided a theoretical foundation which focused on those variables which influenced learning and instruction. The nature of the learner
and the learning process took precedence over the nature of the delivery media.

Some of the early audiovisual professionals referred to the work of Watson, Thorndike, Guthrie, Tolman, and Hull. But it was not until the appearance of Skinner’s (1954) work with teaching machines and programmed learning that professionals in the field felt that they had a psychological base. Skinner’s work in behavioral psychology, popularized by Mager (1961), brought a new and apparently more respectable rationale for the field. Lumsdaine (1964) illustrated the relationship of behavioral psychology to the field, and Wiman and Meierhenry (1969) edited the first major work that summarized the relationship of learning psychology to the emerging field of instructional technology. Bruner (1966) offered new insights that eventually led to broader participation of cognitive psychologists like Glaser (1965) and Gagné (1985). Today, the field not only seems convinced of the importance of the various aspects of cognitive processing of information, but is placing new emphasis upon the role of instructional context, and the unique perceptions and views of the individual learner.

Perhaps one of the most profound changes in instructional technology has come in the expansion of the arenas in which it is typically practiced. From its beginnings in elementary and secondary education, the field was later heavily influenced by military training, adult education, post-secondary education, and much of today’s activity is in the area of private sector employee training. Consequently, there is increased concentration on issues such as organizational change, performance improvement, school reform, and cost benefits.

Use of the principles, products, and procedures of instructional technology, however, continue to be vital to school effectiveness, especially in times of school restructuring. In addition, the new technologies and new delivery media offer expanded ways of meeting the special needs of learners and schools.

Instructional technology, and instructional design procedures in particular, are also becoming more common in health care education, training, and non-formal educational settings. Each of these instructional contexts highlight the diverse needs of learners of many ages and interests, and of organizations with many goals. The many settings also provide laboratories for experimenting with and perfecting the use of the new technologies.

However, the disparate contexts also highlight a wide range of organizational, cultural, and personal values and attitudes. Cultures vary among the different communities, creating new issues and possibilities for new avenues of disciplinary growth and development.

The historical context which has surrounded the development of the field has implications that reach beyond the actual events themselves. This is equally true of the development of modern technology responsible for an increasing number of new media and new uses for existing media. Such developments have redirected the energies of many people, causing today’s society to be much broader and richer than was ever contemplated in the early 1900s.

Prior to the twentieth century, the only formal means of widespread communication was the printing press. The technological developments since then have provided many different modes of expression, enabling ideas, concepts, and information gained from experience to be conveyed in ways and with contextual richness never before possible.

The unique means of expression that have expanded with each new medium have added new dimensions through which creative talents can be applied. For example, the photographic and cinematographic media have long been accepted as legitimate avenues for creative work in the arts,
and television has provided new avenues for expanding views of society.

Still photography, motion picture photography, television, and the computer have proved to be excellent tools for a variety of academic endeavors. Historians consider film coverage of public events to be important primary documentation. Psychologists now use film, computers, and interactive video to control experiences and to collect data on a wide variety of problems in human behavior. Medical researchers employ both color photography and color television in their studies. In fact, it would be difficult for modern scholars to maintain a position of leadership in their fields of investigation without the assistance from media that present day technology makes possible. Further, the future of humanity’s understanding of the universe and the pursuit of greater self knowledge depends upon increasingly sophisticated applications and utilizations of these technologies.

Alternative modes for teaching and learning are most important in today’s educational environment. Opportunities for self-directed learning should be provided by institutions of higher education. Other forms of alternative teaching and learning patterns which require increased student involvement and higher levels of learning (application, synthesis, evaluation) also rely upon media as an invaluable tool in the preparation of students.

Teaching and communication, though not synonymous, are related. Much of what the teacher does involves communication. From the spoken word to the viewing of the real world, directly or by means of some technological invention, communication permeates instructional activities.

Media, materials, and interactive technologies, though not the exclusive ingredients in learning, are an integral part of almost every learning experience. The raw materials for scholarship increasingly reside in these means. The scholarly experiences for the student can often be afforded only through these options. The young scholar, the college student, is a deprived scholar without access to these learning tools.

The scholar must have available all that modern technology can provide. Media, materials, and interactive technologies have a crucial role to play in any teacher education program if that program hopes to meet the needs of our dynamic, sophisticated world.

**Application Exercise**

Think about the technology you are surrounded by every day (e.g. smartphones, tablets, digital assistants, wearable technology, VR/AR, etc.). Discuss how one or two of these technologies can be used in the field of instructional design or how they could have a future impact in the field.

Please complete this short survey to provide feedback on this chapter: [http://bit.ly/LIDTHistory](http://bit.ly/LIDTHistory)
A Short History of the Learning Sciences

Victor Lee

It is inevitable that someone studying learning and instructional design and technology (LIDT) will come across the term Learning Sciences. Yet, for many, that moniker is fundamentally ambiguous and misunderstood, and questions abound about this thing called Learning Sciences. Are there multiple learning sciences or is there one dedicated and official field referred to with the plural of Learning Sciences? Is one supposed to capitalize both words when writing about it? Is it essentially classic educational psychology with a new name? Does it involve things beyond the mental phenomenon of learning? Is it actually a science? Are there points of convergence, divergence, or redundant overlap with other fields, including those that would be seen in the field of instructional design and technology? Are those who call themselves learning scientists best seen as friends, rivals, or innocuous others to those who consider themselves instructional designers? There are so many questions. There are also many answers. And a lack of a one-to-one correspondence between questions and answers has persisted in the roughly 30 years (see Figure 1) since the term began to see heavy use (assuming we are concerned with the capitalized L and capitalized S version, which will be the default for this chapter).

No article, book, nor chapter has been written that gives authoritative and definitive answers to these questions. The current chapter is no exception. Others have made noteworthy efforts, including contributors to a special issue of Educational Technology (Hoadley, 2004; Kolodner, 2004), those who have edited handbooks of the Learning Sciences (Fischer, Hmelo-Silver, Goldman, & Reimann, in press; Sawyer, 2006), and those who have prepared edited volumes that gather and publish firsthand reports from a number of seminal learning scientists (Evans, Packer, & Sawyer, 2016). In a sense, all
To Understand, We Must Look Backwards

There seems to be consensus that Learning Sciences is a relatively young, interdisciplinary academic field. (The word learning is obviously important.) Yet the same could be said for other fields, including many that are more prominently known as LIDT fields. In addition, many seemingly related questions and problems touching on teaching, learning, and technology are addressed by both Learning Sciences and LIDT fields. Yet some people will adamantly maintain that the fields are, at their core, fundamentally different bodies who do different things. Others will argue that those differences are inconsequential and that, functionally, they are the same. So in response to these differing views, I suggest we consider the similarities between Learning Sciences and other LIDT fields as analogous to convergent evolution in evolutionary biology—the process by which dolphins and sharks evolved similar traits but were preceded by different genetic histories. There is certainly much overlap in what each field does and the spaces each inhabits, but the histories leading up to each are markedly different. Those histories matter, because they formed the skeletons for the bodies that exist today and help us understand why there may be some underlying differences coupled with functional similarities.

Cognitive and Artificial Intelligence Roots

If Figure 1 is any indication, the recent history of Learning Sciences goes back about 30 years, and it can be traced to some important locations and events: namely, the first International Conference of the Learning Sciences (ICLS), which took place in 1991 and was connected to the Artificial Intelligence in Education (AIED) community. No formal society nor publication venue for Learning Sciences existed at that time. The first ICLS was hosted in Evanston, Illinois, in the United States, home of what was then the Institute for the Learning Sciences and the first degree program in Learning Sciences, at Northwestern University. The year 1991 was also when the first issue of the Journal of the Learning Sciences was published.

The connection to the AIED community is central to the historic identity of Learning Sciences. In the 1980s, cognitive science had emerged as an interdisciplinary field that, along with segments of computer science, was concerned with the workings of the human mind. The so-called “cognitive revolution” led to interdisciplinary work among researchers to build new models of human knowledge. The models would enable advances in the development of artificial intelligence technologies, meaning that problem solving, text comprehension, and natural language processing figured prominently. The concern in the artificial intelligence community was on the workings of the human mind, not immediately on issues of training or education. The deep theoretical commitments were to knowledge representations (rather than to human behaviors) and how computers could be used to model knowledge and cognitive processes.
Of course, as work in the years leading up to the first ICLS progressed in how to model and talk about (human) cognition, many had also become interested in using these new understandings to support learning and training. Intelligent tutoring systems gained prominence and became an important strand of work in Learning Sciences. That work continues to this day, with much of the work having ties historically to institutions like Carnegie Mellon University and the University of Pittsburgh. These tutoring systems were informed by research on expertise and expert-novice differences along with studies of self-explanation, worked examples, and human tutoring. Many of those who did original work in those areas still remain in Pittsburgh, but their students, colleagues, postdoctoral fellows, and others have since established their own careers in other institutions.

Another locus of work on artificial intelligence was at the Massachusetts Institute of Technology, home to the Artificial Intelligence Laboratory (now known as the Computer Science and Artificial Intelligence Laboratory [CSAIL]) founded by the late Marvin Minsky. Also at MIT was Seymour Papert, who was named co-director of the AI Lab. Papert was a mathematician who contributed significantly to early AI research with Minsky. Papert saw early on the tremendous power of computers and their potential for learning and knowledge construction and became a passionate advocate for learning through computation, expressed largely through his theory of constructionism (Papert, 1980) and in the creation of the Logo programming language with Wallace Feurzig. Papert’s research program migrated away from classical AI research and more toward issues of epistemology and learning. His efforts later led to the creation of the MIT Media Lab. A number of scholars trained with him, and the ideas and technologies generated at the Media Lab would spread with students who went on to positions at other institutions. As a result, constructionism, computational thinking, and Papert’s sense of “powerful ideas” continue to be major strands of Learning Sciences to this day.
Papert was not the only one interested in how people learned to do computer programming\textsuperscript{[3]}\footnote{#footnote-796-3}. Relatedly, programming was a concern for the Pittsburgh tutoring systems and also for others involved in the field, such as Elliot Soloway, who was initially at Yale before later relocating to University of Michigan. Others influential in the field were asking questions about what cognitive benefits result from learning to program. One such person was Roy Pea, who had been doing work in new educational technology and media with Jan Hawkins at the Bank Street College in New York. In Cambridge, educational technology endeavors informed by recent cognitive science were being pursued at places like Bolt, Beranek, and Newman (BBN) by the likes of John Seely Brown and Allan Collins, among other talented social scientists and technologists. These early scholars represented a part of the new educational media and computer programming sphere of research and development.

Text comprehension was another important area of initial research in artificial intelligence, with research on text and reading taking pace in numerous places, including Yale, University of Illinois, and Vanderbilt to name a few. There are numerous scholars of major influence who were involved at these different institutions, and any effort on my part to name them all would certainly fail to be exhaustive. A few to note, however, include Roger Schank, who relocated from Yale to Northwestern University, established the Institute for the Learning Sciences, and amassed faculty who would subsequently establish what has become the oldest academic program in the field; Janet Kolodner, who studied case-based reasoning in AI text-comprehension systems at Yale, proceeded to move on to a successful professorship at Georgia Tech, and was founding editor of the field’s first journal; John Bransford at Vanderbilt University; and Ann Brown at University of Illinois, who then moved with her husband, Joseph Campione, to University of California, Berkeley. Schank and Bransford, with their respective teams at their institutions, were developing new ways to integrate narrative story structures into technology-enhanced learning environments based on the discoveries that were being made in text-comprehension and related cognition research. Brown, with her student Annemarie Palincsar (who moved on to University of Michigan), worked on extending seminal work on reciprocal teaching (Palincsar & Brown, 1984) to support improvement in text comprehension in actual real-world classroom contexts. The desire to use the new tools and techniques that were being developed from this cognitive research in actual learning settings rather than laboratories had been growing at all the aforementioned locations and led to the development of a methodological staple in Learning Sciences research: design-based research (Brown, 1992; Collins, 1992), to be elaborated upon more below.

Thus far, what one should be able to see from this gloss of Learning Sciences history is the major areas of research. For instance, cognitive science and artificial intelligence figured prominently. Understanding how to best model knowledge and understanding in complex domains continued to be a major strand of research. New technological media and a focus on children expressing and exploring new ideas through computer programming played prominently. There were also inclinations to look at story structure as it related to human memory in order to improve the design of tools and technologies for learning. Finally, there was a desire to take all these discoveries and findings and try to get them to work in actual learning settings rather than laboratories. These were not unified positions but rather all core areas of research and interest in the group that was coming together to establish the field of Learning Sciences. With that list in mind, and knowing that academic conference keynote lectures are usually given to high-profile or aspirational figures in the field, we have some context for the following list of invited keynote addresses at the first ICLS in 1991.

- Cognition and Technology Group at Vanderbilt—Designing Environments that Invite Thinking
In that list, we can see the Vanderbilt group represented along with Collins and Soloway. Andrea diSessa, a prominent and frequently cited scholar in Learning Sciences (Lee, Yuan, Ye, & Recker, 2016) and in other fields, had completed his PhD at MIT in physics and worked closely with Seymour Papert. diSessa’s areas of research included students learning to program and how physics is learned. His academic career is largely associated with the institution where he spent most of his time as a professor: the University of California, Berkeley. Other important scholars at this point were Greeno and Scardamalia, who will be covered in the sections below.

Sociocultural Critiques and Situative Perspectives

Cognitive science and artificial intelligence were major influences in Learning Sciences, but contemporary work in the field is not exclusively intelligent tutoring systems, research on students’ mental models, or how people learn to program or use new digital media. A major, if not primary, strand of Learning Sciences research is based on a sociocultural perspective on learning. At times, this maintains an ongoing tension with the cognitive- and AI-oriented perspectives, and active dialogue continues (diSessa, Levin, & Brown, 2016).

John Seely Brown, mentioned previously as being a key figure in the New England area, was later brought to the West Coast to work for Xerox PARC (Palo Alto Research Center) and head the new Institute for Research on Learning (IRL). Part of the activities of the IRL team at PARC involved studying how to support learning, including in the photocopying business (Brown & Duguid, 1991). Importantly, the Bay Area location positioned PARC near the University of California, Berkeley, where scholars like Alan Schoenfeld, Peter Pirolli, Marcia Linn, Ann Brown, Andrea diSessa, and James Greeno had all been hired into a new program focusing on education in mathematics, science, and technology.

Of great importance was the presence of Jean Lave, who was also on the faculty at Berkeley. Lave, an anthropologist by training, had studied how mathematics was done in everyday life, discovering that what mathematics looked like in practice was very different from how mathematics understanding was conceptualized by the cognitive psychologists (e.g., Lave, Murtaugh, & de la Rocha, 1984). Additionally, Lave and Wenger published a seminal monograph, Situated Learning (1991), summarizing several cases of learning as it took place in actual communities of practice. The learning involved much more than knowledge acquisition and instead was better modeled as changes from peripheral to central participation in a community. Adequately encapsulating the extensive work of Lave, Wenger, and colleagues is well beyond what can be done in a chapter. However, they earned the attention of Greeno (Greeno & Nokes-Malach, 2016) and others by suggesting that entirely different units of analysis were necessary for people to study learning. These perspectives were largely cultural and social in nature, taking talk and interaction and material artifacts as they were taken up in practice as critical. At the time, there were also groundbreaking works published, such as the translation of Lev Vygotsky’s work (1978), Barbara Rogoff’s studies of real-world apprenticeship (Rogoff, 1990), and Edwin Hutchins’s bold proposal that AI approaches to cognitive science were being far too restrictive in recognizing and understanding cognition as it happened “in the wild”
These ideas had a great deal of influence on the emerging community of learning scientists, and the close proximity of the scholars and their ideas led to major public debates about how learning could best be understood (Anderson, Reder, & Simon, 1996; Greeno, 1997). The establishment and acceptance of cultural-historical activity theory and the work of Michael Cole (an institutional colleague of Hutchins) and Yrjo Engestrom also figured prominently as CHAT found a place in education and other scholarly communities. Also influential was James Wertsch, an anthropologically oriented, cultural historical educational scholar.

In essence, a critique of mainstream cognitive science and an alternative perspective had emerged and attracted a contingent. Graduate programs and major research centers formed, and still the networks of scholars that existed continued to dialogue with one another and produce trainees who would later continue developing the newly created field of Learning Sciences. Those individuals would shape the scholarly agenda and produce theoretical innovations for how learning was conceptualized that were different from what had been dominant in previous academic discourse.

Much of contemporary Learning Sciences research has extended these ideas. Rather than focusing on knowledge, many learning scientists focus on social practices, whether they be scientific or mathematical practices, classroom practices, or informal practices. Identity as a socially constructed and continually mediated construct has become a major concern. Seeking continuities between cultures (with cultures not necessarily being geographical nor ethnic in nature) and discovering how to design activities, tools, or routines that are taken up by a culture or give greater understanding of how cultures operate remain ongoing quests. Other concerns include historicity, marginalization of communities, cultural assets rather than cultural deficits, equity, social justice, and social and material influences on spaces that are intended to support learning.

Helping people learn and using new technologies remain important themes, but rather than focusing on computers solely as tutoring systems or spaces where simulations of complex phenomena can be run, current learning sciences technologies with a sociocultural bent allow for youth to collect data about their cities and critically examine equity and opportunity; to become community documentarians and journalists so that local history is valued and conserved in line with the individual interests of participating youth; to build custom technologies of students’ own design that better the circumstances of their peers, homes, and communities; and to obtain records of everyday family or museum or after-school activities that have embedded within them germs of rich literary, mathematical, historical, or scientific thought. Current technologies also act as data- and knowledge-sharing tools that help make invisible practices and routines in schools more visible to teachers and other educators.

**Computer-supported Collaborative Learning**

In the early days of Learning Sciences, cognitive and sociocultural perspectives figured prominently, in addition to the opportunity to look at and modify intact educational systems rather than relegating research to strictly the laboratory. The relationships being built and dialogues taking place were critically important, as was the proximity of research centers to universities that were establishing associated degree programs. However, according to Stahl (2016), some distance grew after the first ICLS conference. Some of this distance was geographic, but it also had a great deal to do with what got spotlighted as internally sanctioned Learning Sciences research. The community that participated in the first ICLS that began to feel a rift was the Computer Supported Collaborative Learning (CSCL)
community. Many, but not all, scholars in this area were located in Europe.

CSCL, like the rest of the Learning Sciences community, was also seriously interested in cognition, new technologies, and social contexts of learning. However, if there were some distinguishing features of the CSCL community, the focus on technology-mediated group cognition figured prominently. Several topics were important for looking at how people learned together online in designed spaces. Examining conceptual change as it became a reciprocal and negotiated process between multiple parties using a technology was also part of this group emphasis. Scripting that informed implicit expectations for how students would interact and move through collaborative learning activities became a major focus. Online knowledge building environments with asynchronous participation and online discourse were also a big focus of CSCL. Ideas about collaborative learning from Naomi Miyake (Chukyo University, then University of Tokyo, Japan), Jeremy Roschelle (SRI International, USA), Stephanie Teasley (SRI International, now at University of Michigan, USA), Claire O’Malley (University of Nottingham, UK), Frank Fischer (Ludwig-Maximilian University of Munich, Germany), Pierre Dillenbourg (University of Geneva and later at École Polytechnique Fédérale de Lausanne, Switzerland), Paul Kirschner (Open University, Netherlands), Pierre Stahl (Drexel University, USA), Marlene Scardamalia and Carl Bereiter (Ontario Institute for Studies in Education, Canada), and Timothy Koschmann (Southern Illinois University, USA) were formative. Sometimes classrooms were the focus, but other learning settings, such as surgical rooms or online forums, became important research sites as well.

CSCL became a distinct enough strand of research that its own workshop was held in 1992 and then its own conference in 1995. Analyses of networks of collaboration and conference topics appear in Kienle and Wessner (2006). There were scholars who consistently appeared at both ICLS and CSCL conferences. Activity in one conference was in no way mutually exclusive from activity in the other. However, there were eventually contingents that were more drawn to one community over the other. Ultimately, given deep overlaps and crossover between CSCL and ICLS, a formal society that oversaw both conference series, the International Society of the Learning Sciences (ISLS), was established in 2002. Many of the aforementioned CSCL scholars were elected president of that society as the years proceeded, and many early graduate students who participated in the formation of these communities and the Learning Sciences field, who went on to become established scholars themselves, were elected as well. In 2006, the International Journal of Computer-Supported Collaborative Learning was established as a leading publication venue, with Gerry Stahl as founding editor. This was officially sponsored by the ISLS, as was the society’s other flagship journal that had been operating since 1991, Journal of the Learning Sciences, with Janet Kolodner as the founding editor.
Learning Sciences Organizations, Academic Venues, and Resources

- **Professional Organizations**
  - International Society of the Learning Sciences
  - American Educational Research Association SIGs Learning Sciences and Advanced Technologies for Learning
- **Conference Venues**
  - International Conference of the Learning Sciences
  - Computer-Supported Collaborative Learning
- **Academic Journals**
  - Journal of the Learning Sciences
  - International Journal of Computer-Supported Collaborative Learning
- **Academic Programs and Online Resources**
  - Network of Academic Programs in the Learning Sciences (NAPLeS)

Design-based Research

As an interdisciplinary field with a mix of cognitive, computational, sociocultural, and anthropological traditions all in dialogue, the methodological palette began with and maintained a great deal of diversity. Controlled experiments, think-aloud protocols, interview studies, field work, and computational modeling all appear in Learning Sciences research along with other methods and methodological approaches. However, Learning Sciences strongly associates itself also with the articulation of design-based research as a methodology.

The nature of design-based research has been described in many places elsewhere (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; The Design-Based Research Collective, 2003; Sandoval & Bell, 2004), and new innovations to support that paradigm have been developed in the over two and a half decades since it was first introduced in academic publication (e.g., Sandoval, 2013). The simplest articulation of design-based research is that it involves researchers working with real educational settings and introducing new tools, practices, or activities that embody a set of assumptions that exist based on prior research.

For example, one might know from the existing literature that metacognitive support can improve learning outcomes during laboratory text-comprehension tasks. Rather than accept that as a given and hope that this finding gets translated on its own into classroom practice, the aspiring design-based researcher may then design and develop a new software tool that helps students continually monitor their own understanding and reflect on their own progress when reading science texts at school. The researcher would then test it informally to make sure it is usable and make arrangements with a local school to have some of their English classes use it. Upon bringing it into a school classroom, they discover that the metacognitive supports are actually confusing and counterproductive in the classroom because so much depends on whether students find the topic engaging and whether the teacher can orchestrate a classroom activity to split instructional time such that students begin by using the tool, participate in a reflective discussion with the teacher, and then return to the tool. The design-based researcher may discover that, unlike the 15-minute sessions reported in the existing literature when metacognitive training was done in the lab, a week is actually required to smoothly implement the tool in the classroom. The teachers need some help noticing what student comments to build upon in the reflection discussions. Texts need to be modified to immediately connect more to topics students already know.
In this experience, a well-meaning researcher attempted to take the best of what was known from prior research and ended up taking participants on a much more complicated journey than intended. That journey began to reveal how metacognitive activity works in a real education setting, how software tools should be designed and used in school settings, and what sorts of things classroom teachers need to do with the software to make it maximally effective. To verify that these new discoveries are actually valid ones, the researcher implements some revisions and sees if the expected outcomes emerge. If not, the design-based researcher repeats, or reiterates, the design work with that classroom.

That cycle is a very general summary of how design-based research unfolds. The researcher may have varying levels of involvement in the educational setting, where they may provide some initial professional development or training to a facilitator and then watch what unfolds later or where they may directly lead the classroom activities by their self. Design-based research can be a solo endeavor or a major team one. The benefit of this type of research is that it puts theoretical assertions (e.g., metacognitive supports improve text comprehension) in harm’s way by allowing for the complexity of the real world to be introduced. This helps to refine (or even establish) stronger theory that speaks to complexities of how learning works in different systems. The intact unit could be a single student, a single classroom, a group of teachers, multiple classrooms, multiple grade bands in a school, a museum exhibit, a museum floor, an after-school program, a university course, or an online course. The outcomes of design-based research are articulated especially nicely by Edelson (2002), who argues that design-based research ultimately produces new knowledge about domain theories, design frameworks, and design methodologies. diSessa and Cobb (2004) have also suggested that design-based research can be the locus for new theoretical constructs to emerge.

As design-based research has matured, some have pushed to broaden its scope to speak to larger educational systems. Rather than working with individual students or classrooms, design-based implementation research (DBIR) promotes partnership with educational institutions such as entire schools or school districts (Penuel, Fishman, Cheng, & Sabelli, 2014). Related design-based approaches also appear as improvement science (Lewis, 2015) and in research-practice partnerships (Coburn & Penuel, 2016). As of late, these have been receiving more attention. Optimistically, we could see this as the desire of funding agencies and academic communities to scale important findings from the past decades of design-based research and to understand what enables new and powerful tools and activities to support learning and impact more learners.

As such, it is common for design-based research to appear in Learning Sciences research, whether in a single study or across a multi-year research program that may involve dozens of researchers and multiple academic institutions working in partnership with educational systems. Again, even though design-based research is prominent, effective and successful learning scientists need not claim design involvement in order to be considered as meaningfully contributing to the field. It does help, however, to be aware of the methodological approach, its history, warrants for arguments made through design-based research, and the kinds of knowledge that the field develops from design-based studies. It is also important to consider that design-based research has broadened in its appeal such that other fields are participating in design-based research without having prior historical ties to the Learning Sciences.

Learning Sciences and LIDT Fields

To summarize, Learning Sciences has a history that gives it its unique character. That history is tied
to cognitive science and artificial intelligence, to new forms of educational media, to sociocultural and situative critiques and studies of learning, to group cognition as it involves multiple learners and technology mediation, and to an appreciation for what design can do in service of advancing academic knowledge. At its surface, this looks much like what LIDT fields also care about and also pursue. In broad strokes, that is true. However, the histories of Learning Sciences and LIDT fields have differences, and those origins ripple unintentionally in terms of what conferences and what journals are favored. The argument has been made that LIDT and Learning Sciences have much to gain from more cross talk, and that is likely true. However, that cross talk has not always happened (Kirby, Hoadley, & Carr-Chellman, 2005), and perceptions remain that fundamental barriers exist that discourage such cross talk. In some cases, strong academic departments have split because faculty in them felt that LIDT and Learning Sciences were incompatible.

However, there have since been deliberate efforts to close perceived rifts. For example, Pennsylvania State University made a deliberate effort to hire individuals trained in Learning Sciences (Chris Hoadley, Brian K. Smith) into their already strong LIDT-oriented department, and that promoted dialogue and relationship building, although the LS-oriented faculty composition has since changed. Utah State University hired Mimi Recker, an early student of the Berkeley program that emerged in the 1990s and subsequently took on a blended departmental identity (USU ITLS Faculty, 2009). Members of the University of Georgia Learning and Performance Systems Laboratory (Daniel Hickey and Kenneth Hay) took positions in a new Learning Sciences program established at Indiana University. The push for more relationship building is now there.

The future of the relationship between LIDT and Learning Sciences organizations and programs is ultimately up to those who are currently training as students in those fields. As someone who has been operating in both spaces, although I was explicitly trained in one, I understand many barriers are actually illusory. There are different foci and theoretical commitments and expectations in each field, but both communities deeply care about learning and how we can build knowledge to improve the tools, practices, and environments that support it. To gain traction in the other field, people simply start by reserving judgment and then reading the other field’s core literatures. They start conversations with individuals who are connected to the other field and initiate collaborations. They get excited about ideas that other parties are also currently thinking about, and they have dialogue. In fact, that’s the simplified version of how Learning Sciences began. It could be the beginning of the history for a new multidisciplinary field in the future as well.

References


Cambridge, MA: Harvard University Press.


Please complete this short survey to provide feedback on this chapter: http://bit.ly/learningsciences
Footnotes

1. Compared to, say, Philosophy, Mathematics, or History.  
2. The prehistory of Learning Sciences is presented quite compellingly by Pea (2016) and Schank (2016).
3. A true Papert perspective would likely not privilege computer programming so much as rich and generative representational media embedded in contexts that allow the exploration, construction, and sharing of powerful ideas.
4. Of course, there were far more highly influential CSCL scholars than are in this list, and many were also participating in ICLS primarily.
Editor’s Note

The following timeline was created by students in the Instructional Psychology and Technology department at Brigham Young University.

Click on the image or website link below to go to the timeline.

[https://edtechbooks.org/-dYS]

Programmed Instruction

Michael Molenda

Editor's Note

The following was originally published by Michael Molenda in TechTrends with the following citation:


Programmed instruction (PI) was devised to make the teaching-learning process more humane by making it more effective and customized to individual differences. B.F. Skinner’s original prescription, although it met with some success, had serious limitations. Later innovators improved upon the original notion by incorporating more human interaction, social reinforcers and other forms of feedback, larger and more flexible chunks of instruction, and more attention to learner appeal. Although PI itself has receded from the spotlight, technologies derived from PI, such as programmed tutoring, Direct Instruction, and Personalized System of Instruction have compiled an impressive track record of success when compared to so-called conventional instruction. They paved the way for computer-based instruction and distance learning. The success of the PI movement can be attributed largely to the commitment of its proponents to relentless, objective measurement of effectiveness.

Origins of the Programmed Instruction Movement

During the first half of the 20th century, research and theory in American psychology tended to revolve around the perspective of behaviorism, and Thorndike’s (1911) theorems—the law of recency, the law of effect, and the law of exercise—remained at the center of discussion for decades. In the 1920s Sidney Pressey, a psychology professor at Ohio State University, invented a mechanical device based on a typewriter drum, designed primarily to automate testing of simple informational material (1926). As he experimented with the device he realized that it could also provide control over drill-and-practice exercises, teaching as well as testing. In explaining why his device was successful he explicitly drew upon Thorndike’s laws of recency, effect, and exercise as theoretical rationales (Pressey, 1927). Unfortunately, despite the fact that Pressey continued to develop successful self-teaching devices, including punchboards, that had all the qualities of later “teaching machines,” his efforts were essentially a dead end in terms of a lasting effect on education. However, Pressey lived and worked long enough to participate in the discussions surrounding the new generation of teaching machines that came along in the 1950s.
The movement that had a more enduring impact on education and training was animated by a reframing of Thorndike’s behaviorist principles under the label of radical behaviorism. This school of thought proposed a more rigorous definition of the law of effect, adopting the term *reinforcer* to refer to any event that increases the frequency of a preceding behavior. Operant conditioning, the major operationalization of this theory, involves the relationships among stimuli, the responses, and the consequences that follow a response (Burton, Moore & Magliaro, 2004, p. 10). The leading proponent of radical behaviorism, B.F. Skinner, demonstrated that by manipulating these three variables experimenters could elicit quite complex new behaviors from laboratory animals (Ferster & Skinner, 1957).

**Skinner’s Invention of Programmed Instruction**

Skinner was led to apply the principles of operant conditioning to academic tasks by a personal experience with one of his own children. As reported by his older daughter, Julie:

> When the younger [daughter, Deborah] was in fourth grade, on November 11, 1953, Skinner attended her math class for Father’s Day. The visit altered his life. As he sat at the back of that typical fourth grade math class, what he saw suddenly hit him with the force of an inspiration. As he put it, ‘through no fault of her own the teacher was violating almost everything we knew about the learning process.’ (Vargas, n.d.)

Having analyzed the deficiencies of group-based traditional instruction, Skinner (1954) proceeded to develop a mechanical device (shown in Figure 1) that could overcome the limitations of lock-step group presentation, replacing it with individually guided study in which the contingencies of reinforcement could be carefully controlled. In Skinner’s new format the content was arranged in small steps, or frames, of information. These steps lead the learner from the simple to the complex in a carefully ordered sequence, and, most importantly, at each step the learner is required to make a response—to write or select an answer. The program then judges whether the response is correct. The theory dictated that the learner should then receive some sort of reinforcer if the response were correct. In Skinner’s method, the reinforcer took the form of “knowledge of correct response,” that is, telling the learner the right answer or confirming that they got the right answer. The main purpose of the mechanical elements of the system was to ensure that users could not peek ahead at the correct answers. The next step in the sequence could only take place after a response was written inside a little window frame and a lever pulled to cover the learner’s response with a transparent cover while revealing the correct answer. The device, referred to by others as a *teaching machine*, soon gained national attention and attracted a following of eager software authors.
Further Development of Programmed Instruction

The instructional format used in teaching machines became known as programmed instruction (PI), and this new technology became a popular subject of educational research and development by the late 1950s. Within a few years developers were dispensing with the elaborate mechanical apparatus, instead relying on users (rightly or wrongly) to discipline themselves and refrain from peeking ahead at the correct answer. Thus PI lessons could be published in book format, with short instructional units (“frames”) followed by a question, with the correct answer lower on the page (to be covered up by the user) or on the next page. Released from the necessity of providing hardware along with the software, publishers rushed to produce books in programmed format. They offered programmed books that appealed to mass audiences, such as Goren’s *Easy Steps to Winning Bridge* (1963) by the famous bridge master Charles Goren, and those that aimed at the school market, such as *English 2600* (Blumenthal, 1961), which taught the fundamentals of grammar in a step-by-step linear program, illustrated in Figure 2.

Linear vs. Intrinsic Programming

The original programs devised by B.F. Skinner and his followers led users through a pre-specified sequence of small steps. Shortly after Skinner’s invention, Norman Crowder introduced a variation that was not founded on any particular theory of learning, but only on practicality. It featured a more flexible programmed lesson structure that allowed learners to skip ahead through material that was easy for them or to branch off to remedial frames when they had difficulty. Crowder (1962) labeled his method intrinsic programming, but it was quickly dubbed branching programming because a schematic outline of the program resembled a tree trunk (the prime path) with multiple branches (the remedial sequences). Skinner’s method was thereafter known as linear programming. The two approaches are contrasted in Figure 3.
Initially, Crowder’s programs were incorporated into the AutoTutor, a desktop teaching machine which used his branching technique to tailor the lesson to the responses of the learner. The original AutoTutor, released in the early 1960s, provided individualized instruction long before general-purpose desktop computers were feasible. But Crowder also joined the rush to convert programs to book form. His TutorText series became one of the best-known series of programmed materials. In the print format, readers encountered multiple-choice questions and each alternative answer led to a different “next page” in the book.

**Pi in Formal Education**

PI was first employed in formal education in the college courses taught by Skinner and his colleagues in the late 1950s. Experiments in schools began with teaching spelling to second- and third-graders in 1957 and teaching mathematics in high schools in 1959 (Saettler, 1990, p. 297). Large-scale school implementation projects were conducted in the early 1960s in Denver and Long Island, NY. The major lesson learned in these experiments was that although the materials themselves were effective, PI could not make a substantial impact on the efficiency or effectiveness of schooling without extensive restructuring of classroom routines and school organization. Schools then, as now, were resistant to systemic restructuring (Saettler, 1990, pp. 297-302).
The Programmed Instruction Boom

Authors and publishers unleashed a flood of programmed materials both in linear and branching formats. Between the early 1960s and 1966, new titles proliferated at an accelerating rate as publishers vied with each other for market dominance. Figure 4 illustrates this boom, showing the growth curve of programmed materials in the United Kingdom, which was paralleled in the U.S. As with other technological innovations, the upward slope did not continue indefinitely. After 1966 the publication of new titles declined rather rapidly and then leveled off. Although there is little fanfare today, programmed materials are still distributed and used by learners, many of whom continue to feel empowered by the ability to work through material methodically with frequent checks for comprehension.

Figure 4. Number of programmed instruction titles available in the market each year in the United Kingdom. Adapted from Figure 1 in Hamer, J.W., Howe, A. & Romiszowski, A.J. (1972). Used with permission of SEDA, successor to APLET.

Striving for Effectiveness

One of the major tenets of PI was that learners should practice mainly correct responses, so that they could experience frequent reinforcement. The only way of assuring this was to test and revise each program during development. In fact, developmental testing was a mandatory specification for materials destined for the military training market. The US Air Force required that “at least 90% of the target population will achieve 90% of the objectives” (Harris, p. 142). This was known as the 90/90 criterion and was widely accepted as the standard benchmark of effectiveness. One of the consequences of this practice was to promote the flowering of a systematic procedure for designing, testing, and revising programmed materials, a precursor to later instructional design models.
Another consequence was to encourage an empirical, data-based approach to instruction, since each PI development project was similar to a controlled experiment. The professional literature of the 1960s carried hundreds of reports on testing of PI programs and comparisons of programmed treatments with other sorts of treatments. One of the first casualties of this research was Skinner’s set of specifications. Small steps did not prove to be essential, nor linear sequencing...as demonstrated by Crowder’s branching method. The immediacy of reinforcement did not prove to be critical for a great many types of learning tasks. Indeed, the efficacy of “knowledge of results” as a reinforcer did not stand up under scrutiny. In retrospect, it was predictable that “knowledge of correct response” would not work as a universal reinforcer. Researchers (and lay people) already knew that different people respond to different reinforcers at different times. When a person is satiated with ice cream, ice cream is no longer reinforcing. The same is true of being told the correct answer. At some point curiosity is satiated. Researchers rediscovered that there are no universal reinforcers.

Interestingly, even though the individual hypotheses making up PI did not prove to be robust, experiments comparing PI to so-called conventional instruction (a construct that needs to be critically deconstructed in its own right!) tended to show PI as superior (Walberg, 1984; Ellson, 1986). Why was that? In retrospect, we can surmise that PI did have several advantages over so-called conventional instruction. First, in many educational experiments, the experimental treatment simply received more time and effort in its preparation and delivery. Second, users are often attracted to the novelty of any new treatment—at least until the novelty wears off. Finally, the PI treatments not only had more time and attention, they were designed through a rigorously thought-out, systematic process, which included not only precise specification of objectives but also testing, revision, and re-testing. Indeed, it was the realization that the design process was the valuable part of programmed instruction that led to the emergence of systematic instructional design as a powerful tool (Markle, 1967).

Programmed Instruction in DAVI

It was not inevitable that PI would become a factor in the field then known as audiovisual (AV) communications, represented by AECT’s predecessor, the Department of Audio-Visual Instruction (DAVI), a unit of the National Education Association. In the late 1950s and early 1960s DAVI was enjoying a growth spurt stimulated, first, by the mushrooming of new schools in the post-World War II expansion period and, second, by the largest ever federal infusion of money into public education, the National Defense Education Act (NDEA) of 1958. Schools and colleges, like the rest of American society, lived under the shadow of the Cold War, and the feeling of a life-or-death struggle with the Soviet Union was palpable. With the Soviet launch of Sputnik I in 1957, America confronted the prospect of a dangerous technological inferiority. Education—especially in mathematics, science, and engineering—became an urgent priority.

The DAVI community benefited from the reinvigorated march to expand and improve education through the NDEA. New educational media became the hot topic of ramped-up research and development activity as well as the beneficiary of enhanced school-equipment budgets. Attendance at DAVI conventions zoomed from the hundreds to the thousands as school AV administrators, many newly assigned, flocked to see and buy the new hardware and software exhibited there: film, slide and filmstrip, phonograph and audio tape, opaque and overhead projection, radio, and television (Godfrey, 1967).

The 1959 DAVI convention program was primarily devoted to these audiovisual media. It had a single...
research paper devoted to PI, “Teaching Machines and Self-Instructional Materials: Recent Developments and Research Issues,” but by 1960 there were several sessions devoted to PI, including a major one entitled “Programmed Instructional Materials for Use in Teaching Machines” (Sugar & Brown, n.d.). This title gives a clue to the connection between AV administrators and PI: mechanical devices were initially used to deliver the programmed lessons. When schools and colleges acquired teaching machines someone had to take care of them. Who was more suited to this task than the AV coordinator who already took care of film, filmstrip, slide, and overhead projectors? The focus on hardware is indicated by the name that marked this new special interest group at the next several DAVI conventions: the Teaching Machine Group.

DAVI’s commitment to this new phenomenon was signaled by the publication of a collection of key documents on PI (Lumsdaine & Glaser) in 1960, and then a follow-up compilation of later research and commentary in 1965 (Glaser). Attention at the annual DAVI convention grew; by the late 1960s the convention offered about a dozen sessions a year on PI, representing about a one-tenth share of the stage. The conversation was still predominantly about AV media, but PI had a visible, sustained presence. PI was even more visible in scholarly circles, as indicated by Torkelson’s (1977) analysis of the contents of AV Communication Review, which showed that between 1963 and 1967 the topics of teaching machines and programmed instruction represented a plurality of all articles published in that journal.

DAVI was not the only, or even the primary professional association interested in PI. When Air Force experiments in 1961 demonstrated the dramatic time and cost advantages of PI (efficiency as well as effectiveness) military trainers and university researchers quickly formed an informal interest group, which by 1962 became a national organization, the National Society for Programmed Instruction (NSPI). The organization grew to encompass over 10,000 members in the U.S., Canada, and forty other countries. As the interests of members also grew and evolved to include all sorts of technological interventions for improved human performance, the name, too, evolved to its current form, International Society for Performance Improvement (ISPI).

The Emergence of a Concept of Educational Technology

Gradually, throughout the 1960s the central focus of the field was shifting from the production and use of AV materials to designing and utilizing interactive self-instructional systems. B.F. Skinner coined the term technology of teaching in 1968 to describe PI as an application of the science of learning to the practical task of instruction. Other authors used the term educational technology; an early example being Educational technology: Readings in programmed instruction (DeCecco, 1964). This idea supported the notion promoted by James D. Finn (1965) that instructional technology could be viewed as a way of thinking about instruction, not just a conglomeration of devices. Thereafter, more and more educators and trainers came to accept soft technology, the “application of scientific thinking” as well as hard technology, the various communications media. And when the time came to reconsider the name of the association in the late 1960s, one of the names offered to the membership for vote combined elements of both. The vote in June 1970 showed a three-to-one preference for the hybrid name, Association for Educational Communications and Technology (AECT).
Other Soft Technologies Derived From Programmed Instruction

Over the decades since Sidney Pressey’s and B.F. Skinner’s bold innovations in self-instruction, many other concerned educators have tried their hands at improving upon the format initially incorporated into teaching machines. Obviously, computer-assisted instruction was heavily influenced by PI. In addition, a number of other technological spin-offs from PI have gone on to chart a record of success in improving the effectiveness of education. Three will be examined in some detail—programmed tutoring, Direct Instruction, and Personalized System of Instruction.

Programmed Tutoring

A psychology professor at Indiana University, Douglas Ellson, had a life-long consuming interest in improving the teaching-learning process. He examined PI very closely, detected its weaknesses, and in 1960 developed a new approach to address those weaknesses (Ellson, Barber, Engle & Kampwerth, 1965). Programmed tutoring (PT) puts the learner together with a tutor who has been trained to follow a structured pattern for guiding the tutee. Like PI, students work at their own pace and they are constantly active—reading, solving problems, or working through other types of materials. The tutor watches and listens. When the tutee struggles to complete a step, the tutor gives hints, taking the learner back to something he already knows, then helps him to move forward again. Thus, learners are usually generating their own answers. And instead of receiving “knowledge of correct response” as reinforcement, they receive social reinforcers from the tutor—praise, encouragement, sympathy, or at least some attention.

Of course, giving every student a tutor is a labor-intensive proposition, but Ellson solved this problem by using peers as tutors—students of the same age or a little older, a role they proved able to play after a little training in how to follow the specified procedures. Not only did tutors serve as “free manpower,” but research showed that it was a win-win situation because tutors showed learning gains even greater than the tutees’! By going through the material repeatedly and teaching it to someone else, they strengthened their own grasp of the material.

During the early 1980s PT gained credibility due to its track record in comparison studies (Cohen, J.A. Kulik & C. C. Kulik, 1982). It was recognized by the U.S. Department of Education as one of the half-dozen most successful innovations and it was widely disseminated (although not as widely as it deserves, as with many of the other soft technologies that have been developed over the years).

Direct Instruction

Direct Instruction (DI) was actually not derived explicitly from programmed instruction. Its originator, Siegfried “Zig” Engelmann was an advertising executive with a degree in philosophy. He developed DI as a way to help disadvantaged children succeed academically. He was an eager experimenter, and, through trial, he worked out an instructional framework that produced rapid learning gains. It consists of fast-paced, scripted, teacher-directed lessons with teacher showing-and-telling punctuated by group responses in unison. As the method evolved it happened to incorporate many features that coincided with behaviorist principles:

- overt practice—students respond to teacher cues in unison
- social reinforcers—teacher attention, praise, and encouragement
ongoing feedback and correction from the teacher
lessons developed through extensive testing and revision.

DI has been extensively used and tested since the 1960s. A large-scale comparison of twenty different instructional models implemented with at-risk children showed DI to be the most effective in terms of basic skills, cognitive skills, and self-concept (Watkins, 1988). More recently it has been found to be one of three comprehensive school reform models “to have clearly established, across varying contexts and varying study designs, that their effects are relatively robust and ... can be expected to improve students’ test scores” (Borman, Hewes, Overman & Brown, 2002, p. 37).

Personalized System of Instruction

Fred Keller devised the Personalized System of Instruction (PSI) or “Keller Plan” in 1963 for the introductory psychology course at a new university in Brasilia. He was seeking a course structure that would maximize students’ success and satisfaction. He and his collaborators were inspired by Skinner’s programmed course at Harvard and Ferster’s at the Institute for Behavioral Research (Keller, 1974). In PSI, all the content material of a course is divided into sequential units (such as textbook chapters or specially created modules). These units are used independently by learners, progressing at their own pace. At the end of a unit, learners take a competency test and immediately afterward they receive feedback from a proctor with any coaching needed to correct mistakes. This procedure prevents ignorance from accumulating so that students to fall further and further behind if they miss a key point (Keller, 1968). During the period it was being tested at many colleges and universities, the 1960s and 1970s, PSI was found to be the most instructionally powerful innovation evaluated up to that time (J.A. Kulik, C. C. Kulik & Cohen, 1979; Keller, 1977). Although “pure PSI” courses are not common nowadays, the mastery-based, resource-centered, self-paced approach has been incorporated into many face-to-face courses in schools, universities, and corporate training centers...and it set the pattern for what was to become “distance education.”

Conclusion

The programmed instruction movement was born as a radical reconstruction of the traditional procedures for teaching. It aimed to free learners (and teachers!) from the misery of the lock-step group lecture method. The innovators who followed were similarly motivated to expand human freedom and dignity by giving learners more customized programs of instruction in a humane, caring context with frequent one-to-one contact. They developed methods of instruction that were amenable to objective examination, testing, and revision. They viewed caring instruction as synonymous with effective instruction. In the words of Zig Engelmann:

My goal for years has been to do things that are productive and that help make life better for kids, particularly at-risk kids. I don’t consider myself a kinderphile.... For me it’s more an ethical obligation. Certainly kids are enchanting, but they also have a future, and their future will be a lot brighter if they have choices. We can empower them with the capacity to choose between being an engineer, a musician, an accountant, or a vagrant through instruction (Engelmann, n.d.).

They welcomed empirical testing of their products and demanded it of others. Instruction that was wasting students’ time or grinding down their enthusiasm was simply malpractice. Their legacy lives on, mainly in corporate and military training, where efficiency and effectiveness matter because savings in learning time and learning cost have direct bearing on the well-being of the organization.
As public purse strings tighten, the day may come when learning time and learning costs are subjected to close accountability in public school and university education also.

**Application Exercises**

1. Think about Programmed Instruction, Programmed Tutoring, Direct Instruction, and Personalized System of Instruction. What type of instruction would you prefer to receive? What type would you prefer to give?
2. What aspects of Skinner’s programmed instruction are still used in instructional design today?

**References**


**Is Programmed Instruction Still Relevant Today?**

Hack Education [http://teachingmachin.es/] is a collection of essays by Audrey Watters that discuss the fascination in our field and society with automizing teaching and learning, from Skinner’s teaching machines to modern day MOOCs.

*Can you think of any other examples of the principles of Programmed Instruction still being discussed today?*

Please complete this short survey to provide feedback on this chapter: [http://bit.ly/ProgrammedInstruction](http://bit.ly/ProgrammedInstruction)
Edgar Dale and the Cone of Experience

Sang Joon Lee & Thomas Reeves

Editor’s Note

The following chapter was based on the following article, previously published in Educational Technology.


Background

Born in 1900 at the dawn of a new millennium, Edgar Dale’s work continues to influence educational technologists in the 21st Century. Dale grew up on a North Dakota farm, and according to Wagner (1970), he retained the no-nonsense thinking habits and strong work ethic of his Scandinavian forebears throughout his illustrious career. While working on the family farm and later as a teacher in a small rural school, Dale earned both his Bachelors and Masters degrees from the University of North Dakota partially through correspondence courses.

In 1929, he completed a Ph.D. at the University of Chicago, and then joined the Eastman Kodak Company where he collaborated on some of the earliest studies of learning from film. Interestingly, although many of these early studies were experimental ones designed to compare learning from film with other media, Dale later expressed distain for such studies. According to De Vaney and Butler (1996):
When Dale was asked why he did not do experimental research in which a scholar attempted to prove over and over that students learn from radio or film, he replied: “It always bothers me, because anybody knows that we learn from these things (media). There’s no issue about that. . . . Well I suppose in any field, to be respectable you have to do a certain kind of research. (p. 17)

In addition to his own prolific scholarship, Edgar Dale mentored an outstanding cadre of doctoral students during his long role as a professor at Ohio State University (1929-1973), including Jeanne Chall and James Finn. Dale also served as President of the Division of Visual Instruction (DVI) of the National Education Association (NEA) from 1937-38, the professional association that is now known as the Association for Educational Communications and Technology (AECT).

Influences

Although he traced his ideas back as far as Pestalozzi (1746 – 1827), who pioneered the concept of learning through activity, and Froebel (1782 – 1852), who first promoted the principle that children have unique needs and capabilities, Edgar Dale’s work was most heavily influenced by John Dewey (1859-1952). Dewey stressed the importance of the continuity of learning experiences from schools into the real world and argued for a greater focus on higher order outcomes and meaningful learning.

In his first edition of Audiovisual Methods in Teaching (1946), Dale expanded Dewey’s concept of the continuity of learning through experience by developing the “Cone of Experience” which relates a concrete to abstract continuum to audiovisual media options (Seels, 1997). Dale (1969) regarded the Cone as a “visual analogy” (p. 108) to show the progression of learning experiences from the concrete to the abstract (see Figure 1) rather than as a prescription for instruction with media. In the last edition of Audiovisual Methods in Teaching (1969), Dale integrated Bruner’s (1966) three modes of learning into the Cone by categorizing learning experiences into three modes: enactive (i.e., learning by doing), iconic (i.e., learning through observation), and symbolic experience (i.e., learning through abstraction).
In moving toward the pinnacle of the Cone from direct, purposeful experiences to verbal symbols, the degree of abstraction gradually increases. As a result, learners become spectators rather than participants (Seels, 1997). The bottom of the Cone represented “purposeful experience that is seen, handled, tasted, touched, felt, and smelled” (Dale, 1954, p. 42). By contrast, at the top of the Cone, verbal symbols (i.e., words) and messages are highly abstract. They do not have physical resemblance to the objects or ideas. As Dale (1969) wrote, “The word horse as we write it does not look like a horse or sound like a horse or feel like a horse” (p. 127).

Dale (1969) explained that the broad base of the cone illustrated the importance of direct experience for effective communication and learning. Especially for young children, real and concrete experiences are necessary to provide the foundation of their permanent learning. The historical importance of Dale’s Cone rests in its attempt to relate media to psychological theory (Seels, 1997) and the Cone has shaped various sets of media selection guidelines ever since. For example, influenced by Dale, Briggs (1972) delineated general principles for media selection according to the age of learners, the type of learners, and the type of task.
Current Application

Dale’s Cone of Experience continues to influence instructional designers today in both theory and practice. For example, Baukal, Auburn, and Ausburn built upon Dale’s ideas in developing their Multimedia Cone of Abstraction [https://edtechbooks.org/-Yq](https://edtechbooks.org/-Yq), available at [https://edtechbooks.org/-Yq](https://edtechbooks.org/-Yq).

![Multimedia Cone of Abstraction](https://edtechbooks.org/-Yq)

As noted above, Dale’s Cone has been frequently misunderstood and misused. Dale’s Cone is often confounded with the “Remembering Cone” or “Bogus Cone” (Subramony, 2003, p. 27) which claims that learners will generally remember 10 percent of what they read, 20 percent of what they hear, 30 percent of what they see, 50 percent of what they hear and see, 70 percent of what they say, and 90 percent of what they both say and do. Even though Dale did not mention the relationship between the level of the Cone and a learner’s level of recall, many practitioners mistakenly believe that the bogus “Remembering Cone” was Dale’s work. A Google search reveals an astonishing number of attributions of the “Bogus Cone” to Edgar Dale. Molenda (2003) concludes that the so-called empirical evidence for the “Remembering Cone” appears to have been fabricated by petroleum industry trainers in the 1960s.
In addition to this confusion, the implications of Dale’s Cone have been misunderstood or misapplied. For example, Dale’s Cone has been used to maintain that more realistic and direct experience is always better. However, Dale (1969) demurred, writing that, “Too much reliance on concrete experience may actually obstruct the process of meaningful generalization” (p. 130). Also, Dale noted that providing realistic learning experiences may not be efficient in terms of cost, time, and efforts. Instead, Dale suggested that teachers should balance combinations of concrete and abstract learning experiences.

Further Reading

For a thorough analysis of the prevalence of the “Remembering Cone” myth in instructional design, along with analysis tracing the history of this myth and the evidence against it, see the final issue in 2014 of Educational Technology, which presented a special issue on the topic.

Application Exercises

While learning by doing (direct, purposeful experience) may be better than learning through abstraction (symbolic experience), explain why you think Dale (1969) felt that “Too much reliance on concrete experience may actually obstruct the process of meaningful generalization.”

Experiential Learning Environments

In another book Can You Give The Public What It Wants (1967), Dale reiterated Dewey’s influence on his ideas by writing: “As I return to Democracy and Education [published by Dewey in 1916] I always find a new idea that I had not seen or adequately grasped before” (p. 186). Dale (1969) described learning as a “fourfold organic process” (p. 42) which consisted of needs, experiences, incorporation of the experiences, and the use of them. To promote permanent learning, Dale asserted that teachers should help students identify their needs for learning and set clearly defined learning goals related to their needs. A learning experience must be personally meaningful with respect to students’ backgrounds and developmental stages and the nature of the experience should be logically arranged to help students incorporate new knowledge with what they already have. Later, students should have opportunities to practice and try out their new knowledge in real life as well as in learning contexts. Dale (1972) wrote:

To experience an event is to live through it, to participate in it, to incorporate it, and to continue to use it. To experience is to test, to try out. It means to be a concerned participant, not a half-attentive observer. (p. 4)

Thus, effective learning environments should be filled with rich and memorable experiences where students can see, hear, taste, touch, and try. Dale (1969) articulated the characteristics of rich experiences. In a rich experience:

- students are immersed in it and use their eyes, ears, noses, mouths and hands to explore the experience,
- students have a chance to discover new experiences and new awareness of them,
- students have emotionally rewarding experiences that will motivate them for learning throughout their lives,
students have chances to practice their past experiences and combine them to create new experiences,
students have a sense of personal achievement, and
students can develop their own dynamic experiences.

In Dale’s perspective (1972), most students in schools did not learn how to think, discover, and solve real problems. Rather, students were forced to memorize facts and knowledge in most schools, and as a result, any knowledge they acquired was inert in their real lives. For this reason, he argued that we should have revolutionary approaches to improve the quality of educational learning environments. To build learning environments infused with rich experiences, Dale argued for the development of new materials and methods of instruction. Dale promoted the potential of audiovisual materials, believing that they could provide vivid and memorable experiences and extend them regardless of the limitations of time and space. Dale (1969) argued:

Thus, through the skilful use of radio, audio recording, television, video recording, painting, line drawing, motion picture, photograph, model, exhibit, poster, we can bring the world to the classroom. We can make the past come alive either by reconstructing it or by using records of the past. (p. 23)

Dale believed that audiovisual materials could help students learn from others’ first-hand experience, or vicarious experience. Dale (1967) claimed, “Audiovisual materials furnish one especially effective way to extend the range of our vicarious experience” (p. 23). Dale concluded that audiovisual materials could provide a concrete basis for learning concepts, heighten students’ motivation, encourage active participation, give needed reinforcement, widen student experiences and improve the effectiveness of other materials.

Although as noted above, Dale (1969) did not advocate comparative media studies, he did recommend evaluating combinations of media and instructional materials in actual learning environments. Amazingly, Dale anticipated the direction of media research as if he had been privy to the Great Media Debate between Clark (1994) and Kozma (1994). Dale (1969) provided an analogy:

As we think about freight cars and their contents we can and do distinguish them. But the vehicle and its contents are closely linked. The gondola car is linked with coal: we do not haul oil in it. The piggy-back conveyances for transporting automobiles are not used to transport wheat. In all communicating of messages, therefore, we must consider the kind of vehicle used to transport them, realizing that medium-message characteristics will influence what can be “sent” to a receiver. (p. 133)

Dale recommended that researchers should look at the effects of combinations of media in the environment where they will be used rather than the testing of a single, isolated medium in the laboratory. By conducting research in real classrooms, the varied combinations of possible factors such as attributes of audiovisual materials, how to use and administer them, learners’ characteristics, and learning environments could be examined because learning occurs through dynamic interaction among the learner, the context, and the media. Although the experimental methods of educational and psychological research were focused on testing the tenets of behaviorism and pitting one media against another throughout most of his career, Dale was prescient in his recognition that the
complexities of learning render most such studies fruitless.

**Final Remarks**

Dale was much more than a scholar isolated in the ivory towers of academe. As described by Wagner (1970), “He actively fought for better schools, academic freedom, civil rights, and other causes long before these became popular issues” (p. 94). Dale also anticipated the still-neglected importance of media education by promoting in the 1930s the then radical notion that teachers should help their students to understand the effects of media on them, their parents, and society, and to learn how to critically evaluate the contents of the radio, newspapers, and films. Dale was a socially responsible researcher, a thoughtful humanist, and dedicated educator. Any educational technologist seeking inspiration for their work in our field would find no better role model than Edgar Dale.

**Application Exercises**

- Think about your most memorable learning experience. How was it (or how was it not) a “rich experience” as defined by Dale?
- Dale felt that a rich experience would be “emotionally rewarding” and “motivate [learners] for learning throughout their lives.” Describe an experience you have had that was emotionally rewarding and motivated you to continue learning throughout your life.
- Why does Dale suggest teachers balance their time providing concrete and abstract teaching opportunities?

**References**


Please complete this short survey to provide feedback on this chapter: [http://bit.ly/ConeExperience](http://bit.ly/ConeExperience)
Twenty Years of EdTech

Martin Weller

Editor’s Note

The following was originally published by Educause with the following citation:


An opinion often cited among educational technology (edtech) professionals is that theirs is a fast-changing field. This statement is sometimes used as a motivation (or veiled threat) to senior managers to embrace edtech because if they miss out now, it’ll be too late to catch up. However, amid this breathless attempt to keep abreast of new developments, the edtech field is remarkably poor at recording its own history or reflecting critically on its development. When Audrey Watters recently put out a request for recommended books on the history of educational technology, I couldn’t come up with any beyond the handful she already had listed. There are edtech books that often start with a historical chapter to set the current work in context, and there are edtech books that are now part of history, but there are very few edtech books dealing specifically with the field’s history. Maybe this reflects a lack of interest, as there has always been something of a year-zero mentality in the field. Edtech is also an area to which people come from other disciplines, so there is no shared set of concepts or history. This can be liberating but also infuriating. I’m sure I was not alone in emitting the occasional sigh when during the MOOC rush of 2012, so many “new” discoveries about online learning were reported—discoveries that were already tired concepts in the edtech field.

The twentieth anniversary of EDUCAUSE presents an opportune moment to examine some of this history. There are different ways to do so, but for this article I have taken the straightforward approach of selecting a different educational technology, theory, or concept for each of the years from 1998 through 2018. This is not just an exercise in nostalgia (although comparing horror stories about metadata fields is enjoyable); it also allows us to examine what has changed, what remains the same, and what general patterns can be discerned from this history. Although the selection is largely a personal one, it should resonate here and there with most practitioners in the field. I have also been rather arbitrary in allocating a specific year: the year is not when a particular technology was invented but, rather, when it became—in my view—significant.

Looking back twenty years starts in 1998, when the web had reached a level of mainstream awareness. It was accessed through dial-up modems, and there was a general sense of puzzlement...
about what it would mean, both for society more generally and for higher education in particular. Some academics considered it to be a fad. One colleague dismissed my idea of a fully online course by declaring: “No one wants to study like that.” But the potential of the web for higher education was clear, even if the direction this would take over the next twenty years was unpredictable.

1998: Wikis

Perhaps more than any other technology, wikis embody the spirit of optimism and philosophy of the open web. The wiki—a web page that could be jointly edited by anyone—was a fundamental shift in how we related to the internet. The web democratized publishing, and the wiki made the process a collaborative, shared enterprise. In 1998 wikis were just breaking through. Ward Cunningham is credited with inventing them (and the term) in 1994. Wikis had their own markup language, which made them a bit technical to use, although later implementations such as Wikispaces made the process easier. Wikis encapsulated the promise of a dynamic, shared, respectful space—the result partly of the ethos behind them (after all, they were named after the Hawaiian word for quick) and partly of their technical infrastructure. Users can track edits, roll back versions, and monitor contributions. Accountability and transparency are built in.

With Wikipedia now the default knowledge source globally with over 5.5 million articles (counting only those in English), it would seem churlish to bemoan that wikis failed to fulfil their potential. Nevertheless, that statement is probably true in terms of the use of wikis in teaching. For instance, why aren’t MOOCs conducted in wikis? It’s not necessarily that wikis as a technology have not fully realized their potential. Rather, the approach to edtech they represent—cooperative and participatory—has been replaced by a broadcast, commercial publisher model.

1999: E-learning

E-learning had been in use as a term for some time by 1999, but the rise of the web and the prefix of “e” to everything saw it come to prominence. By 1999, e-learning was knocking on the door of, if not already becoming part of, the mainstream. Conventional and distance colleges and universities were adopting e-learning programs, often whenever the target audience would be willing to learn this way. One of the interesting aspects of e-learning was the consideration of costs. The belief was that e-learning would be cheaper than traditional distance-education courses. It wasn’t, although e-learning did result in a shift in costs: institutions could spend less in production (by not using physical resources and by reusing material), but there was a consequent increase in presentation costs (from support costs and a more rapid updating cycle). This cost argument continues to reoccur and was a significant driver for MOOCs (see year 2012).

E-learning set the framework for the next decade in terms of technology, standards, and approaches—a period that represents, in some respects, the golden age of e-learning.

2000: Learning Objects

E-learning was accompanied by new approaches, often derived from computer science. One of these was learning objects. The concept can be seen as arising from programming: object-oriented programming had demonstrated the benefits of reusable, clearly defined pieces of functional code that could be implemented across multiple programs. Learning objects seemed like a logical step in
applying this model to e-learning. As Stephen Downes argued:

There are thousands of colleges and universities, each of which teaches, for example, a course in introductory trigonometry. Each such trigonometry course in each of these institutions describes, for example, the sine wave function.

Now for the premise: the world does not need thousands of similar descriptions of sine wave functions available online. Rather, what the world needs is one, or maybe a dozen at most, descriptions of sine wave functions available online. The reasons are manifest. If some educational content, such as a description of sine wave functions, is available online, then it is available worldwide.

This made a lot of sense then, and it still makes a lot of sense today. A learning object was roughly defined as “a digitized entity which can be used, reused or referenced during technology supported learning.” But learning objects never really took off, despite the compelling rationale for their existence. The failure to make them a reality is instructive for all in the edtech field. They failed to achieve wide-scale adoption for a number of reasons, including over-engineering, debates around definitions, the reusability paradox, and the fact that they were an alien concept for many educators who were already overloaded. Nevertheless, the core idea of learning objects would resurface in different guises.

2001: E-learning Standards

By the turn of the millennium, e-learning was seeing significant interest, resulting in a necessary concentration of efforts: platforms that could be easily set up to run e-learning programs; a more professional approach to the creation of e-learning content; the establishment of evidence; and initiatives to describe and share tools and content. Enter e-learning standards and, in particular, IMS. This was the body that set about to develop standards that would describe content, assessment tools, courses, and more ambitiously, learning design. Perhaps the most significant standard was SCORM, which went on to become an industry standard in specifying content that could be used in virtual learning environments (VLEs). Prior to this, considerable overhead was involved in switching content from one platform to another.

E-learning standards are an interesting case study in edtech. Good standards retreat into the background and just help things work, as SCORM has done. But other standards have failed in some of their ambitions to create easily assembled, discoverable, plug-and-play content. So while the standards community continues to work, it has encountered problems with vendors and has been surpassed in popular usage by the less specific but more human description and sharing approach that underlined the web 2.0 explosion (see year 2006).

2002: Open Educational Resources (OER)

Now that the foundations of modern edtech had been laid, the more interesting developments could commence. In 2001, MIT announced its OpenCourseWare initiative, marking the initiation of the OER movement. But it was in 2002 that the first OER were released and that people began to understand licenses. MIT’s goal was to make all the learning materials used in
its 1,800 courses available via the internet, where the resources could be used and repurposed as desired by others, without charge.

Like learning objects, the software approach (in particular, open-source software) provides the roots for OER. The open-source movement can be seen as creating the context within which open education could flourish, partly by analogy and partly by establishing a precedent. But there is also a very direct link, via David Wiley, through the development of licenses. In 1998 Wiley became interested in developing an open license for educational content, and he directly contacted pioneers in the open-source world. Out of this came the Open Content License (OCL), which he developed with publishers to establish the Open Publication License (OPL) the next year.

The OPL proved to be one of the key components, along with the Free Software Foundation’s GNU license, of the Creative Commons licenses, developed by Larry Lessig and others in 2002. These went on to become essential in the open-education movement. The simple licenses in Creative Commons allowed users to easily share resources, and OER became a global movement. Although OER have not transformed higher education in quite the way many envisaged in 2002 and many projects have floundered after funding ends, the OER idea continues to be relevant, especially through open textbooks and open educational practice (OEP).

The general lessons from OER are that it succeeded where learning objects failed because OER tapped into existing practice (and open textbooks doubly so). The concept of using a license to openly share educational content is alien enough, without all the accompanying standards and concepts associated with learning objects. Patience is required: educational transformation is a slow burn.

2003: Blogs

Blogging developed alongside the more education-specific developments and was then co-opted into edtech. In so doing, it foreshadowed much of the web 2.0 developments, with which it is often bundled.

Blogging was a very obvious extension of the web. Once people realized that anyone could publish on the web, they inevitably started to publish diaries, journals, and regularly updated resources. Blogging emerged from a simple version of “here’s my online journal” when syndication became easy to implement. The advent of feeds, and particularly the universal standard RSS, provided a means for readers to subscribe to anyone’s blog and receive regular updates. This was as revolutionary as the liberation that web publishing initially provided. If the web made everyone a publisher, RSS made everyone a distributor.

People swiftly moved beyond journals. After all, what area isn’t impacted by the ability to create content freely, whenever you want, and have it immediately distributed to your audience? Blogs and RSS-type distribution were akin to giving everyone superhero powers. It’s not surprising that in 2018, we’re still wrestling with the implications. No other edtech has continued to develop and solidify (as the proliferation of WordPress sites attests) and also remain so full of potential. For almost every edtech that comes along—e-portfolios, VLEs, MOOCs, OER, social media—I find myself thinking that a blog version would be better. Nothing develops and anchors an online identity quite like a blog.
2004: The LMS

The learning management system (LMS) offered an enterprise solution for e-learning providers. It stands as the central e-learning technology. Prior to the LMS, e-learning provision was realized through a variety of tools: a bulletin board for communications; a content-management system; and/or home-created web pages. The quality of these solutions was variable, often relying on the enthusiasm of one particular devotee. The combination of tools also varied across any one higher education institution, with the medical school adopting one set of tools, the engineering school another, the humanities school yet another, and so on.

As e-learning became more integral to both blended-learning and fully-online courses, this variety and reliability became a more critical issue. The LMS offered a neat collection of the most popular tools, any one of which might not be as good as the best-of-breed specific tool but was good enough. The LMS allowed for a single, enterprise solution with the associated training, technical support, and helpdesk. The advantage was that e-learning could be implemented more quickly across an entire institution. However, over time this has come to be seen more as a Faustian pact as institutions found themselves locked into contracts with vendors, most famously with providers (e.g., Blackboard) that attempted to file restrictive patents. More problematically, the LMS has become the only route for delivering e-learning in many institutions, with a consequent loss of expertise and innovation.

2005: Video

YouTube was founded in 2005, which seems surprisingly recent, so much has it become a part of the cultural landscape. As internet access began to improve and compression techniques along with it, the viability of streaming video had reached a realistic point for many by 2005. YouTube and other video-sharing services flourished, and the realization that anyone could make a video and share it easily was the next step in the broadcast democratization that had begun with HTML. While the use of video in education was often restricted to broadcast, this was a further development on the learning objects idea. As the success of the Khan Academy [https://www.khanacademy.org/] illustrates, simple video explanations of key concepts—explanations that can be shared and embedded easily—met a great educational demand. However, colleges and universities for the most part still do not assess students on their use of video. In some disciplines, such as the arts, this is more common, but in 2018, text remains the dominant communication form in education. Although courses such as DS106 have innovated in this area, many students will go through their education without being required to produce a video as a form of assessment. We need to fully develop the critical structures for video in order for it to fulfil its educational potential, as we have already done for text.

2006: Web 2.0

The “web 2.0” tag gained popularity from Tim O’Reilly’s use in the first Web 2.0 Conference in 2004, but not until around 2006 did the term begin to penetrate in educational usage, with Bryan Alexander highlighting the relevance of social and open aspects of its application. The practical term “web 2.0” gathered together the user-generated content services, including YouTube, Flickr, and blogs. But it was more than just a useful term for a set of technologies; it seemed to capture a new mindset in our relation to the internet. After O’Reilly set out the seven principles of web 2.0, the web 2.0 boom took off.
Just as the fascination with e-learning had seen every possible term prefixed with “e,” so the addition of “2.0” to any educational term made it fashionable. But soon the boom was followed by the consequent bust (a business plan was needed after all), and problems with some of the core concepts meant that by 2009, web 2.0 was being declared dead. Inherent in much of the web 2.0 approach was a free service, which inevitably led to data being the key source for revenue and gave rise to the oft-quoted line “If you’re not paying for it, you’re the product being sold.” As web 2.0 morphed into social media, the inherent issues around free speech and offensive behavior came to the fore. In educational terms, this raises issues about duty of care for students, recognizing academic labor, and marginalized groups. The utopia of web 2.0 turned out to be one with scant regard for employment laws and largely reserved for “tech bros.”

Nevertheless, at the time, web 2.0 posed a fundamental question as to how education conducts many of its cherished processes. Peer review, publishing, ascribing quality—all of these were founded on what David Weinberger referred to as filtering on the way in rather than on the way out. While the quality of much online content was poor, there was always an aspect of what was “good enough” for any learner. With the demise of the optimism around web 2.0, many of the accompanying issues raised for higher education have largely been forgotten—before they were even addressed. For instance, while the open repository for physics publications (arXiv) and open-access methods for publication became mainstream, the journal system is still dominant, largely based on double-blind, anonymous peer review. Integrating into the mainstream the participatory culture that web 2.0 brought to the fore remains both a challenge and an opportunity for higher education.

### 2007: Second Life and Virtual Worlds

Online virtual worlds and Second Life had been around for some time, with Second Life launching in 2003, but they begin to see an upsurge in popularity around 2007. Colleges and universities began creating their own islands, and whole courses were delivered through Second Life. While the virtual worlds had strong devotees, they didn’t gain as much traction with students as envisaged, and most Second Life campuses are now deserted. Partly this was a result of a lack of imagination: they were often used to re-create an online lecture. The professor may have been represented by a seven-foot-tall purple cat in that lecture, but it was a lecture nonetheless. Virtual worlds also didn’t manage to shrug off their nerdy, role-playing origins, and many users felt an aversion to this. The worlds could be glitchy as well, which meant that many people never made it off Orientation Island in Second Life, for example. However, with the success of games such as Minecraft and Pokémon Go, more robust technology, and more widespread familiarity with avatars and gaming, virtual worlds for learning may be one of those technologies due for a comeback.

### 2008: E-portfolios

Like learning objects, e-portfolios were backed by a sound idea. The e-portfolio was a place to store all the evidence a learner gathered to exhibit learning, both formal and informal, in order to support lifelong learning and career development. But like learning objects—and despite academic interest and a lot of investment in technology and standards—e-portfolios did not become the standard form of assessment as proposed. Many of their problems were similar to those that beleaguered learning objects, including overcomplicated software, an institutional rather than a user focus, and a lack of accompanying pedagogical change. Although e-portfolio tools remain pertinent for many subjects,
particularly vocational ones, for many students owning their own domain and blog remains a better route to establishing a lifelong digital identity. It is perhaps telling that although many practitioners in higher education maintain blogs, asking to see a colleague’s e-portfolio is likely to be met with a blank response.

2009: Twitter and Social Media

Founded in 2006, Twitter had moved well beyond the tech-enthusiast bubble by 2009 but had yet to become what we know it as today: a tool for wreaking political mayhem. With the trolls, bots, daily outrages, and generally toxic behavior not only on Twitter but also on Facebook and other social media, it’s difficult to recall the optimism that we once held for these technologies. In 2009, though, the ability to make global connections, to easily cross disciplines, and to engage in meaningful discussion all before breakfast was revolutionary. There was also a democratizing effect: formal academic status was not significant, since users were judged on the value of their contributions to the network. In educational terms, social media has done much to change the nature of the relationship between academics, students, and the institution. Even though the negative aspects are now undeniable, some of that early promise remains. What we are now wrestling with is the paradox of social media: the fact that its negatives and its positives exist simultaneously.

2010: Connectivism

The early enthusiasm for e-learning saw a number of pedagogies resurrected or adopted to meet the new potential of the digital, networked context. Constructivism, problem-based learning, and resource-based learning all saw renewed interest as educators sought to harness the possibility of abundant content and networked learners. Yet connectivism, as proposed by George Siemens and Stephen Downes in 2004–2005, could lay claim to being the first internet-native learning theory. Siemens defined connectivism as “the integration of principles explored by chaos, network, and complexity and self-organization theories. Learning is a process that occurs within nebulous environments of shifting core elements—not entirely under the control of the individual.”

Further investigating the possibility of networked learning led to the creation of the early MOOCs, including influential open courses by Downes and Siemens in 2008 and 2009. Pinning down exactly what connectivism was could be difficult, but it represented an attempt to rethink how learning is best realized given the new realities of a digital, networked, open environment, as opposed to forcing technology into the service of existing practices. It also provided the basis for MOOCs, although the approach they eventually adopted was far removed from connectivism (see 2012).

2011: PLE

Personal Learning Environments (PLEs) were an outcome of the proliferation of services that suddenly became available following the web 2.0 boom. Learners and educators began to gather a set of tools to realize a number of functions. In edtech, the conversation turned to whether these tools could be somehow “glued” together in terms of data. Instead of talking about one LMS provided to all students, we were discussing how each learner had his/her own particular blend of tools. Yet beyond a plethora of spoke diagrams, with each showing a different collection of icons, the PLE concept didn’t really develop after its peak in 2011. The problem was that passing along data was not a trivial task, and we soon became wary about applications that shared data (although perhaps not wary...
enough, given recent news regarding Cambridge Analytica\textsuperscript{17}. Also, providing a uniform offering and support for learners was difficult when they were all using different tools. The focus shifted from a personalized set of tools to a personalized set of resources, and in recent years this has become the goal of personalization.

**2012: MOOCS**

Inevitably, 2012 will be seen as the year of MOOCs\textsuperscript{18}. In many ways the MOOC phenomenon can be viewed as the combination of several preceding technologies: some of the open approach of OER, the application of video, the experimentation of connectivism, and the revolutionary hype of web 2.0. Clay Shirky mistakenly proclaimed that MOOCs were the internet happening to education\textsuperscript{19}. If he’d been paying attention, he would have seen that this had been happening for some time. Rather, MOOCs were Silicon Valley happening to education. Once Stanford Professor Sebastian Thrun’s course had attracted over 100,000 learners and almost as many headlines\textsuperscript{20}, the venture capitalist investment flooded in.

Much has been written about MOOCs, more than I can do justice to here. They are a case study still in the making. The raised profile of open education and online learning caused by MOOCs may be beneficial in the long run, but the MOOC hype (only ten global providers of higher education by 2022?\textsuperscript{21}) may be equally detrimental. The edtech field needs to learn how to balance these developments. Millions of learners accessing high-quality material online is a positive, but the rush by colleges and universities to enter into prohibitive contracts, outsource expertise, and undermine their own staff has long-term consequences as well.

**2013: Open Textbooks**

If MOOCs were the glamorous side of open education, all breathless headlines and predictions, open textbooks were the practical, even dowdy, application. An extension of the OER movement, and particularly pertinent in the United States and Canada, open textbooks provided openly licensed versions of bespoke written textbooks, free for the digital version. The cost of textbooks provided a motivation for adoption, and the switching of costs from production to purchase offers a viable model. As with LMSs, open textbooks offer an easy route to adoption. Exploration around open pedagogy, co-creation with students, and diversification of the curriculum all point to a potentially rich, open, edtech ecosystem—with open textbooks at the center.\textsuperscript{22} However, the possible drawback is that like LMSs, open textbooks may not become a stepping-stone on the way to a more innovative, varied teaching approach but, rather, may become an end point in themselves.

**2014: Learning Analytics**

Data, data, data. It’s the new oil and the new driver of capitalism, war, politics. So inevitably its role in education would come to the fore. Interest in analytics is driven by the increased amount of time that students spend in online learning environments, particularly LMSs and MOOCs. The positive side of learning analytics is that for distance education, it provides the equivalent of responding to discreet signals in the face-to-face environment: the puzzled expression, the yawn, or the whispering between students looking for clarity. Every good face-to-face educator will respond to these signals and adjust his/her behavior. If in an online environment, an educator sees that students are repeatedly going back to a resource, that might indicate a similar need to adapt behavior. The
downsides are that learning analytics can reduce students to data and that ownership over the data becomes a commodity in itself. The use of analytics has only just begun. The edtech field needs to avoid the mistakes of data capitalism; it should embed learner agency and ethics in the use of data, and it should deploy that data sparingly.\footnote{\textsuperscript{23}}

\section*{2015: Digital Badges}

Providing digital badges for achievements that can be verified and linked to evidence started with Mozilla’s open badge infrastructure [https://openbadges.org/] in 2011. Like many other edtech developments, digital badges had an initial flurry of interest from devotees but then settled into a pattern of more laborious long-term acceptance. They represent a combination of key challenges for educational technology: realizing easy-to-use, scalable technology; developing social awareness that gives them currency; and providing the policy and support structures that make them valuable.

Of these challenges, only the first relates directly to technology; the more substantial ones relate to awareness and legitimacy. For example, if employers or institutions come to widely accept and value digital badges, then they will gain credence with learners, creating a virtuous circle. There is some movement in this area, particularly with regard to staff development within organizations and often linked with MOOCs.\footnote{\textsuperscript{24}} Perhaps more interesting is what happens when educators design for badges, breaking courses down into smaller chunks with associated recognition, and when communities of practice give badges value. Currently, their use is at an indeterminate stage—neither a failed enterprise nor the mainstream adoption once envisaged.

2016: The Return of AI

Artificial intelligence (AI) was the focus of attention in education in the 1980s and 1990s with the possible development of intelligent tutoring systems. The initial enthusiasm for these systems has waned somewhat, mainly because they worked for only very limited, tightly specified domains. A user needed to predict the types of errors people would make in order to provide advice on how to rectify those errors. And in many subjects (the humanities in particular), people are very creative in the errors they make, and more significantly, what constitutes the right answer is less well defined.

Interest in AI faded as interest in the web and related technologies increased, but it has resurfaced in the past five years or so. What has changed over this intervening period is the power of computation. This helps address some of the complexity because multiple possibilities and probabilities can be accommodated. Here we see a recurring theme in edtech: nothing changes while, simultaneously, everything changes. AI has definitely improved since the 1990s, but some of its fundamental problems remain. It always seems to be a technology that is just about to break out of the box.

More significant than the technological issues are the ethical ones. As Audrey Watters contends, AI is ideological.\footnote{\textsuperscript{25}} The concern about AI is not that it won’t deliver on the promise held forth by its advocates but, rather, that someday it will. And then the assumptions embedded in code will shape how education is realized, and if learners don’t fit that conceptual model, they will find themselves outside of the area in which compassion will allow a human to alter or intervene. Perhaps the greatest contribution of AI will be to make us realize how important people truly are in the education system.
2017: Blockchain

Of all the technologies listed here, blockchain is perhaps the most perplexing, both in how it works and in why it is even in this list. In 2016 several people independently approached me about blockchain—the distributed, secure ledger for keeping the records that underpin Bitcoin. The question was always the same: “Could we apply this in education somehow?” The imperative seemed to be that blockchain was a cool technology, and therefore there must be an educational application. It could provide a means of recording achievements and bringing together large and small, formal and informal, outputs and recognition.\[fn26\]

Viewed in this way, blockchain is attempting to bring together several issues and technologies: e-portfolios, with the aim to provide an individual, portable record of educational achievement; digital badges, with the intention to recognize informal learning; MOOCs and OER, with the desire to offer varied informal learning opportunities; PLEs and personalized learning, with the idea to focus more on the individual than on an institution. A personal, secure, permanent, and portable ledger may well be the ring to bind all these together. However, the history of these technologies should also be a warning for blockchain enthusiasts. With e-portfolios, for instance, even when there is a clear connection to educational practice, adoption can be slow, requiring many other components to fall into place. In 2018 even the relatively conservative and familiar edtech of open textbooks is far from being broadly accepted. Attempting to convince educators that a complex technology might solve a problem they don’t think they have is therefore unlikely to meet with widespread support.

If blockchain is to realize any success, it will need to work almost unnoticed; it will succeed only if people don’t know they’re using blockchain. Nevertheless, many who propose blockchain display a definite evangelist’s zeal. They desire its adoption as an end goal in itself, rather than as an appropriate solution to a specific problem.

2018: TBD

We’re only halfway through 2018, so it would be premature to select a technology, theory, or concept for the year. But one aspect worth considering is what might be termed the dark side of edtech. Given the use of social media for extremism, data scares such as the Facebook breach by Cambridge Analytica, anxieties about Russian bots, concerted online abuse, and increased data surveillance, the unbridled optimism that technology will create an educational utopia now seems naïve. It is not just informed critics such as Michael Caulfield\[fn27\] who are warning of the dangers of overreliance on and trust in edtech; the implicit problems are now apparent to most everyone in the field. In 2018, edtech stands on the brink of a new era, one that has a substantial underpinning of technology but that needs to build on the ethical, practical, and conceptual frameworks that combat the nefarious applications of technology.

Conclusion

Obviously, one or two paragraphs cannot do justice to technologies that require several books each, and my list has undoubtedly omitted several important developments (e.g., gaming, edupunk, automatic assessment, virtual reality, and Google might all be contenders). However, from this brief overview, a number of themes can be extracted to help inform the next twenty years.
The first of these is that in edtech, the *tech* part of the phrase walks taller. In my list, most of the innovations are technologies. Sometimes these come with strong accompanying educational frameworks, but other times they are a technology seeking an application. This is undoubtedly a function of my having lived through the first flush of the digital revolution. A future list may be better balanced with conceptual frameworks, pedagogies, and social movements.

Second, several ideas recur, with increasing success in their adoption. Learning objects were the first attempt at making teaching content reusable, and even though they weren’t successful, the ideas they generated led to OER, which begat open textbooks. So, those who have been in the edtech field for a while should be wary of dismissing an idea by saying: “We tried that; it didn’t work.” Similarly, those proposing a new idea need to understand why previous attempts failed.

Third, technology outside of education has consistently been co-opted for educational purposes. This has met with varying degrees of success. Blogs, for instance, are an ideal educational technology, whereas Second Life didn’t reach a sustainable adoption. The popularity of—or the number of *Wired* headlines about—a technology does not automatically make it a contender as a useful technology for education.

This leads into the last point: education is a complex, highly interdependent system. It is not like the banking, record, or media industries. The simple transfer of technology from other sectors often fails to appreciate the sociocultural context in which education operates. Generally, only those technologies that directly offer an improved, or alternative, means of addressing the core functions of education get adopted. These core functions can be summarized as content, delivery and recognition. OER, LMS, and online assessment all directly map onto these functions. Yet even when there is a clear link, such as between e-portfolios and recognition, the required cultural shifts can be more significant. Equally, edtech has frequently failed to address the social impact of advocating for or implementing a technology beyond the higher education sector. MOOCs, learning analytics, AI, social media—the widespread adoption of these technologies leads to social implications that higher education has been guilty of ignoring. The next phase of edtech should be framed more as a conversation about the specific needs of higher education and the responsibilities of technology adoption.

When we look back twenty years, the picture is mixed. Clearly, a rapid and fundamental shift in higher education practice has taken place, driven by technology adoption. Yet at the same time, nothing much has changed, and many edtech developments have failed to have significant impact. Perhaps the overall conclusion, then, is that edtech is not a game for the impatient.

Notes

5. See, e.g., Michael Feldstein, “How and Why the IMS Failed with LTI 2.0 [https://edtechbooks.org/-xZi](https://edtechbooks.org/-xZi)” (August 2002). [#fnr4](#fnr4)


Please complete this short survey to provide feedback on this chapter: [http://bit.ly/20yearsEdTech](http://bit.ly/20yearsEdTech)
II. Learning and Instruction

Many of the activities that LIDT professionals engage in are also completed by other professionals, such as web designers, curriculum writers, multimedia developers, and teachers. A powerful difference for LIDT professionals is our understanding of learning and instructional theory, and our efforts to apply these theories to our LIDT practice. For this reason, understanding what psychology and science can teach us about how people learn, and how good instruction is provided, is critical to any effective LIDT professional. The chapters in this section serve only as a basic starting ground to your pursuit of understanding in this area. You will learn about how the mind works and remembers information, and emotional factors in learning such as motivation and self-efficacy. I have included a classic article by Peg Ertmer and Tim Newby on the "Big 3" learning theories of behaviorism, cognitivism, and constructivism and a new chapter on sociocultural learning theories which extend beyond the Big 3. Included are a few chapters on more recent theoretical developments in the areas of informal learning, internet-based learning (connectivism), learning communities, and creative learning. Finally, two chapters are included on instructional theory from Charles Reigeluth, who edited several editions of the book Instructional-Design Theories and Models and David Merrill, whose First Principles of Instruction summary of basic instructional principles is perhaps the most well known of instructional frameworks in our field.

Additional Reading

An excellent resource to supplement your reading of learning theories in this section is the newly released How People Learn book, available for free online.

https://edtechbooks.org/-iT
How Memory Functions

Memory is an information processing system; therefore, we often compare it to a computer. Memory is the set of processes used to encode, store, and retrieve information over different periods of time.

Encoding

We get information into our brains through a process called encoding, which is the input of information into the memory system. Once we receive sensory information from the environment, our brains label or code it. We organize the information with other similar information and connect new concepts to existing concepts. Encoding information occurs through automatic processing and effortful processing.

If someone asks you what you ate for lunch today, more than likely you could recall this information quite easily. This is known as automatic processing, or the encoding of details like time, space, frequency, and the meaning of words. Automatic processing is usually done without any conscious awareness. Recalling the last time you studied for a test is another example of automatic processing. But what about the actual test material you studied? It probably required a lot of work and attention on your part in order to encode that information. This is known as effortful processing.

What are the most effective ways to ensure that important memories are well encoded? Even a simple sentence is easier to recall when it is meaningful (Anderson, 1984). Read the following sentences (Bransford & McCarrell, 1974), then look away and count backwards from 30 by threes to zero, and then try to write down the sentences (no peeking!).

Editor's Notes

The following is excerpted from an OpenStax book produced by Rice University. It can be downloaded for free at https://edtechbooks.org/-Gz

1. The notes were sour because the seams split.
2. The voyage wasn’t delayed because the bottle shattered.
3. The haystack was important because the cloth ripped.

How well did you do? By themselves, the statements that you wrote down were most likely confusing and difficult for you to recall. Now, try writing them again, using the following prompts: bagpipe, ship christening, and parachutist. Next count backwards from 40 by fours, then check yourself to see how well you recalled the sentences this time. You can see that the sentences are now much more memorable because each of the sentences was placed in context. Material is far better encoded when you make it meaningful.

There are three types of encoding. The encoding of words and their meaning is known as semantic encoding. It was first demonstrated by William Bousfield (1935) in an experiment in which he asked people to memorize words. The 60 words were actually divided into 4 categories of meaning, although the participants did not know this because the words were randomly presented. When they were asked to remember the words, they tended to recall them in categories, showing that they paid attention to the meanings of the words as they learned them.

Visual encoding is the encoding of images, and acoustic encoding is the encoding of sounds, words in particular. To see how visual encoding works, read over this list of words: car, level, dog, truth, book, value. If you were asked later to recall the words from this list, which ones do you think you’d most likely remember? You would probably have an easier time recalling the words car, dog, and book, and a more difficult time recalling the words level, truth, and value. Why is this? Because you can recall images (mental pictures) more easily than words alone. When you read the words car, dog, and book you created images of these things in your mind. These are concrete, high-imagery words. On the other hand, abstract words like level, truth, and value are low-imagery words. High-imagery words are encoded both visually and semantically (Paivio, 1986), thus building a stronger memory.

Now let’s turn our attention to acoustic encoding. You are driving in your car and a song comes on the radio that you haven’t heard in at least 10 years, but you sing along, recalling every word. In the United States, children often learn the alphabet through song, and they learn the number of days in each month through rhyme: “Thirty days hath September, / April, June, and November; / All the rest have thirty-one, / Save February, with twenty-eight days clear, / And twenty-nine each leap year.” These lessons are easy to remember because of acoustic encoding. We encode the sounds the words make. This is one of the reasons why much of what we teach young children is done through song, rhyme, and rhythm.

Which of the three types of encoding do you think would give you the best memory of verbal information? Some years ago, psychologists Fergus Craik and Endel Tulving (1975) conducted a series of experiments to find out. Participants were given words along with questions about them. The questions required the participants to process the words at one of the three levels. The visual processing questions included such things as asking the participants about the font of the letters. The acoustic processing questions asked the participants about the sound or rhyming of the words, and the semantic processing questions asked the participants about the meaning of the words. After participants were presented with the words and questions, they were given an unexpected recall or recognition task.

Words that had been encoded semantically were better remembered than those encoded visually or acoustically. Semantic encoding involves a deeper level of processing than the shallower visual or
acoustic encoding. Craik and Tulving concluded that we process verbal information best through semantic encoding, especially if we apply what is called the self-reference effect. The self-reference effect is the tendency for an individual to have better memory for information that relates to oneself in comparison to material that has less personal relevance (Rogers, Kuiper & Kirker, 1977).

Storage

Once the information has been encoded, we somehow have to retain it. Our brains take the encoded information and place it in storage. Storage is the creation of a permanent record of information.

In order for a memory to go into storage (i.e., long-term memory), it has to pass through three distinct stages: Sensory Memory, Short-Term Memory, and finally Long-Term Memory. These stages were first proposed by Richard Atkinson and Richard Shiffrin (1968). Their model of human memory (Figure 1), called Atkinson-Shiffrin (A-S), is based on the belief that we process memories in the same way that a computer processes information.

**Multi Store Model - Atkinson & Shiffrin**

![Atkinson & Shiffrin Memory Model](https://commons.wikimedia.org/wiki/File:Atkinson_Shiffrin_memory_model.png)

**Figure 1.** Atkinson & Shiffrin Memory Model. Created by Dkahng and available on Wikimedia Commons under a CC-BY, Share Alike license.

But A-S is just one model of memory. Others, such as Baddeley and Hitch (1974), have proposed a model where short-term memory itself has different forms. In this model, storing memories in short-
term memory is like opening different files on a computer and adding information. The type of short-term memory (or computer file) depends on the type of information received. There are memories in visual spatial form, as well as memories of spoken or written material, and they are stored in three short-term systems: a visuospatial sketchpad, an episodic buffer, and a phonological loop. According to Baddeley and Hitch, a central executive part of memory supervises or controls the flow of information to and from the three short-term systems.

**Sensory Memory**

In the Atkinson-Shiffrin model, stimuli from the environment are processed first in sensory memory: storage of brief sensory events, such as sights, sounds, and tastes. It is very brief storage—up to a couple of seconds. We are constantly bombarded with sensory information. We cannot absorb all of it, or even most of it. And most of it has no impact on our lives. For example, what was your professor wearing the last class period? As long as the professor was dressed appropriately, it does not really matter what she was wearing. Sensory information about sights, sounds, smells, and even textures, which we do not view as valuable information, we discard. If we view something as valuable, the information will move into our short-term memory system.

One study of sensory memory researched the significance of valuable information on short-term memory storage. J. R. Stroop discovered a memory phenomenon in the 1930s: you will name a color more easily if it appears printed in that color, which is called the Stroop effect. In other words, the word “red” will be named more quickly, regardless of the color the word appears in, than any word that is colored red. Try an experiment: name the colors of the words you are given in Figure 2. Do not read the words, but say the color the word is printed in. For example, upon seeing the word “yellow” in green print, you should say, “Green,” not “Yellow.” This experiment is fun, but it’s not as easy as it seems.

![Stroop Effect Memory Test](https://commons.wikimedia.org/wiki/File:Stroop_effect_test.png)

**Figure 2.** Stroop Effect Memory Test. Available on Wikimedia Commons from “Fitness queen04,” and licensed CC-By, Share Alike

**Short-term Memory**

Short-term memory (STM) is a temporary storage system that processes incoming sensory memory; sometimes it is called working memory. Short-term memory takes information from sensory memory and sometimes connects that memory to something already in long-term memory. Short-term memory storage lasts about 20 seconds. George Miller (1956), in his research on the capacity of memory, found that most people can retain about 7 items in STM. Some remember 5, some 9, so he called the capacity of STM 7 plus or minus 2.

Think of short-term memory as the information you have displayed on your computer screen—a document, a spreadsheet, or a web page. Then, information in short-term memory goes to long-term memory (you save it to your hard drive), or it is discarded (you delete a document or close a web browser). This step of rehearsal, the conscious repetition of information to be remembered, to move
STM into long-term memory is called memory consolidation.

You may find yourself asking, “How much information can our memory handle at once?” To explore the capacity and duration of your short-term memory, have a partner read the strings of random numbers (Figure 3) out loud to you, beginning each string by saying, “Ready?” and ending each by saying, “Recall,” at which point you should try to write down the string of numbers from memory.

![Figure 3](image-url) Work through this series of numbers using the recall exercise explained above to determine the longest string of digits that you can store. Image available in original OpenStax chapter.

Note the longest string at which you got the series correct. For most people, this will be close to 7, Miller’s famous 7 plus or minus 2. Recall is somewhat better for random numbers than for random letters (Jacobs, 1887), and also often slightly better for information we hear (acoustic encoding) rather than see (visual encoding) (Anderson, 1969).

**Long-term Memory**

Long-term memory (LTM) is the continuous storage of information. Unlike short-term memory, the storage capacity of LTM has no limits. It encompasses all the things you can remember that happened more than just a few minutes ago to all of the things that you can remember that happened days, weeks, and years ago. In keeping with the computer analogy, the information in your LTM would be like the information you have saved on the hard drive. It isn’t there on your desktop (your short-term memory), but you can pull up this information when you want it, at least most of the time. Not all long-term memories are strong memories. Some memories can only be recalled through prompts. For example, you might easily recall a fact (“What is the capital of the United States?”) or a procedure (“How do you ride a bike?”) but you might struggle to recall the name of the restaurant you had dinner at when you were on vacation in France last summer. A prompt, such as that the restaurant was named after its owner, who spoke to you about your shared interest in soccer, may help you recall the name of the restaurant.

Long-term memory is divided into two types: explicit and implicit (Figure 4). Understanding the different types is important because a person’s age or particular types of brain trauma or disorders can leave certain types of LTM intact while having disastrous consequences for other types. Explicit memories are those we consciously try to remember and recall. For example, if you are studying for your chemistry exam, the material you are learning will be part of your explicit memory. (Note: Sometimes, but not always, the terms explicit memory and declarative memory are used interchangeably.)

Implicit memories are memories that are not part of our consciousness. They are memories formed from behaviors. Implicit memory is also called non-declarative memory.
Procedural memory is a type of implicit memory: it stores information about how to do things. It is
the memory for skilled actions, such as how to brush your teeth, how to drive a car, how to swim the
crawl (freestyle) stroke. If you are learning how to swim freestyle, you practice the stroke: how to
move your arms, how to turn your head to alternate breathing from side to side, and how to kick your
legs. You would practice this many times until you become good at it. Once you learn how to swim
freestyle and your body knows how to move through the water, you will never forget how to swim
freestyle, even if you do not swim for a couple of decades. Similarly, if you present an accomplished
guitarist with a guitar, even if he has not played in a long time, he will still be able to play quite well.

Declarative memory has to do with the storage of facts and events we personally experienced.
Explicit (declarative) memory has two parts: semantic memory and episodic memory. Semantic
means having to do with language and knowledge about language. An example would be the question
“What does argumentative mean?” Stored in our semantic memory is knowledge about words,
concepts, and language-based knowledge and facts. For example, answers to the following questions
are stored in your semantic memory:

- Who was the first President of the United States?
- What is democracy?
- What is the longest river in the world?

Episodic memory is information about events we have personally experienced. The concept of
episodic memory was first proposed about 40 years ago (Tulving, 1972). Since then, Tulving and
others have looked at scientific evidence and reformulated the theory. Currently, scientists believe
that episodic memory is memory about happenings in particular places at particular times, the what,
where, and when of an event (Tulving, 2002). It involves recollection of visual imagery as well as the
feeling of familiarity (Hassabis & Maguire, 2007).

Watch these Part 1 (link [https://edtechbooks.org/-XP]) and Part 2 (link [https://edtechbooks.org/-
Puz]) video clips on superior autobiographical memory from the television news show 60 Minutes.

**Retrieval**

So you have worked hard to encode (via effortful processing) and store some important information
for your upcoming final exam. How do you get that information back out of storage when you need it?
The act of getting information out of memory storage and back into conscious awareness is known as retrieval. This would be similar to finding and opening a paper you had previously saved on your computer’s hard drive. Now it’s back on your desktop, and you can work with it again. Our ability to retrieve information from long-term memory is vital to our everyday functioning. You must be able to retrieve information from memory in order to do everything from knowing how to brush your hair and teeth, to driving to work, to knowing how to perform your job once you get there.

There are three ways you can retrieve information out of your long-term memory storage system: recall, recognition, and relearning. Recall is what we most often think about when we talk about memory retrieval: it means you can access information without cues. For example, you would use recall for an essay test. Recognition happens when you identify information that you have previously learned after encountering it again. It involves a process of comparison. When you take a multiple-choice test, you are relying on recognition to help you choose the correct answer. Here is another example. Let’s say you graduated from high school 10 years ago, and you have returned to your hometown for your 10-year reunion. You may not be able to recall all of your classmates, but you recognize many of them based on their yearbook photos.

The third form of retrieval is relearning, and it’s just what it sounds like. It involves learning information that you previously learned. Whitney took Spanish in high school, but after high school she did not have the opportunity to speak Spanish. Whitney is now 31, and her company has offered her an opportunity to work in their Mexico City office. In order to prepare herself, she enrolls in a Spanish course at the local community center. She’s surprised at how quickly she’s able to pick up the language after not speaking it for 13 years; this is an example of relearning.

Summary

Memory is a system or process that stores what we learn for future use.

Our memory has three basic functions: encoding, storing, and retrieving information. Encoding is the act of getting information into our memory system through automatic or effortful processing. Storage is retention of the information, and retrieval is the act of getting information out of storage and into conscious awareness through recall, recognition, and relearning. The idea that information is processed through three memory systems is called the Atkinson-Shiffrin (A-S) model of memory. First, environmental stimuli enter our sensory memory for a period of less than a second to a few seconds. Those stimuli that we notice and pay attention to then move into short-term memory (also called working memory). According to the A-S model, if we rehearse this information, then it moves into long-term memory for permanent storage. Other models like that of Baddeley and Hitch suggest there is more of a feedback loop between short-term memory and long-term memory. Long-term memory has a practically limitless storage capacity and is divided into implicit and explicit memory. Finally, retrieval is the act of getting memories out of storage and back into conscious awareness. This is done through recall, recognition, and relearning.

Please complete this short survey to provide feedback on this chapter: [http://bit.ly/TheoriesonMemory](http://bit.ly/TheoriesonMemory)
10

Intelligence

What is Intelligence?

Rose Spielman, Kathryn Dumper, William Jenkins, Arlene Lacombe, Marilyn Lovett, & Marion Perlmutter

Editor's Note

The following is excerpted from an OpenStax book produced by Rice University. Download at https://edtechbooks.org/-Gz.


The way that researchers have defined the concept of intelligence has been modified many times since the birth of psychology. British psychologist Charles Spearman believed intelligence consisted of one general factor, called $g$, which could be measured and compared among individuals. Spearman focused on the commonalities among various intellectual abilities and de-emphasized what made each unique. Long before modern psychology developed, however, ancient philosophers, such as Aristotle, held a similar view (Cianciolo & Sternberg, 2004).

Other psychologists believe that instead of a single factor, intelligence is a collection of distinct abilities. In the 1940s, Raymond Cattell proposed a theory of intelligence that divided general intelligence into two components: crystallized intelligence and fluid intelligence (Cattell, 1963). Crystallized intelligence is characterized as acquired knowledge and the ability to retrieve it. When you learn, remember, and recall information, you are using crystallized intelligence. You use crystallized intelligence all the time in your coursework by demonstrating that you have mastered the information covered in the course. Fluid intelligence encompasses the ability to see complex relationships and solve problems. Navigating your way home after being detoured onto an unfamiliar route because of road construction would draw upon your fluid intelligence. Fluid intelligence helps you tackle complex, abstract challenges in your daily life, whereas crystallized intelligence helps you overcome concrete, straightforward problems (Cattell, 1963).

Other theorists and psychologists believe that intelligence should be defined in more practical terms. For example, what types of behaviors help you get ahead in life? Which skills promote success? Think about this for a moment. Being able to recite all 44 presidents of the United States in order is an excellent party trick, but will knowing this make you a better person?

Robert Sternberg developed another theory of intelligence, which he titled the triarchic theory of
intelligence because it sees intelligence as comprised of three parts (Sternberg, 1988): practical, creative, and analytical intelligence (Figure 1).

Figure 1. Sternberg’s theory identifies three types of intelligence: practical, creative, and analytical. Included in original OpenStax chapter.

Practical intelligence, as proposed by Sternberg, is sometimes compared to “street smarts.” Being practical means you find solutions that work in your everyday life by applying knowledge based on your experiences. This type of intelligence appears to be separate from traditional understanding of IQ; individuals who score high in practical intelligence may or may not have comparable scores in creative and analytical intelligence (Sternberg, 1988).

This story about the 2007 Virginia Tech shootings illustrates both high and low practical intelligences. During the incident, one student left her class to go get a soda in an adjacent building. She planned to return to class, but when she returned to her building after getting her soda, she saw that the door she used to leave was now chained shut from the inside. Instead of thinking about why there was a chain around the door handles, she went to her class’s window and crawled back into the room. She thus potentially exposed herself to the gunman. Thankfully, she was not shot. On the other hand, a pair of students was walking on campus when they heard gunshots nearby. One friend said, “Let’s go check it out and see what is going on.” The other student said, “No way, we need to run away from the gunshots.” They did just that. As a result, both avoided harm. The student who crawled through the window demonstrated some creative intelligence but did not use common sense. She would have low practical intelligence. The student who encouraged his friend to run away from the sound of gunshots would have much higher practical intelligence.

Analytical intelligence is closely aligned with academic problem solving and computations. Sternberg says that analytical intelligence is demonstrated by an ability to analyze, evaluate, judge, compare, and contrast. When reading a classic novel for literature class, for example, it is usually necessary to compare the motives of the main characters of the book or analyze the historical context of the story.
In a science course such as anatomy, you must study the processes by which the body uses various minerals in different human systems. In developing an understanding of this topic, you are using analytical intelligence. When solving a challenging math problem, you would apply analytical intelligence to analyze different aspects of the problem and then solve it section by section.

Creative intelligence is marked by inventing or imagining a solution to a problem or situation. Creativity in this realm can include finding a novel solution to an unexpected problem or producing a beautiful work of art or a well-developed short story. Imagine for a moment that you are camping in the woods with some friends and realize that you’ve forgotten your camp coffee pot. The person in your group who figures out a way to successfully brew coffee for everyone would be credited as having higher creative intelligence.

Multiple Intelligences Theory was developed by Howard Gardner, a Harvard psychologist and former student of Erik Erikson. Gardner’s theory, which has been refined for more than 30 years, is a more recent development among theories of intelligence. In Gardner’s theory, each person possesses at least eight intelligences. Among these eight intelligences, a person typically excels in some and falters in others (Gardner, 1983). Figure 2 describes each type of intelligence.

![Multiple Intelligences Theory](image)

**Figure 2.** Multiple intelligences theory proposed by Gardner. Image from Sajaganesandip on Wikimedia Commons and licensed CC-By, Share Alike

*Foundations of Learning and Instructional Design Technology*
Gardner’s theory is relatively new and needs additional research to better establish empirical support. At the same time, his ideas challenge the traditional idea of intelligence to include a wider variety of abilities, although it has been suggested that Gardner simply relabeled what other theorists called “cognitive styles” as “intelligences” (Morgan, 1996). Furthermore, developing traditional measures of Gardner’s intelligences is extremely difficult (Furnham, 2009; Gardner & Moran, 2006; Klein, 1997).

Gardner’s inter- and intrapersonal intelligences are often combined into a single type: emotional intelligence. Emotional intelligence encompasses the ability to understand the emotions of yourself and others, show empathy, understand social relationships and cues, and regulate your own emotions and respond in culturally appropriate ways (Parker, Saklofske, & Stough, 2009). People with high emotional intelligence typically have well-developed social skills. Some researchers, including Daniel Goleman, the author of Emotional Intelligence: Why It Can Matter More than IQ, argue that emotional intelligence is a better predictor of success than traditional intelligence (Goleman, 1995). However, emotional intelligence has been widely debated, with researchers pointing out inconsistencies in how it is defined and described, as well as questioning results of studies on a subject that is difficult to measure and study empirically (Locke, 2005; Mayer, Salovey, & Caruso, 2004).

Intelligence can also have different meanings and values in different cultures. If you live on a small island, where most people get their food by fishing from boats, it would be important to know how to fish and how to repair a boat. If you were an exceptional angler, your peers would probably consider you intelligent. If you were also skilled at repairing boats, your intelligence might be known across the whole island. Think about your own family’s culture. What values are important for Latino families? Italian families? In Irish families, hospitality and telling an entertaining story are marks of the culture. If you are a skilled storyteller, other members of Irish culture are likely to consider you intelligent.

Some cultures place a high value on working together as a collective. In these cultures, the importance of the group supersedes the importance of individual achievement. When you visit such a culture, how well you relate to the values of that culture exemplifies your cultural intelligence, sometimes referred to as cultural competence.

**Application Exercises**

- Some argue “that emotional intelligence is a better predictor of success than traditional intelligence.” Discuss whether you agree and/or disagree with this statement, and support why you feel this way.
- What intelligence theory did you find most compelling? Why?

Please complete this short survey to provide feedback on this chapter: [http://bit.ly/IntelligenceTheory](http://bit.ly/IntelligenceTheory)
Behaviorism, Cognitivism, Constructivism

Comparing Critical Features From an Instructional Design Perspective

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Editor's Note

This article was originally published in 1993 and then republished in 2013 by Performance Improvement Quarterly. © 2013 International Society for Performance Improvement Published online in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/piq.21143. The original citation is below:


The need for a bridge between basic learning research and educational practice has long been discussed. To ensure a strong connection between these two areas, Dewey (cited in Reigeluth, 1983) called for the creation and development of a “linking science”; Tyler (1978) a “middleman position”; and Lynch (1945) for employing an “engineering analogy” as an aid for translating theory into practice. In each case, the respective author highlighted the information and potential contributions of available learning theories, the pressing problems faced by those dealing with practical learning issues, and a general lack of using the former to facilitate solutions for the latter. The value of such a bridging function would be its ability to translate relevant aspects of the learning theories into optimal instructional actions. As described by Reigeluth (1983, p. 5), the field of Instructional Design performs this role.

Instructional designers have been charged with “translating principles of learning and instruction into specifications for instructional materials and activities” (Smith & Ragan, 1993, p. 12). To achieve this goal, two sets of skills and knowledge are needed. First, the designer must understand the position of the practitioner. In this regard, the following questions would be relevant: What are the situational and contextual constraints of the application? What is the degree of individual differences among the learners? What form of solutions will or will not be accepted by the learners as well as by those actually teaching the materials? The designer must have the ability to diagnose and analyze practical learning problems. Just as a doctor cannot prescribe an effective remedy without a proper diagnosis, the instructional designer cannot properly recommend an effective prescriptive solution without an accurate analysis of the instructional problem.

In addition to understanding and analyzing the problem, a second core of knowledge and skills is needed to “bridge” or “link” application with research—that of understanding the potential sources of
solutions (i.e., the theories of human learning). Through this understanding, a proper prescriptive solution can be matched with a given diagnosed problem. The critical link, therefore, is not between the design of instruction and an autonomous body of knowledge about instructional phenomena, but between instructional design issues and the theories of human learning.

Why this emphasis on learning theory and research? First, learning theories are a source of verified instructional strategies, tactics, and techniques. Knowledge of a variety of such strategies is critical when attempting to select an effective prescription for overcoming a given instructional problem. Second, learning theories provide the foundation for intelligent and reasoned strategy selection. Designers must have an adequate repertoire of strategies available, and possess the knowledge of when and why to employ each. This knowledge depends on the designer’s ability to match the demands of the task with an instructional strategy that helps the learner. Third, integration of the selected strategy within the instructional context is of critical importance. Learning theories and research often provide information about relationships among instructional components and the design of instruction, indicating how specific techniques/strategies might best fit within a given context and with specific learners (Keller, 1979). Finally, the ultimate role of a theory is to allow for reliable prediction (Richey, 1986). Effective solutions to practical instructional problems are often constrained by limited time and resources. It is paramount that those strategies selected and implemented have the highest chance for success. As suggested by Warries (1990), a selection based on strong research is much more reliable than one based on “instructional phenomena.”

The task of translating learning theory into practical applications would be greatly simplified if the learning process were relatively simple and straightforward. Unfortunately, this is not the case. Learning is a complex process that has generated numerous interpretations and theories of how it is effectively accomplished. Of these many theories, which should receive the attention of the instructional designer? Is it better to choose one theory when designing instruction or to draw ideas from different theories? This article presents three distinct perspectives of the learning process (behavioral, cognitive, and constructivist) and although each has many unique features, it is our belief that each still describes the same phenomena (learning). In selecting the theory whose associated instructional strategies offers the optimal means for achieving desired outcomes, the degree of cognitive processing required of the learner by the specific task appears to be a critical factor. Therefore, as emphasized by Snelbecker (1983), individuals addressing practical learning problems cannot afford the “luxury of restricting themselves to only one theoretical position... [They] are urged to examine each of the basic science theories which have been developed by psychologists in the study of learning and to select those principles and conceptions which seem to be of value for one’s particular educational situation’ (p. 8).

If knowledge of the various learning theories is so important for instructional designers, to what degree are they emphasized and promoted? As reported by Johnson (1992), less than two percent of the courses offered in university curricula in the general area of educational technology emphasize “theory” as one of their key concepts. It appears that the real benefits of theoretical knowledge are, at present, not being realized. This article is an attempt to “fill in some of the gaps” that may exist in our knowledge of modern learning theories. The main intent is to provide designers with some familiarity with three relevant positions on learning (behavioral, cognitive, and constructivist) which should provide a more structured foundation for planning and conducting instructional design activities. The idea is that if we understand some of the deep principles of the theories of learning, we can extrapolate to the particulars as needed. As Bruner (1971) states, “You don’t need to encounter everything in nature in order to know nature” (p. 18). A basic understanding of the learning theories can provide you with a “canny strategy whereby you could know a great deal about a lot of things...
while keeping very little in mind” (p. 18).

It is expected that after reading this article, instructional designers and educational practitioners should be better informed “consumers” of the strategies suggested by each viewpoint. The concise information presented here can serve as an initial base of knowledge for making important decisions regarding instructional objectives and strategies.

**Learning Defined**

Learning has been defined in numerous ways by many different theorists, researchers and educational practitioners. Although universal agreement on any single definition is nonexistent, many definitions employ common elements. The following definition by Shuell (as interpreted by Schunk, 1991) incorporates these main ideas: “Learning is an enduring change in behavior, or in the capacity to behave in a given fashion, which results from practice or other forms of experience” (p. 2).

Undoubtedly, some learning theorists will disagree on the definition of learning presented here. However, it is not the definition itself that separates a given theory from the rest. The major differences among theories lie more in interpretation than they do in definition. These differences revolve around a number of key issues that ultimately delineate the instructional prescriptions that flow from each theoretical perspective. Schunk (1991) lists five definitive questions that serve to distinguish each learning theory from the others:

1. How does learning occur?
2. Which factors influence learning?
3. What is the role of memory?
4. How does transfer occur? and
5. What types of learning are best explained by the theory?

Expanding on this original list, we have included two additional questions important to the instructional designer:

1. What basic assumptions/principles of this theory are relevant to instructional design? and
2. How should instruction be structured to facilitate learning?

In this article, each of these questions is answered from three distinct viewpoints: behaviorism, cognitivism, and constructivism. Although learning theories typically are divided into two categories—behavioral and cognitive—a third category, constructive, is added here because of its recent emphasis in the instructional design literature (e.g., Bednar, Cunningham, Duffy, & Perry, 1991; Duffy & Jonassen, 1991; Jonassen, 1991b; Winn, 1991). In many ways these viewpoints overlap; yet they are distinctive enough to be treated as separate approaches to understanding and describing learning. These three particular positions were chosen because of their importance, both historically and currently, to the field of instructional design. It is hoped that the answers to the first five questions will provide the reader with a basic understanding of how these viewpoints differ. The answers to the last two questions will translate these differences into practical suggestions and recommendations for the application of these principles in the design of instruction.

These seven questions provide the basis for the article’s structure. For each of the three theoretical positions, the questions are addressed and an example is given to illustrate the application of that perspective. It is expected that this approach will enable the reader to compare and contrast the
different viewpoints on each of the seven issues.

As is common in any attempt to compare and contrast similar products, processes, or ideas, differences are emphasized in order to make distinctions clear. This is not to suggest that there are no similarities among these viewpoints or that there are no overlapping features. In fact, different learning theories will often prescribe the same instructional methods for the same situations (only with different terminology and possibly with different intentions). This article outlines the major differences between the three positions in an attempt to facilitate comparison. It is our hope that the reader will gain greater insight into what each viewpoint offers in terms of the design and presentation of materials, as well as the types of learning activities that might be prescribed.

**Historical Foundations**

Current learning theories have roots that extend far into the past. The problems with which today's theorists and researchers grapple and struggle are not new but simply variations on a timeless theme: Where does knowledge come from and how do people come to know? Two opposing positions on the origins of knowledge-empiricism and rationalism have existed for centuries and are still evident, to varying degrees, in the learning theories of today. A brief description of these views is included here as a background for comparing the “modern” learning viewpoints of behaviorism, cognitivism, and constructivism.

**Empiricism** is the view that experience is the primary source of knowledge (Schunk, 1991). That is, organisms are born with basically no knowledge and anything learned is gained through interactions and associations with the environment. Beginning with Aristotle (384-322 B.C.), empiricists have espoused the view that knowledge is derived from sensory impressions. Those impressions, when associated contiguously in time and/or space, can be hooked together to form complex ideas. For example, the complex idea of a tree, as illustrated by Hulse, Egeth, and Deese (1980), can be built from the less complex ideas of branches and leaves, which in turn are built from the ideas of wood and fiber, which are built from basic sensations such as greenness, woody odor, and so forth. From this perspective, critical instructional design issues focus on how to manipulate the environment in order to improve and ensure the occurrence of proper associations.

**Rationalism** is the view that knowledge derives from reason without the aid of the senses (Schunk, 1991). This fundamental belief in the distinction between mind and matter originated with Plato (c. 427-347 B.C.), and is reflected in the viewpoint that humans learn by recalling or “discovering” what already exists in the mind. For example, the direct experience with a tree during one’s lifetime simply serves to reveal that which is already in the mind. The “real” nature of the tree (greenness, woodiness, and other characteristics) becomes known, not through the experience, but through a reflection on one’s idea about the given instance of a tree. Although later rationalists differed on some of Plato’s other ideas, the central belief remained the same: that knowledge arises through the mind. From this perspective, instructional design issues focus on how best to structure new information in order to facilitate (1) the learners’ encoding of this new information, as well as (2) the recalling of that which is already known.

The empiricist, or associationist, mindset provided the framework for many learning theories during the first half of this century, and it was against this background that behaviorism became the leading psychological viewpoint (Schunk, 1991). Because behaviorism was dominant when instructional theory was initiated (around 1950), the instructional design (ID) technology that arose alongside it
was naturally influenced by many of its basic assumptions and characteristics. Since ID has its roots in behavioral theory, it seems appropriate that we turn our attention to behaviorism first.

**Behaviorism**

**How Does Learning Occur?**

Behaviorism equates learning with changes in either the form or frequency of observable performance. Learning is accomplished when a proper response is demonstrated following the presentation of a specific environmental stimulus. For example, when presented with a math flashcard showing the equation “2 + 4 = ?” the learner replies with the answer of “6.” The equation is the stimulus and the proper answer is the associated response. The key elements are the stimulus, the response, and the association between the two. Of primary concern is how the association between the stimulus and response is made, strengthened, and maintained.

Behaviorism focuses on the importance of the consequences of those performances and contends that responses that are followed by reinforcement are more likely to recur in the future. No attempt is made to determine the structure of a student’s knowledge nor to assess which mental processes it is necessary for them to use (Winn, 1990). The learner is characterized as being reactive to conditions in the environment as opposed to taking an active role in discovering the environment.

**Which Factors Influence Learning?**

Although both learner and environmental factors are considered important by behaviorists, environmental conditions receive the greatest emphasis. Behaviorists assess the learners to determine at what point to begin instruction as well as to determine which reinforcers are most effective for a particular student. The most critical factor, however, is the arrangement of stimuli and consequences within the environment.

**What is the Role of Memory?**

Memory, as commonly defined by the layman, is not typically addressed by behaviorists. Although the acquisition of “habits” is discussed, little attention is given as to how these habits are stored or recalled for future use. Forgetting is attributed to the “nonuse” of a response over time. The use of periodic practice or review serves to maintain a learner’s readiness to respond (Schunk, 1991).

**How Does Transfer Occur?**

Transfer refers to the application of learned knowledge in new ways or situations, as well as to how prior learning affects new learning. In behavioral learning theories, transfer is a result of generalization. Situations involving identical or similar features allow behaviors to transfer across common elements. For example, the student who has learned to recognize and classify elm trees demonstrates transfer when (s)he classifies maple trees using the same process. The similarities between the elm and maple trees allow the learner to apply the previous elm tree classification learning experience to the maple tree classification task.
What Types of Learning Are Best Explained by This Position?

Behaviorists attempt to prescribe strategies that are most useful for building and strengthening stimulus-response associations (Winn, 1990), including the use of instructional cues, practice, and reinforcement. These prescriptions have generally been proven reliable and effective in facilitating learning that involves discriminations (recalling facts), generalizations (defining and illustrating concepts), associations (applying explanations), and chaining (automatically performing a specified procedure). However, it is generally agreed that behavioral principles cannot adequately explain the acquisition of higher level skills or those that require a greater depth of processing (e.g., language development, problem solving, inference generating, critical thinking) (Schunk, 1991).

What Basic Assumptions/principles of This Theory Are Relevant to Instructional Design?

Many of the basic assumptions and characteristics of behaviorism are embedded in current instructional design practices. Behaviorism was used as the basis for designing many of the early audio-visual materials and gave rise to many related teaching strategies, such as Skinner’s teaching machines and programmed texts. More recent examples include principles utilized within computer-assisted instruction (CAI) and mastery learning.

Specific assumptions or principles that have direct relevance to instructional design include the following (possible current ID applications are listed in italics and brackets following the listed principle):

1. An emphasis on producing observable and measurable outcomes in students [behavioral objectives, task analysis, criterion-referenced assessment]
2. Pre-assessment of students to determine where instruction should begin [learner analysis]
3. Emphasis on mastering early steps before progressing to more complex levels of performance [sequencing of instructional presentation, mastery learning]
4. Use of reinforcement to impact performance [tangible rewards, informative feedback]
5. Use of cues, shaping and practice to ensure a strong stimulus-response association [simple to complex sequencing of practice, use of prompts]

How Should Instruction Be Structured?

The goal of instruction for the behaviorist is to elicit the desired response from the learner who is presented with a target stimulus. To accomplish this, the learner must know how to execute the proper response, as well as the conditions under which that response should be made. Therefore, instruction is structured around the presentation of the target stimulus and the provision of opportunities for the learner to practice making the proper response. To facilitate the linking of stimulus-response pairs, instruction frequently uses cues (to initially prompt the delivery of the response) and reinforcement (to strengthen correct responding in the presence of the target stimulus).

Behavioral theories imply that the job of the teacher/designer is to (1) determine which cues can elicit the desired responses; (2) arrange practice situations in which prompts are paired with the target stimuli that initially have no eliciting power but which will be expected to elicit the responses in the “natural” (performance) setting; and (3) arrange environmental conditions so that students can make the correct responses in the presence of those target stimuli and receive reinforcement for
those responses (Gropper, 1987).

For example, a newly-hired manager of human resources may be expected to organize a meeting agenda according to the company’s specific format. The target stimulus (the verbal command “to format a meeting agenda”) does not initially elicit the correct response nor does the new manager have the capability to make the correct response. However, with the repeated presentation of cues (e.g., completed templates of past agendas, blank templates arranged in standard format) paired with the verbal command stimulus, the manager begins to make the appropriate responses. Although the initial responses may not be in the final proper form, repeated practice and reinforcement shape the response until it is correctly executed. Finally, learning is demonstrated when, upon the command to format a meeting agenda, the manager reliably organizes the agenda according to company standards and does so without the use of previous examples or models.

Cognitivism

In the late 1950’s, learning theory began to make a shift away from the use of behavioral models to an approach that relied on learning theories and models from the cognitive sciences. Psychologists and educators began to de-emphasize a concern with overt, observable behavior and stressed instead more complex cognitive processes such as thinking, problem solving, language, concept formation and information processing (Snelbecker, 1983). Within the past decade, a number of authors in the field of instructional design have openly and consciously rejected many of ID’s traditional behavioristic assumptions in favor of a new set of psychological assumptions about learning drawn from the cognitive sciences. Whether viewed as an open revolution or simply a gradual evolutionary process, there seems to be the general acknowledgment that cognitive theory has moved to the forefront of current learning theories (Bednar et al., 1991). This shift from a behavioral orientation (where the emphasis is on promoting a student’s overt performance by the manipulation of stimulus material) to a cognitive orientation (where the emphasis is on promoting mental processing) has created a similar shift from procedures for manipulating the materials to be presented by an instructional system to procedures for directing student processing and interaction with the instructional design system (Merrill, Kowalis, & Wilson, 1981).

How Does Learning Occur?

Cognitive theories stress the acquisition of knowledge and internal mental structures and, as such, are closer to the rationalist end of the epistemology continuum (Bower & Hilgard, 1981). Learning is equated with discrete changes between states of knowledge rather than with changes in the probability of response. Cognitive theories focus on the conceptualization of students’ learning processes and address the issues of how information is received, organized, stored, and retrieved by the mind. Learning is concerned not so much with what learners do but with what they know and how they come to acquire it (Jonassen, 1991b). Knowledge acquisition is described as a mental activity that entails internal coding and structuring by the learner. The learner is viewed as a very active participant in the learning process.

Which Factors Influence Learning?

Cognitivism, like behaviorism, emphasizes the role that environmental conditions play in facilitating learning. Instructional explanations, demonstrations, illustrative examples and matched non-examples are all considered to be instrumental in guiding student learning. Similarly, emphasis is
placed on the role of practice with corrective feedback. Up to this point, little difference can be
detected between these two theories. However, the “active” nature of the learner is perceived quite
differently. The cognitive approach focuses on the mental activities of the learner that lead up to a
response and acknowledges the processes of mental planning, goal-setting, and organizational
strategies (Shuell, 1986). Cognitive theories contend that environmental “cues” and instructional
components alone cannot account for all the learning that results from an instructional situation.
Additional key elements include the way that learners attend to, code, transform, rehearse, store and
retrieve information. Learners’ thoughts, beliefs, attitudes, and values are also considered to be
influential in the learning process (Winne, 1985). The real focus of the cognitive approach is on
changing the learner by encouraging him/her to use appropriate learning strategies.

What is the Role of Memory?

As indicated above, memory is given a prominent role in the learning process. Learning results when
information is stored in memory in an organized, meaningful manner. Teachers/designers are
responsible for assisting learners in organizing that information in some optimal way. Designers use
techniques such as advance organizers, analogies, hierarchical relationships, and matrices to help
learners relate new information to prior knowledge. Forgetting is the inability to retrieve information
from memory because of interference, memory loss, or missing or inadequate cues needed to access
information.

How Does Transfer Occur?

According to cognitive theories, transfer is a function of how information is stored in memory
(Schunk, 1991). When a learner understands how to apply knowledge in different contexts, then
transfer has occurred. Understanding is seen as being composed of a knowledge base in the form of
rules, concepts, and discriminations (Duffy & Jonassen, 1991). Prior knowledge is used to establish
boundary constraints for identifying the similarities and differences of novel information. Not only
must the knowledge itself be stored in memory but the uses of that knowledge as well. Specific
instructional or real-world events will trigger particular responses, but the learner must believe that
the knowledge is useful in a given situation before he will activate it.

What Types of Learning Are Best Explained by This Position?

Because of the emphasis on mental structures, cognitive theories are usually considered more
appropriate for explaining complex forms of learning (reasoning, problem-solving, information-
processing) than are those of a more behavioral perspective (Schunk, 1991). However, it is important
to indicate at this point that the actual goal of instruction for both of these viewpoints is often the
same: to communicate or transfer knowledge to the students in the most efficient, effective manner
possible (Bednar et al., 1991). Two techniques used by both camps in achieving this effectiveness and
efficiency of knowledge transfer are simplification and standardization. That is, knowledge can be
analyzed, decomposed, and simplified into basic building blocks. Knowledge transfer is expedited if
irrelevant information is eliminated. For example, trainees attending a workshop on effective
management skills would be presented with information that is “sized” and “chunked” in such a way
that they can assimilate and/or accommodate the new information as quickly and as easily as
possible. Behaviorists would focus on the design of the environment to optimize that transfer, while
cognitivists would stress efficient processing strategies.
What Basic Assumptions/principles of This Theory Are Relevant to Instructional Design?

Many of the instructional strategies advocated and utilized by cognitivists are also emphasized by behaviorists, yet usually for different reasons. An obvious commonality is the use of feedback. A behaviorist uses feedback (reinforcement) to modify behavior in the desired direction, while cognitivists make use of feedback (knowledge of results) to guide and support accurate mental connections (Thompson, Simonson, & Hargrave, 1992).

Learner and task analyses are also critical to both cognitivists and behaviorists, but once again, for different reasons. Cognitivists look at the learner to determine his/her predisposition to learning (i.e., How does the learner activate, maintain, and direct his/her learning?) (Thompson et al., 1992). Additionally, cognitivists examine the learner to determine how to design instruction so that it can be readily assimilated (i.e., What are the learner’s existing mental structures?). In contrast, the behaviorists look at learners to determine where the lesson should begin (i.e., At what level are they currently performing successfully?) and which reinforcers should be most effective (i.e., What consequences are most desired by the learner?).

Specific assumptions or principles that have direct relevance to instructional design include the following (possible current ID applications are listed in italics and brackets following the listed principle):

1. Emphasis on the active involvement of the learner in the learning process [learner control, metacognitive training (e.g., self-planning, monitoring, and revising techniques)]
2. Use of hierarchical analyses to identify and illustrate prerequisite relationships [cognitive task analysis procedures]
3. Emphasis on structuring, organizing, and sequencing information to facilitate optimal processing [use of cognitive strategies such as outlining, summaries, synthesizers, advance organizers, etc.]
4. Creation of learning environments that allow and encourage students to make connections with previously learned material [recall of prerequisite skills; use of relevant examples, analogies]

How Should Instruction Be Structured?

Behavioral theories imply that teachers ought to arrange environmental conditions so that students respond properly to presented stimuli. Cognitive theories emphasize making knowledge meaningful and helping learners organize and relate new information to existing knowledge in memory. Instruction must be based on a student’s existing mental structures, or schema, to be effective. It should organize information in such a manner that learners are able to connect new information with existing knowledge in some meaningful way. Analogies and metaphors are examples of this type of cognitive strategy. For example, instructional design textbooks frequently draw an analogy between the familiar architect’s profession and the unfamiliar instructional design profession to help the novice learner conceptualize, organize and retain the major duties and functions of an instructional designer (e.g. Reigeluth, 1983, p. 7). Other cognitive strategies may include the use of framing, outlining, mnemonics, concept mapping, advance organizers and so forth (West, Farmer, & Wolff, 1991).

Such cognitive emphases imply that major tasks of the teacher/designer include (1) understanding
that individuals bring various learning experiences to the learning situation which can impact learning outcomes; (2) determining the most effective manner in which to organize and structure new information to tap the learners’ previously acquired knowledge, abilities, and experiences; and (3) arranging practice with feedback so that the new information is effectively and efficiently assimilated and/or accommodated within the learner’s cognitive structure (Stepich & Newby, 1988).

Consider the following example of a learning situation utilizing a cognitive approach: A manager in the training department of a large corporation had been asked to teach a new intern to complete a cost-benefit analysis for an upcoming development project. In this case, it is assumed that the intern has no previous experience with cost-benefit analysis in a business setting. However, by relating this new task to highly similar procedures with which the intern has had more experience, the manager can facilitate a smooth and efficient assimilation of this new procedure into memory. These familiar procedures may include the process by which the individual allocates his monthly paycheck, how (s)he makes a buy/no-buy decision regarding the purchase of a luxury item, or even how one’s weekend spending activities might be determined and prioritized. The procedures for such activities may not exactly match those of the cost-benefit analysis, but the similarity between the activities allows for the unfamiliar information to be put within a familiar context. Thus processing requirements are reduced and the potential effectiveness of recall cues is increased.

**Constructivism**

The philosophical assumptions underlying both the behavioral and cognitive theories are primarily objectivistic; that is: the world is real, external to the learner. The goal of instruction is to map the structure of the world onto the learner (Jonassen, 1991b). A number of contemporary cognitive theorists have begun to question this basic objectivistic assumption and are starting to adopt a more constructivist approach to learning and understanding: knowledge “is a function of how the individual creates meaning from his or her own experiences” (p.10). Constructivism is not a totally new approach to learning. Like most other learning theories, constructivism has multiple roots in the philosophical and psychological viewpoints of this century, specifically in the works of Piaget, Bruner, and Goodman (Perkins, 1991). In recent years, however, constructivism has become a “hot” issue as it has begun to receive increased attention in a number of different disciplines, including instructional design (Bednar et al., 1991).

**How Does Learning Occur?**

Constructivism is a theory that equates learning with creating meaning from experience (Bednar et al., 1991). Even though constructivism is considered to be a branch of cognitivism (both conceive of learning as a mental activity), it distinguishes itself from traditional cognitive theories in a number of ways. Most cognitive psychologists think of the mind as a reference tool to the real world; constructivists believe that the mind filters input from the world to produce its own unique reality (Jonassen, 1991a). Like with the rationalists of Plato’s time, the mind is believed to be the source of all meaning, yet like the empiricists, individual, direct experiences with the environment are considered critical. Constructivism crosses both categories by emphasizing the interaction between these two variables.

Constructivists do not share with cognitivists and behaviorists the belief that knowledge is mind-independent and can be “mapped” onto a learner. Constructivists do not deny the existence of the real world but contend that what we know of the world stems from our own interpretations of our
experiences. Humans create meaning as opposed to acquiring it. Since there are many possible meanings to glean from any experience, we cannot achieve a predetermined, “correct” meaning. Learners do not transfer knowledge from the external world into their memories; rather they build personal interpretations of the world based on individual experiences and interactions. Thus, the internal representation of knowledge is constantly open to change; there is not an objective reality that learners strive to know. Knowledge emerges in contexts within which it is relevant. Therefore, in order to understand the learning which has taken place within an individual, the actual experience must be examined (Bednar et al., 1991).

Which Factors Influence Learning?

Both learner and environmental factors are critical to the constructivist, as it is the specific interaction between these two variables that creates knowledge. Constructivists argue that behavior is situationally determined (Jonassen, 1991a). Just as the learning of new vocabulary words is enhanced by exposure and subsequent interaction with those words in context (as opposed to learning their meanings from a dictionary), likewise it is essential that content knowledge be embedded in the situation in which it is used. Brown, Collins, and Duguid (1989) suggest that situations actually co-produce knowledge (along with cognition) through activity. Every action is viewed as “an interpretation of the current situation based on an entire history of previous interactions” (Clancey, 1986). Just as shades of meanings of given words are constantly changing a learner’s “current” understanding of a word, so too will concepts continually evolve with each new use. For this reason, it is critical that learning occur in realistic settings and that the selected learning tasks be relevant to the students’ lived experience.

What is the Role of Memory?

The goal of instruction is not to ensure that individuals know particular facts but rather that they elaborate on and interpret information. “Understanding is developed through continued, situated use ... and does not crystallize into a categorical definition” that can be called up from memory (Brown et al., 1989, p. 33). As mentioned earlier, a concept will continue to evolve with each new use as new situations, negotiations, and activities recast it in a different, more densely textured form. Therefore, “memory” is always under construction as a cumulative history of interactions. Representations of experiences are not formalized or structured into a single piece of declarative knowledge and then stored in the head. The emphasis is not on retrieving intact knowledge structures, but on providing learners with the means to create novel and situation-specific understandings by “assembling” prior knowledge from diverse sources appropriate to the problem at hand. For example, the knowledge of “design” activities has to be used by a practitioner in too many different ways for them all to be anticipated in advance. Constructivists emphasize the flexible use of pre-existing knowledge rather than the recall of prepackaged schemas (Spiro, Feltovich, Jacobson, & Coulson, 1991). Mental representations developed through task-engagement are likely to increase the efficiency with which subsequent tasks are performed to the extent that parts of the environment remain the same: “Recurring features of the environment may thus afford recurring sequences of actions” (Brown et al., p. 37). Memory is not a context-independent process.

Clearly the focus of constructivism is on creating cognitive tools which reflect the wisdom of the culture in which they are used as well as the insights and experiences of individuals. There is no need for the mere acquisition of fixed, abstract, self-contained concepts or details. To be successful, meaningful, and lasting, learning must include all three of these crucial factors: activity (practice),
concept (knowledge), and culture (context) (Brown et al., 1989).

**How Does Transfer Occur?**

The constructivist position assumes that transfer can be facilitated by involvement in authentic tasks anchored in meaningful contexts. Since understanding is “indexed” by experience (just as word meanings are tied to specific instances of use), the authenticity of the experience becomes critical to the individual’s ability to use ideas (Brown et al., 1989). An essential concept in the constructivist view is that learning always takes place in a context and that the context forms an inexorable link with the knowledge embedded in it (Bednar et al., 1991). Therefore, the goal of instruction is to accurately portray tasks, not to define the structure of learning required to achieve a task. If learning is decontextualized, there is little hope for transfer to occur. One does not learn to use a set of tools simply by following a list of rules. Appropriate and effective use comes from engaging the learner in the actual use of the tools in real-world situations. Thus, the ultimate measure of learning is based on how effective the learner’s knowledge structure is in facilitating thinking and performing in the system in which those tools are used.

**What Types of Learning Are Best Explained by This Position?**

The constructivist view does not accept the assumption that types of learning can be identified independent of the content and the context of learning (Bednar et al., 1991). Constructivists believe that it is impossible to isolate units of information or divide up knowledge domains according to a hierarchical analysis of relationships. Although the emphasis on performance and instruction has proven effective in teaching basic skills in relatively structured knowledge domains, much of what needs to be learned involves advanced knowledge in ill-structured domains. Jonassen (1991a) has described three stages of knowledge acquisition (introductory, advanced, and expert) and argues that constructive learning environments are most effective for the stage of advanced knowledge acquisition, where initial misconceptions and biases acquired during the introductory stage can be discovered, negotiated, and if necessary, modified and/or removed. Jonassen agrees that introductory knowledge acquisition is better supported by more objectivistic approaches (behavioral and/or cognitive) but suggests a transition to constructivistic approaches as learners acquire more knowledge which provides them with the conceptual power needed to deal with complex and ill-structured problems.

**What Basic Assumptions/principles of This Theory Are Relevant to Instructional Design?**

The constructivist designer specifies instructional methods and strategies that will assist learners in actively exploring complex topics/environments and that will move them into thinking in a given content area as an expert user of that domain might think. Knowledge is not abstract but is linked to the context under study and to the experiences that the participants bring to the context. As such, learners are encouraged to construct their own understandings and then to validate, through social negotiation, these new perspectives. Content is not prespecified; information from many sources is essential. For example, a typical constructivist’s goal would not be to teach novice ID students straight facts about instructional design, but to prepare students to use ID facts as an instructional designer might use them. As such, performance objectives are not related so much to the content as they are to the processes of construction.
Some of the specific strategies utilized by constructivists include situating tasks in real-world contexts, use of cognitive apprenticeships (modeling and coaching a student toward expert performance), presentation of multiple perspectives (collaborative learning to develop and share alternative views), social negotiation (debate, discussion, evidence giving), use of examples as real “slices of life,” reflective awareness, and providing considerable guidance on the use of constructive processes.

The following are several specific assumptions or principles from the constructivist position that have direct relevance for the instructional designer (possible ID applications are listed in italics and brackets following the listed principle):

1. An emphasis on the identification of the context in which the skills will be learned and subsequently applied [anchoring learning in meaningful contexts].
2. An emphasis on learner control and the capability of the learner to manipulate information [actively using what is learned].
3. The need for information to be presented in a variety of different ways [revisiting content at different times, in rearranged contexts, for different purposes, and from different conceptual perspectives].
4. Supporting the use of problem-solving skills that allow learners to go “beyond the information given.” [developing pattern-recognition skills, presenting alternative ways of representing problems].
5. Assessment focused on transfer of knowledge and skills [presenting new problems and situations that differ from the conditions of the initial instruction].

**How Should Instruction Be Structured?**

As one moves along the behaviorist-cognitivist-constructivist continuum, the focus of instruction shifts from teaching to learning, from the passive transfer of facts and routines to the active application of ideas to problems. Both cognitivists and constructivists view the learner as being actively involved in the learning process, yet the constructivists look at the learner as more than just an active processor of information; the learner elaborates upon and interprets the given information (Duffy & Jonassen, 1991). Meaning is created by the learner: learning objectives are not pre-specified nor is instruction predesigned. “The role of instruction in the constructivist view is to show students how to construct knowledge, to promote collaboration with others to show the multiple perspectives that can be brought to bear on a particular problem, and to arrive at self-chosen positions to which they can commit themselves, while realizing the basis of other views with which they may disagree” (Cunningham, 1991, p. 14).

Even though the emphasis is on learner construction, the instructional designer/teacher’s role is still critical (Reigeluth, 1989). Here the tasks of the designer are two-fold: (1) to instruct the student on how to construct meaning, as well as how to effectively monitor, evaluate, and update those constructions; and (2) to align and design experiences for the learner so that authentic, relevant contexts can be experienced.

Although constructivist approaches are used quite frequently in the preparation of lawyers, doctors, architects, and businessmen through the use of apprenticeships and on-the-job training, they are typically not applied in the educational arena (Resnick, 1987). If they were, however, a student placed in the hands of a constructivist would likely be immersed in an “apprenticeship” experience. For example, a novice instructional design student who desires to learn about needs assessment...
would be placed in a situation that requires such an assessment to be completed. Through the modeling and coaching of experts involved in authentic cases, the novice designer would experience the process embedded in the true context of an actual problem situation. Over time, several additional situations would be experienced by the student, all requiring similar needs assessment abilities. Each experience would serve to build on and adapt that which has been previously experienced and constructed. As the student gained more confidence and experience, (s)he would move into a collaborative phase of learning where discussion becomes crucial. By talking with others (peers, advanced students, professors, and designers), students become better able to articulate their own understandings of the needs assessment process. As they uncover their naive theories, they begin to see such activities in a new light, which guides them towards conceptual reframing (learning). Students gain familiarity with analysis and action in complex situations and consequently begin to expand their horizons: they encounter relevant books, attend conferences and seminars, discuss issues with other students, and use their knowledge to interpret numerous situations around them (not only related to specific design issues). Not only have the learners been involved in different types of learning as they moved from being novices to “budding experts,” but the nature of the learning process has changed as well.

**General Discussion**

It is apparent that students exposed to the three instructional approaches described in the examples above would gain different competencies. This leads instructors/designers to ask two significant questions: Is there a single “best” approach and is one approach more efficient than the others? Given that learning is a complex, drawn-out process that seems to be strongly influenced by one’s prior knowledge, perhaps the best answer to these questions is “it depends.” Because learning is influenced by many factors from many sources, the learning process itself is constantly changing, both in nature and diversity, as it progresses (Shuell, 1990). What might be most effective for novice learners encountering a complex body of knowledge for the first time, would not be effective, efficient or stimulating for a learner who is more familiar with the content. Typically, one does not teach facts the same way that concepts or problem-solving are taught; likewise, one teaches differently depending on the proficiency level of the learners involved. Both the instructional strategies employed and the content addressed (in both depth and breadth) would vary based on the level of the learners.

So how does a designer facilitate a proper match between learner, content, and strategies? Consider, first of all, how learners’ knowledge changes as they become more familiar with a given content. As people acquire more experience with a given content, they progress along a low-to-high knowledge continuum from 1) being able to recognize and apply the standard rules, facts, and operations of a profession (knowing what), to 2) thinking like a professional to extrapolate from these general rules to particular, problematic cases (knowing how), to 3) developing and testing new forms of understanding and actions when familiar categories and ways of thinking fail (reflection-in-action) (Schon, 1987). In a sense, the points along this continuum mirror the points of the learning theory continuum described earlier. Depending on where the learners “sit” on the continuum in terms of the development of their professional knowledge (knowing what vs. knowing how vs. reflection-in-action), the most appropriate instructional approach for advancing the learners’ knowledge at that particular level would be the one advocated by the theory that corresponds to that point on the continuum. That is, a behavioral approach can effectively facilitate mastery of the content of a profession (knowing what); cognitive strategies are useful in teaching problem-solving tactics where defined facts and rules are applied in unfamiliar situations (knowing how); and constructivist strategies are especially
suited to dealing with ill-defined problems through reflection-in-action.

A second consideration depends upon the requirements of the task to be learned. Based on the level of cognitive processing required, strategies from different theoretical perspectives may be needed. For example, tasks requiring a low degree of processing (e.g., basic paired associations, discriminations, rote memorization) seem to be facilitated by strategies most frequently associated with a behavioral outlook (e.g., stimulus-response, contiguity of feedback/reinforcement). Tasks requiring an increased level of processing (e.g., classifications, rule or procedural executions) are primarily associated with strategies having a stronger cognitive emphasis (e.g., schematic organization, analogical reasoning, algorithmic problem solving). Tasks demanding high levels of processing (e.g., heuristic problem solving, personal selection and monitoring of cognitive strategies) are frequently best learned with strategies advanced by the constructivist perspective (e.g., situated learning, cognitive apprenticeships, social negotiation).

We believe that the critical question instructional designers must ask is not “Which is the best theory?” but “Which theory is the most effective in fostering mastery of specific tasks by specific learners?” Prior to strategy(ies) selection, consideration must be made of both the learners and the task. An attempt is made in Figure 1 to depict these two continua (learners’ level of knowledge and cognitive processing demands) and to illustrate the degree to which strategies offered by each of the theoretical perspectives appear applicable. The figure is useful in demonstrating: (a) that the strategies promoted by the different perspectives overlap in certain instances (i.e., one strategy may be relevant for each of the different perspectives, given the proper amount of prior knowledge and the corresponding amount of cognitive processing), and (b) that strategies are concentrated along different points of the continua due to the unique focus of each of the learning theories. This means that when integrating any strategies into the instructional design process, the nature of the learning task (i.e., the level of cognitive processing required) and the proficiency level of the learners involved must both be considered before selecting one approach over another. Depending on the demands of the task and where the learners are in terms of the content to be delivered/discovered, different strategies based on different theories appear to be necessary. Powerful frameworks for instruction have been developed by designers inspired by each of these perspectives. In fact, successful instructional practices have features that are supported by virtually all three perspectives (e.g., active participation and interaction, practice and feedback).

For this reason, we have consciously chosen not to advocate one theory over the others, but to stress
instead the usefulness of being well versed in each. This is not to suggest that one should work without a theory, but rather that one must be able to intelligently choose, on the basis of information gathered about the learners’ present level of competence and the type of learning task, the appropriate methods for achieving optimal instructional outcomes in that situation.

As stated by Smith and Ragan (1993, p. viii): “Reasoned and validated theoretical eclecticism has been a key strength of our field because no single theoretical base provides complete prescriptive principles for the entire design process.” Some of the most crucial design tasks involve being able to decide which strategy to use, for what content, for which students, and at what point during the instruction. Knowledge of this sort is an example of conditional knowledge, where “thinking like” a designer becomes a necessary competency. It should be noted however, that to be an eclectic, one must know a lot, not a little, about the theories being combined. A thorough understanding of the learning theories presented above seems to be essential for professional designers who must constantly make decisions for which no design model provides precise rules. Being knowledgeable about each of these theories provides designers with the flexibility needed to be spontaneous and creative when a first attempt doesn’t work or when they find themselves limited by time, budget, and/or personnel constraints. The practitioner cannot afford to ignore any theories that might provide practical implications. Given the myriad of potential design situations, the designer’s “best” approach may not ever be identical to any previous approach, but will truly “depend upon the context.” This type of instructional “cherry-picking” has been termed “systematic eclecticism” and has had a great deal of support in the instructional design literature (Snelbecker, 1989).

In closing, we would like to expand on a quote by P. B. Drucker, (cited in Snelbecker, 1983): “These old controversies have been phonies all along. We need the behaviorist’s triad of practice/reinforcement/feedback to enlarge learning and memory. We need purpose, decision, values, understanding—the cognitive categories—lest learning be mere behavioral activities rather than action” (p. 203).

And to this we would add that we also need adaptive learners who are able to function well when optimal conditions do not exist, when situations are unpredictable and task demands change, when the problems are messy and ill-formed and the solutions depend on inventiveness, improvisation, discussion, and social negotiation.

References


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Reigeluth, C. M. (1983). Instructional Design: What is it and why is it? In C. M.


Additional Reading

An update was published in Performance Improvement Quarterly in 2013 by the authors to accompany the 30 year anniversary and republication of the original article. This update adds a strong second part to this article, and you are encouraged to read it here [https://edtechbooks.org/-BQ].


Application Exercises

- How would the instruction be designed differently by a behaviorist, a cognitivist, and a constructivist? Scenario: A high school social study teacher is planning a class on the Vietnam War.
- Describe an example from your life of when you were taught using each method described in this article: behaviorism, cognitivism, and constructivism.
- Based on your reading, would you consider your current instruction style more behavioralist, cognitivist, or constructivist? Elaborate with your specific mindset and examples.

Please complete this short survey to provide feedback on this chapter: http://bit.ly/3LearningTheories
When considering theories of learning, LIDT professionals should also consider sociocultural perspectives and the role that culture, interaction, and collaboration have on quality learning. Modern social learning theories stem from the work of Russian psychologist Vygotsky, who produced his ideas between 1924 and 1934 as a reaction to existing conflicting approaches in psychology (Kozulin, 1990). Vygotsky’s ideas are most recognized for identifying the role social interactions and culture play in the development of higher-order thinking skills, and it is especially valuable for the insights it provides about the dynamic “interdependence between individual and social processes in the construction of knowledge” (John-Steiner & Mahn, 1996, p. 192). Vygotsky’s views are often considered primarily as developmental theories, focusing on qualitative changes in behavior over time as attempts to explain unseen processes of development of thought, language, and higher-order thinking skills. Although Vygotsky’s intent was mainly to understand higher psychological processes in children, his ideas have many implications and practical applications for learners of all ages.

Interpretations of Vygotsky’s and other sociocultural scholars’ work have led to diverse perspectives and a variety of new approaches to education. Today, sociocultural theory and related approaches are widely recognized and accepted in psychology and education and are especially valued in the field of applied linguistics because of its underlying notion that language and thought are connected. Sociocultural theory is also becoming increasingly influential in the field of instructional design. In this chapter, we first review some of the fundamental principles of sociocultural theory of learning. We then suggest design implications for learning, teaching, and education in general. Following, we consider how sociocultural theories of learning should influence instructional design.

**Fundamental Principles of Sociocultural Perspectives On Learning**

Three themes are often identified with Vygotsky’s ideas of sociocultural learning: (1) human development and learning originate in social, historical, and cultural interactions, (2) use of psychological tools, particularly language, mediate development of higher mental functions, and (3) learning occurs within the Zone of Proximal Development. While we discuss these ideas separately, they are closely interrelated, non-hierarchical, and connected.

**Human development and learning originate in social, historical, and cultural interactions.** Vygotsky contended that thinking has social origins, social interactions play a critical role especially in the development of higher order thinking skills, and cognitive development cannot be fully understood without considering the social and historical context within which it is embedded. He explained, “Every function in the child’s cultural development appears twice: first, on the social level, and later, on the individual level; first between people (interpsychological) and then inside the child...
(intrapsychological)” (Vygotsky, 1978, p. 57). It is through working with others on a variety of tasks 
that a learner adopts socially shared experiences and associated effects and acquires useful 
strategies and knowledge (Scott & Palincsar, 2013).

Rogoff (1990) refers to this process as guided participation, where a learner actively acquires new 
culturally valuable skills and capabilities through a meaningful, collaborative activity with an 
assisting, more experienced other. It is critical to notice that these culturally mediated functions are 
viewed as being embedded in sociocultural activities rather than being self-contained. Development is 
a “transformation of participation in a sociocultural activity” not a transmission of discrete cultural 
knowledge or skills (Matusov, 2015, p. 315). The processes of guided participation reveal the 
Vygotskian view of cognitive development “as the transformation of socially shared activities into 
internalized processes,” or an act of enculturation, thus rejecting the Cartesian dichotomy between 
the internal and the external (John-Steiner & Mahn, 1996, p. 192).

This Vygotskian notion of social learning stands in contrast to more popular Piaget’s ideas of 
cognitive development, which assume that development through certain stages is biologically 
determined, originates in the individual, and precedes cognitive complexity. This difference in 
assumptions has significant implications to the design and development of learning experiences. If we 
believe as Piaget did that development precedes learning, then we will make sure that new concepts 
and problems are not introduced until learners have developed innate capabilities to understand 
them. On the other hand, if we believe as Vygotsky did that learning drives development and that 
development occurs as we learn a variety of concepts and principles, recognizing their applicability to 
new tasks and new situations, then our instructional design will look very different. We will ensure 
that instructional activities are structured in ways that promote individual student learning and 
development. We will know that it is the process of learning that enables achievement of higher levels 
of development, which in turn affects “readiness to learn a new concept” (Miller, 2011, p. 197). In 
essence:

Learning awakens a variety of internal developmental processes that are able to operate 
only when the child is interacting with people in his environment and with his peers... 
learning is not development; however, properly organized learning results in mental development and sets in motion a variety of developmental processes that would be impossible apart from learning. Thus learning is a necessary and universal aspect of the 
process of developing culturally organized, specifically human, psychological functions 

Another implication based on Vygotskian views of learning is recognizing that there are individual 
differences as well as cross-cultural differences in learning and development. As instructional 
designers, we should be more sensitive to diversity in learners and recognize that a large amount of 
research has been done on white, middle-class individuals associated with Western tradition, and the 
resulting understanding of development and learning often incorrectly assumes universality. 
Recognizing that “ideal thinking and behavior may differ for different cultures” and that “different 
historical and cultural circumstances may encourage different developmental routes to any given developmental endpoint” may prevent incorrect universalist views of all individuals and allow for environments that value diversity as a resource (Miller, 2011, p. 198).

Use of psychological tools, particularly language, mediate development of higher mental
functions. Another important aspect of Vygotsky’s views on learning is the significance of language in the learning process. Vygotsky reasoned that social structures determine people’s working conditions and interactions with others, which in turn shape their cognition, beliefs, attitudes, and perception of reality and that social and individual work is mediated by tools and signs, or semiotics, such as language, systems of counting, conventional signs, and works of art. He suggested that the use of tools, or semiotic mediation, facilitates co-construction of knowledge and mediates both social and individual functioning. These semiotic means play an important role in development and learning through appropriation, a process of an individual’s adopting these socially available psychological tools to assist future independent problem solving (John-Steiner & Mahn, 1996). This means that children and learners do not need to reinvent already existing tools in order to be able to use them. They only need to be introduced to how a particular tool is used, then they can use it across a variety of situations solving new problems (Scott & Palincsar, 2013).

Vygotsky viewed language as the ultimate collection of symbols and tools that emerge within a culture. It is potentially the greatest tool at our disposal, a form of a symbolic mediation that plays two critical roles in development: to communicate with others and to construct meaning.

Learning occurs within the zone of proximal development. Probably the most widely applied sociocultural concept in the design of learning experiences is the concept of the Zone of Proximal Development (ZPD). Vygotsky (1978) defined ZPD as “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (p. 86). He believed that learning should be matched with an individual’s developmental level and that in order to understand the connection between development and learning, it is necessary to distinguish the actual and the potential levels of development. Learning and development are best understood when the focus is on processes rather than their products. He considered the ZPD to be a better and more dynamic indicator of cognitive development since it reflects what the learner is in the process of learning as compared to merely measuring what the learner can accomplish independently, reflecting what has been already learned (Vygotsky, 1978).

Vygotsky argued that productive interactions align instruction toward the ZPD, and providing instruction and guidance within the ZPD allows a learner to develop skills and strategies they will eventually apply on their own in other situations (1978). This highlights the importance of instructional decisions related to types and quality of interactions in designing effective learning experiences. Whether these interactions occur with a more experienced other or another learner with similar skills, there should always be a degree of common understanding about the task, described as intersubjectivity. The partners should have a sense of shared authority over the process, and they should actively collaborate to co-construct understanding. It is important to notice that ZPD should be viewed broadly as “any situation in which some activity is leading individuals beyond their current level of functioning,” applicable not only to instructional activities but to play, work, and many other activities (Miller, 2011, p. 178).

The notion of instructional scaffolding is closely related to the idea of ZPD. Scaffolding is the set of tools or actions that help a learner successfully complete a task within ZPD. Scaffolding typically include a mutual and dynamic nature of interaction where both the learner and the one providing the scaffold influence each other and adjust their behavior as they collaborate. The types and the extent of supports provided in a learning experience are based on performance, and the scaffold is gradually phased out (Miller, 2011). The expert motivates and guides the learner by providing just enough assistance, modeling, and highlighting critical features of the task as well as continually evaluating
and adjusting supports as needed. Additionally, providing opportunities for reflection as part of the learning experience further promotes more complex, meaningful, and lasting learning experiences. In the case of digital learning experiences, scaffolds are not necessarily provided by individuals, but may be embedded into the experience.

Ideas such as ZPD and scaffolding bring to light a fundamentally different view of an instructor who serves more as a facilitator of learning rather than a fount of knowledge. Likewise, the learner takes on more responsibilities such as determining their learning goals, becoming a resource of knowledge for peers, and actively collaborating in the learning process (Grabinger, Aplin, & Ponnappa-Brenner, 2007). This shift in roles promotes individualized, differentiated, and learner-centered types of instruction, and when accompanied with effective pedagogical practices, it has a potential to become a powerful alternative for reforming current educational systems and creating environments where many different individuals develop deep understanding of important subjects (Watson & Reigeluth, 2016).

Summary of Sociocultural Theory

Sociocultural theory has several widely recognized strengths. First, it emphasizes the broader social, cultural, and historical context of any human activity. It does not view individuals as isolated entities; rather, it provides a richer perspective, focusing on the fluid boundary between self and others. It portrays the dynamic of a learner acquiring knowledge and skills from the society and then in turn shaping their environment (Miller, 2011). Second, sociocultural theory is sensitive to individual and cross-cultural diversity. In contrast to many other universalist theories, sociocultural theory acknowledges both differences in individuals within a culture and differences in individuals across cultures. It recognizes that “different historical and cultural circumstances may encourage different developmental routes to any given developmental endpoint” depending on particular social or physical circumstances and tools available (Miller, 2011, p. 198). Finally, sociocultural theory greatly contributes to our theoretical understanding of cognitive development by integrating the notion of learning and development. The idea of learning driving development rather than being determined by a developmental level of the learner fundamentally changes our understanding of the learning process and has significant instructional and educational implications (Miller, 2011).

There are also limitations to the sociocultural perspective. The first limitation is related to Vygotsky’s premature death, as many of his theories remained incomplete. Furthermore, his work was largely unknown until fairly recently due to political reasons and issues with translation. The second major limitation is associated with the vagueness of the ZPD. Individuals may have wide or narrow zones, which may be both desirable and undesirable, depending on the circumstances. Knowing only the width of the zone “does not provide an accurate picture of [the learner’s] learning, ability, style of learning, and current level of development compared to other children of the same age and degree of motivation” (Miller, 2011, p. 198). Additionally, there is little known about whether a child’s zone is comparable across different learning domains, with different individuals, and whether the size of the zone changes over time. Here is also not a common metric scale to measure ZPD. Finally, Rogoff (1990) pointed out that Vygotsky’s theories may not be as relevant to all cultures as originally thought. She provides an example of scaffolding being heavily dependent on verbal instruction and thus not equally effective in all cultures for all types of learning.

The notion of social origins of learning, the interrelationship of language and thought, and the Zone of Proximal Development are Vygotsky’s most important contributions. However, the practical applications of sociocultural theory are also significant that emphasize creating learner-centered
instructional environments where learning by discovery, inquiry, active problem solving, and critical thinking are fostered through collaboration with experts and peers in communities of learners and encourage self-directed lifelong learning habits. Presenting authentic and cognitively challenging tasks within a context of collaborative activities, scaffolding learner’s efforts by providing a structure and support to accomplish complex tasks, and providing opportunities for authentic and dynamic assessment are all important aspects of this approach. Sociocultural principles can be applied in effective and meaningful ways to design instruction across the curriculum for learners of different ages and variety of skills, and they can be effectively integrated using a wide range of technologies and learning environments. The challenge remains for educators and instructional designers to elevate our practices from efficient, systemic approaches for teaching and instructional design to a focus on individual learners and effective pedagogical practices to develop empowered learners ready to successfully negotiate the rapidly changing era of information. Technology is at our fingertips, and it is up to us to competently implement its unique affordances to promote new ways to educate and support deep, meaningful, and self-directed learning. Grounding our practices in sociocultural theory can significantly aid our efforts.

**Design Characteristics Related to Social Perspectives of Learning**

In this section major characteristics of sociocultural theory important to instructional design will be discussed. These include the focus on the individual learner and their context for learning and the use of effective pedagogies centered around collaborative practice and communities of learners.

**Focus On the Contextualized Learner in Social Learning Activities**

Sociocultural theory and related ideas provide a valuable contribution to a focus on the learner within their social, cultural, and historical context and also offer sound pedagogical solutions and strategies that facilitate development of critical thinking and lifelong learning (Grabinger, Aplin, & Ponnappa-Brenner, 2007). The American Psychological Association’s *Learner-Centered Principles* (APA Work Group, 1997, p. 6) stated the following about social interactions on individual learners: “In interactive and collaborative instructional contexts, individuals have an opportunity for perspective taking and reflective thinking that may lead to higher levels of cognitive, social, and moral development, as well as self-esteem.”

Most instructional design models take into consideration a common or isolated concept of the learner, but recently, a strong call has been issued for a complete shift in our education and instructional design approaches to reflect our society’s changing educational needs (Watson & Reigeluth, 2016). More contemporary design approaches, such as Universal Design for Learning, recognize that every learner is unique and influenced by his or her embedded context. These approaches strive to provide challenging and engaging curricula for diverse learners while also designing for the social influences that surround them.

**Use of Pedagogies Around Collaborative Practice**

Sociocultural theory encourages instructional designers to apply principles of collaborative practice that go beyond social constructivism to create learning communities. The sociocultural perspective views learning taking place through interaction, negotiation, and collaboration in solving authentic
problems while emphasizing learning from experience and discourse, which is more than cooperative learning. This is visible, for example, in the ideas of **situated cognition (situated learning)** and **cognitive apprenticeships**.

Brown, Collins, and Duguid (1989), seminal authors on **situated cognition**, contended that “activity and situations are integral to cognition and learning” (p. 32). By socially interacting with others in real life contexts, learning occurs on deeper levels. They explained that “people who use tools actively rather than just acquire them, by contrast, build an increasingly rich implicit understanding of the world in which they use the tools and of the tools themselves” (Brown, Collins, & Duguid, 1989, p. 33).

This implicit understanding of the world around them influences how learners understand and respond to instruction. In one study, Carraher, Carraher, and Schliemann (1985) researched Brazilian children solving mathematics problems while selling produce. While selling produce, the context and artifacts positively influenced a child’s ability to work through mathematics problems, use appropriate strategies, and find correct solutions. However, these children failed to solve the same problems when they were presented out of context in conventional mathematical form. Lave (1988) studied tailors in Liberia and found that while the tailors were adept at solving mathematics problems embedded in their daily work, they could not apply those same skills to novel contexts. In addition, Brill (2001) synthesized the work of Collins (1988) and identified four benefits of using situated cognition as a theory guiding teaching and instructional design: (1) learners develop the ability to apply knowledge; (2) learners become effective problem solvers after learning in novel and diverse settings; (3) learners are able to see the implications of knowledge; and (4) learners receive support in organizing knowledge in ways to use later.

Cognitive apprenticeships, meanwhile, acknowledge the situated nature of cognition by contextualizing learning (Brown et al., 1989) through apprenticing learners to more experienced experts who model and scaffold implicit and explicit concepts to be learned. Lave and Wenger (1991) wrote about the work of teaching tailors in Liberia and found that new tailors developed the necessary skills by serving as apprenticeships and learning from experienced tailors.

In addition to cognitive apprenticeships, approaches grounded in sociocultural theory pay attention to and model the discourse, norms, and practices associated with a certain **community of practice** in order to develop knowledge and skills important to that community (Scott & Palincsar, 2013). Communities of practice involve learners and those teaching or facilitating learning authentic practice within the target context to facilitate easier transfer of learning (Lave & Wenger, 1991). Wenger (1998, pp. 72-73) identified communities of practice as groups of individuals who share three characteristics:

- **Mutual Engagement**: Firstly, through participation in the community, members establish norms and build collaborative relationships; this is termed mutual engagement.
- **Joint Enterprise**: Secondly, through their interactions, they create a shared understanding of what binds them together; this is termed the joint enterprise.
- **Shared Repertoire**: Finally, as part of its practice, the community produces a set of communal resources, which is termed their shared repertoire.

Similarly, Garrison, Anderson, and Archer (2000) described a **community of inquiry** as a community of learners who through discourse and reflection construct personal and shared meanings (Garrison, Anderson, & Archer, 2000). Garrison and Akyol (2013) explained that when social presence is
established as part of a community of inquiry, “collaboration and critical discourse is enhanced and sustained” (p. 108). Establishment of solid social presence further reflects in positive learning outcomes, increased satisfaction, and improved retention (Garrison & Akyol, 2013). Integrating sociocultural practices into learning design, for example through creation of communities of inquiry, spontaneously integrates a learner’s previous knowledge, relationships, and cultural experiences into the learning process and encultures the learner into the new community of practice through relevant activities and experiences (Grabinger, Aplin, & Ponappa-Brenner, 2007). In the context of technology-enhanced environments, the emergence of new synchronous and asynchronous communication technologies and increased attention to computer-supported collaborative learning (CSCL) and virtual communities of practice create new opportunities for applying sociocultural methodologies, as their affordances allow quality collaboration and new ways of interacting in face-to-face, blended, and online environments (Garrison & Akyol, 2013).

**Third-space discourse** encourages instructors and instructional designers to create learning experiences that provide opportunities to build off of learners’ primary discourses (related to informal settings such as home and the community) and students’ secondary discourses (related to formal learning settings such as schools) (Soja, 1996). Studies that have examined learning experiences grounded in the construct of third space discourse benefited learners through demonstrated gains in their conceptual understanding and use of academic language (Maniotes, 2005; Scott & Palincsar, 2013). As an example, Mojé et al. (2001) wrote:

> weaving together of counter scripts [student personal discourses] and official scripts [school science discourses] constructs a Third Space in which alternative and competing discourses and positionings transform conflict and difference into rich zones of collaborative learning ... (p. 487)

In summary, perspectives of social learning recognize that learners develop individually with the support of others in their community, receive support from more knowledgeable others or learning tools within their zone of proximal development, and learn within meaningful situations that are likely to deepen their understanding compared to knowledge void of context.

**Examples of Learning Environments Aligned to Social Perspectives**

In this section we detail specific examples of learning environments and activities that align to social perspectives of learning. They include collaborative authentic activities, project-based learning, flipped learning environments, and online collaborative spaces.

**Collaborative Authentic Activities**

Collaborative environments that encourage learners to think critically and apply knowledge and skills is a central component of social learning theories. As educators strive to create cooperative learning experiences for students, authentic activities and anchored instruction promote sociocultural perspectives of learning by encouraging the contextualization of learning in the simulation of practical problems, the development of cultural skills through guided participation in collaborative groups, and the use of language to both communicate and internalize learning. The implementation
of collaborative, authentic activities in learning experiences typically involves learners collaborating to solve problems embedded in real-life situations (Reeves et al., 2002), reflecting learning through situated cognition. Teachers, trainers, and facilitators guide and support these collaborative efforts by scaffolding learning with tools and resources, asking questions that support learners’ understanding, and helping learners to make sense of the problems.

Authentic activities contextualize learning and allow for a diverse application of skills and knowledge within real-world scenarios. In the literature these authentic activities have sometimes been referred to as anchors or the process of anchored instruction, which focuses learners on developing knowledge and skills through collaborative problem solving experiences (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990). This type of learning allows students to engage in problem solving within learning contexts that provide for connection-building across the curriculum in order to develop meaning (Bransford et al., 1990). Typically presented in a narrative format, anchored learning begins with the “anchor,” or story in which the problem is set, and uses multimedia outlets to allow students to explore the problem and develop multiple solutions (Bransford et al., 1990). As students collaborate and engage with the material, the teacher becomes a coach and guides students along the process. Through both authentic activities and anchored instruction, learning takes place in a social setting, encouraging students to develop, share, and implement creative solutions to complex problems as collaborative teams.

One example of a collaborative, authentic, anchored learning experience is the Jasper Woodbury mathematics project developed for middle school mathematics students (Cognition and Technology Group at Vanderbilt, 1997). Learners engaged with pre-designed tasks presented as an adventure on a video-disc, and they had to identify needed information, determine how to examine a task, and apply their solutions to an immediate sub-problem (CTGV, 1997). The teacher’s role was to facilitate the experience by asking questions and facilitating discussions of the information in the adventure as well as the mathematics concepts embedded in the situation. Research from the project indicated that learners showed greater understanding of how to solve mathematics problems than their peers who had not participated (Hickey, Moore, & Pellegrino, 2001).

**Project-based Learning**

Project-based learning engages learners in collaborative situations where they must address a complex problem or real-world challenge. According to Vygotsky’s ideas, this collaborative learning style naturally fosters students’ development of higher-order thinking skills. Problem-based learning environments have been empirically linked to K-12 students gaining a deeper understanding of content and greater amount of learner engagement compared to more traditional instruction (Condliffe, Visher, Bangser, Drohojowska, & Saco, 2016; Fogelman, McNeill, & Krajcik, 2011).

This instructional method derived from problem-based learning, which was first introduced at McMaster University in Ontario, Canada in 1969 (O’Grady, Yew, Goh, & Schmidt, 2012, p. 21). Although they are alike, problem-based learning and project-based learning traditionally differ in scope and size. Unlike the former, the latter requires students to work together to concurrently master several learning objectives as they apply newly acquired skills and knowledge embedded in several problems to solve (Capraro, Capraro, and Morgan, 2013).

Due to the complexity of these situations, most enactments of project-based learning involve learners working in teams on these tasks (Condliffe et al., 2016). Project-based work that is collaborative, however, teaches students how to prioritize and apportion tasks within the project (Garcia, 2017).
also promotes student-initiated inquiry, scaffolding, and soft skill development in areas such as collaboration and communication.

Project-based learning is a multi-layered process of acquiring new skills and knowledge to successfully provide a solution to a challenge. Throughout the process, students are constantly gaining new information from multiple sources, including their peers, to guide them to their final solution. Based on the interaction between project-based learning and social perspectives, Hutchins’ theory of distributed cognition helps to make sense of these ideas with the notion that learning is a cognitive phenomena that occurs when new information is shared, or distributed, from multiple individuals, artifacts, and technological devices (Rogers, 1997). Most systems and careers function as a result of distributed cognition: airports, schools, hospitals, and restaurants are all systems that rely on the sharing of information to effectively work. Project-based learning can be viewed in the same manner since students will accomplish more towards the task as more information is shared with them. The more exposed a student is to resources and classmates, the more learning occurs. Students can learn as individuals, but their opportunities for learning are increased when they can engage in a project within a group.

Flipped Learning Environments

One method of maximizing students full engagement in social learning is through a pedagogical model widely known as “the flipped classroom.” In a “flipped” classroom, students prepare for an upcoming lesson by watching instructional videos before class. Instead of using class time for lecture and passive, individual acquisition or practice of skills, students participate in active and social learning activities, a key component of Vygotsky’s theories of cognitive development. Watching lectures in videos before class is beneficial for two reasons. First, students spend more time communicating and constructing knowledge with hands-on activities during class (Educause, 2012). Secondly, as students are watching the videos and learning new skills and knowledge, they can pause, rewind, and think about their learning as it is happening, a phenomenon that rarely occurs during a lecture given in class and in real-time (Educause, 2012; Brame, 2013).

In theory, the flipped classroom model is an excellent way to maximize social learning under the facilitation of a teacher. In practice, however, it does have some drawbacks, including the additional amount of time teachers must invest in preparing the video assignments, ensuring all students have access to the videos outside of school, and making sure all students complete their video-lecture assignments prior to class. The research literature indicates that there are evidence-based solutions to several of these drawbacks such as offering student incentives, giving quizzes and student feedback during the videos, and devoting some in-class time to check for student understanding (Educause, 2012; Brame, 2013).

Research evidence has indicated significant student learning gains in the flipped classroom model (Brame, 2013), emphasizing the value of learning in a social context (e.g., discussion, project collaboration, debate, student-led inquiry, etc.). Not only is social learning maximized in a flipped classroom, the levels of learning are reversed in comparison to a traditional classroom; therefore, students are engaged in higher levels of cognitive work (in regards to Bloom’s revised taxonomy of learning) amongst their peers as they engage in lower levels of learning on their own outside of class (Brame, 2013).
Online Collaborative Spaces

Online collaborative spaces unite educators’ interests in constructivism, classroom technology, and social learning opportunities in an innovative approach to critical thinking and hands-on learning. Also known as computer-supported collaborative learning (CSCL) (Resta & Laferriere, 2007; Deal, 2009), online collaborative spaces allow students the opportunity to work together in an interactive, flexible online environment. These online spaces promote communication across a variety of modes, including text, speech, and multimedia formats, reflecting Vygotsky’s theory of the importance of language use for learning. They may also provide for a greater diversity of participants than might otherwise be possible in a physical classroom, allowing more cross-cultural connections to inspire social learning. Through meaningful learning activities that include goals, student-driven interests and problem-solving skills, opportunities for collaboration and reflection, and adaptations to individual and cultural needs, educators can facilitate authentic experiences and learning communities for their students in these online spaces (Bonk & Cunningham, 1998).

With an array of online resources available, there are a variety of avenues through which students can virtually collaborate. Deal (2009) proposed a process through which learning occurs in an online collaborative space: communication, team definition and participants, project management, resource management, co-creation and ideation, consensus building, and presenting and archiving. Initially, students must communicate and organize roles to complete an objective, which can be completed through online resources such as email, instant messaging, virtual conferencing (such as Skype or Google Hangouts), or discussion boards (Deal, 2009). In an online collaborative environment, students must also find ways to share and establish ideas through project management, resource management, and co-creation programs, such as Google Drive, Google Docs, wikis, and virtual whiteboards (Deal, 2009). Finally, once the project has been organized and at its final stage, students can use online resources to create a final product, such as a webinar, video, or slideshow. Throughout all components of the online collaboration process, teachers have opportunities for assessment, including evaluating the process, final product, or specific outcomes. Ultimately, as students make use of the variety of online resources to navigate a meaningful learning activity as prescribed by an instructor, social learning provides for the refinement of both content knowledge and critical thinking skills (Stahl, Koschmann, & Suthers, 2006; Scardamalia & Bereiter, 1994).

Applying Social Learning Theories: Suggestions for K-12 Teachers and Instructional Designers

When applying social perspectives of learning for K-12 learners and adults, it is important to establish learning teams with specific roles, identify authentic contexts, and scaffold learners.

Engaging All Learners in Social Learning Groups

For learners of all ages, establishing roles provides support to students to facilitate the completion of learning activities (Antil, Jenkins, Watkins, 1998). Kagan (1999) developed the acronym PIES to represent elements of collaborative learning: positive interdependence, individual accountability, equal participation, and simultaneous interaction. Positive interdependence refers to the idea that the potential work that can be done by the group is greater than if each individual in the group worked alone. Individual accountability means that learners are each responsible for some aspects of the work. Equal participation refers to relatively fair shares of the work required. Simultaneous interaction refers to the idea that learners are working together at the same time on the project.
instead of a jigsaw approach where learners work on their own on separate pieces that are compiled at the end of the work.

For instructional designers who are creating social learning experiences for adults, the tasks must be complex enough to foster positive interdependence and hold individuals accountable. This may include grouping individuals from different backgrounds. If employees of a bank were participating in training on new financial guidelines, an instructional designer may design learning activities in which teams encompassed a mortgage consultant, a retirement consultant, a manager, and a teller. The scenarios included in the training would vary as to require the expertise and background of each to be used in discussing and solving the problem.

K-12 teachers should intentionally establish collaborative learning experiences for students that involve projects, authentic tasks, and other activities embedded in contexts. In order to facilitate collaboration, creating learning teams or groups in which students have specific roles is suggested. For example, in an elementary school classroom, a teacher may put learners in groups and assign the following roles:

- Leader/facilitator: Individual in charge of organizing the group and keeping the group on task.
- Recorder: Individual who records and organizes notes, information, and data.
- Timekeeper: Individual who keeps time and makes sure things are completed in a timely manner.
- Spokesperson: Individual in charge of finalizing the project and leading the presentation.

The intentional establishment of learning teams is fundamental for both K-12 teachers and instructional designers in facilitating social learning experiences.

**Identifying Authentic Contexts**

As stated previously, social perspectives of learning embrace the idea of situated cognition that learning is embedded within specific contexts. For K-12 teachers, the challenge is identifying authentic contexts for learners. Culture, geography, and students’ backgrounds clearly must be taken into consideration when identifying contexts for social learning experiences. Students on the coast of Florida have authentic contexts that are different from those in a rural town in the midwestern United States. As a result, the development of curriculum, instructional materials, and resources for these types of experiences cannot be a one-size-fits-all approach, and should provide opportunities for teachers to modify the activities to ensure that they are authentic to their students.

Further, it is critical to make sure that learning experiences provide opportunities for learners to work within an authentic context but also provide generalizations or opportunities to apply their knowledge and skills in other settings. For example, after high school students study economic concepts of supply and demand in the context of researching the prices of brands of clothes popular in that area, students should have opportunities to apply those concepts in a new context.

For an instructional designer, an authentic setting is a realistic scenario the learners may experience. Instructional designers typically design training for individuals that is directly related to their work. For instance, creating training for lifeguards about CPR and first aid certification could include cases and scenarios that require multiple individuals to participate and collaboratively problem solve. This could include scenarios that require an individual to role play someone who is choking and groups of people to identify how to remove the object causing the individual to choke. During the learning
segment individuals take turns role playing and collaborating to identify and solve various problems.

**Scaffolding Learners**

In social learning experiences both K-12 teachers and instructional designers must create learning activities that include scaffolds and supports for learners. Social learning experiences are guided by teachers or learning facilitators without significant direct teaching and presentation. This does not mean that the teacher is absent or off in the corner; rather, they should leverage strategies such as posing questions, providing examples, or supporting students’ collaboration to support these learning experiences.

Scaffolding can occur in a few ways. First, teachers can serve as a scaffold by providing initial guidance or questions to help students launch into the activity. As the activity continues, teachers can decrease or remove the amount of support that they provide or limit their support to specific instances, such as when learners are stuck and unable to continue with the task. An instructional designer may design training for salesmen in which learners collaborate to learn about new strategies and receive ongoing feedback from the facilitator and other employees. However, after time, the amount of feedback and support decreases. Similar types of support can occur in K-12 classrooms when teachers provide feedback and guidance early on and then withdraw the scaffolds over time. For example, in an elementary school mathematics classroom a teacher may provide a conversion table between units of measurement for a group project at first, and then after students have had time to work with the measurement units take the conversion table away.

Second, teachers and facilitators can provide external scaffolds or learning tools. An instructional designer who is training salesmen about new procedures may provide a document and visual to help learners become familiar with the new procedures at the beginning of their learning experience, but after collaborative activities and feedback, the supporting documents may be removed, requiring learners to rely on each other or their memory. Likewise for K-12 teachers in a middle school science classroom, students studying landforms may be given access to an anchor chart or visual of different types of landforms initially to help them identify and classify landforms that they are learning about. After time, however, the teacher may remove the scaffold so that learners must rely on knowledge and each other as they lean on skills they have developed together. The amount of scaffolding that teachers should provide is a fine balance between teachers over-guiding on the one hand and on the other letting learners falter in a way that is not productive (CTGV, 1997).

**Considering the Role of Technology**

There are a variety of ways in which technology can support the use of social learning theories in the classroom. Through current and emerging online collaborative spaces, such as Google, Skype, wikis, and more, as well as hands-on collaborative technology in the classroom, such as SMART Tables and iPads, students have robust opportunities to experience meaningful collaborative learning in both physical and virtual settings that embody the tenets of sociocultural learning. Different technological and online tools can assist with greater communication strategies, more realistic simulations of real-world problem scenarios, and even greater flexibility when seeking to scaffold instruction within students’ ZPD. Embracing the use of technology within collaborative learning can also foster a more equal distribution of voices as compared to in-person groupings (Deal, 2009), potentially providing greater opportunity to ensure active participation among all students. Through using technology to support the implementation of social learning theories in the classroom, students experience collaboration while refining 21st century skills.
While the array of technology available to support social learning is beneficial, the volume of resources available for online and in-person technology-based collaboration may be overwhelming to some groups of students. Considering the amount of scaffolding needed based on individual class needs may be appropriate to ensure technology is being used most productively. By providing students with useful resources in an online environment or being explicit about technology use within a physical classroom, students may be able to better focus on the actual problem-solving task rather than filtering through different platforms.

Additionally, keeping in mind the purpose of sociocultural learning within technological contexts is important to the task of promoting online collaborative learning. For example, after differentiating instruction to meet individual students’ ZPD and organizing scaffolded activities, providing an authentic task in which students use technology to facilitate communication and the exchange of ideas (rather than simply as a tool to produce) would be integral to a social learning environment. Through use of online environments and organized activities, students could also have greater access to problem-based learning that reflects situated cognition, opportunities for cognitive apprenticeships, participation in flipped classrooms, and a range of experiences that promote the robust and diverse communication critical to Vygotskian theory. Careful consideration of appropriate guidance within the use of technology-based collaborative learning can enable the thoughtful design of learning that maximizes benefits promised by sociocultural learning theories.

Application Exercises

- Vygotsky was instrumental in pioneering Activity Theory, a learning theory closely tied to the principles discussed in this chapter. Research Activity Theory and discuss how sociocultural learning relates to the main points of the theory.
- Name at least 3 ways in which language is important to learning according to the sociocultural theory of learning.

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Learning Communities

How Do You Define a Community?

Richard E. West & Gregory S. Williams

Editor’s note

The following article was first published under an open license in Educational Technology Research and Development with the following citation:


A strong learning community “sets the ambience for life-giving and uplifting experiences necessary to advance an individual and a whole society” (Lenning and Ebbers 1999 [https://edtechbooks.org/-MYC]); thus the learning community has been called “a key feature of 21st century schools” (Watkins 2005 [https://edtechbooks.org/-BTu]) and a “powerful educational practice” (Zhao and Kuh 2004 [https://edtechbooks.org/-fE]). Lichtenstein (2005 [https://edtechbooks.org/-gk]) documented positive outcomes of student participation in learning communities such as higher retention rates, higher grade point averages, lower risk of academic withdrawal, increased cognitive skills and abilities, and improved ability to adjust to college. Watkins (2005 [https://edtechbooks.org/-BTu]) pointed to a variety of positive outcomes from emphasizing the development of community in schools and classes, including higher student engagement, greater respect for diversity of all students, higher intrinsic motivation, and increased learning in the areas that are most important. In addition, Zhao and Kuh (2004 [https://edtechbooks.org/-fE]) found learning communities associated with enhanced academic performance; integration of academic and social experiences; gains in multiple areas of skill, competence, and knowledge; and overall satisfaction with the college experience.

Because of the substantial learning advantages that research has found for strong learning communities, teachers, administrators, researchers, and instructional designers must understand how to create learning communities that provide these benefits. Researchers and practitioners have overloaded the literature with accounts, studies, models, and theories about how to effectively design learning communities. However, synthesizing and interpreting this scholarship can be difficult because researchers and practitioners use different terminology and frameworks for conceptualizing the nature of learning communities. Consequently, many become confused about what a learning community is or how to measure it.
In this chapter we address ways learning communities can be operationalized more clearly so research is more effective, based on a thorough review of the literature described in our other article (West & Williams, 2017).

**Defining Learning Communities**

Knowing what we mean when we use the word community is important for building understanding about best practices. Shen et al. (2008) concluded, “How a community of learners forms and how social interaction may foster a sense of community in distance learning is important for building theory about the social nature of online learning” (p. 18). However, there is very little agreement among educational researchers about what the specific definition of a learning community should be. This dilemma is, of course, not unique to the field of education, as rural sociologists have also debated for decades the exact meaning of community as it relates to their work (Clark 1973; Day and Murdoch 1993; Hillery 1955).

In the literature, learning communities can mean a variety of things, which are certainly not limited to face-to-face settings. Some researchers use this term to describe something very narrow and specific, while others use it for broader groups of people interacting in diverse ways, even though they might be dispersed through time and space. Learning communities can be as large as a whole school, or as small as a classroom (Busher 2005) or even a subgroup of learners from a larger cohort who work together with a common goal to provide support and collaboration (Davies et al. 2005). The concept of community emerges as an ambiguous term in many social science fields.

Perhaps the most frustrating aspect of researching learning communities is the overwhelming acceptance of a term that is so unclearly defined. Strike (2004) articulated this dilemma through an analogy: “The idea of community may be like democracy: everyone approves of it, but not everyone means the same thing by it. Beneath the superficial agreement is a vast substratum of disagreement and confusion” (p. 217). When a concept or image is particularly fuzzy, some find it helpful to focus on the edges (boundaries) to identify where “it” begins and where “it” ends, and then work inward to describe the thing more explicitly. We will apply this strategy to learning communities and seek to define a community by its boundaries.

However, researchers have different ideas about what those boundaries are (Glynn 1981; Lenning and Ebbers 1999; McMillan and Chavis 1986; Royal and Rossi 1996) and which boundaries are most critical for defining a learning community. In our review of the literature, we found learning community boundaries often defined in terms of participants’ sense that they share access, relationships, vision, or function (see Fig. 1). Each of these boundaries contributes in various ways to different theoretical understandings of a learning community.
Figure 1. The defining characteristics of learning communities, representing different ways of defining the boundaries of a community

**Community Defined by Access**

Access might have been at one point the easiest way to define a community. If people lived close together, they were a community. If the children attended the same school or classroom, then they were a school or class community. Some researchers and teachers continue to believe that defining a community is that simple (For example, Kay et al., 2011).

This perception about spatial/geographic communities is common in community psychology research, but also emerges in education when scholars refer to the “classroom community” as simply a synonym for the group of students sitting together. Often this concept is paired with the idea of a cohort, or students entering programs of professional or educational organizations who form a community because they share the same starting time and the same location as their peers.

However, because of modern educational technologies, the meaning of being “present” or having access to one another in a community is blurred, and other researchers are expanding the concept of what it means to be “present” in a community to include virtual rather than physical opportunities for access to other community members.

Rovai et al. (2004) summarized general descriptions of what it means to be a community from many different sources (Glynn 1981; McMillan 1996; Royal and Rossi 1996; Sarason...
and concluded that members of a learning community need to have “ready access” to each other (Rovai et al. 2004). He argued that access can be attained without physical presence in the same geographic space. Rovai (2002) previously wrote that learning communities need a common meeting place, but indicated that this could be a common virtual meeting place. At this common place, members of the community can hold both social and intellectual interactions, both of which are important for fostering community development. One reason why many virtual educational environments do not become full learning communities is that although the intellectual activity occurs in the learning management system, the social interactions may occur in different spaces and environments, such as Twitter and Facebook—thus outside of the potential community.

The negotiation among researchers about what it means to be accessible in a learning community, including whether these boundaries of access are virtual or physical, is still ongoing. Many researchers are adjusting traditional concepts of community boundaries as being physical in order to accommodate modern virtual communities. However, many scholars and practitioners still continue to discuss communities as being bounded by geographic locations and spaces, such as community college math classrooms (Weissman et al. 2011), preservice teachers’ professional experiences (Cavanagh and Garvey 2012), and music educator PhD cohorts (Shin 2013). More important is the question of how significant physical or virtual access truly is. Researchers agree that community members should have access to each other, but the amount of access and the nature of presence needed to qualify as a community are still undefined.

**Community Defined by Relationships**

Being engaged in a learning community often requires more than being present either physically or virtually. Often researchers define learning communities by their relational or emotional boundaries: the emotional ties that bind and unify members of the community (Blanchard et al. 2011). Frequently a learning community is identified by how close or connected the members feel to each other emotionally and whether they feel they can trust, depend on, share knowledge with, rely on, have fun with, and enjoy high quality relationships with each other (Kensler et al. 2009). In this way, affect is an important aspect of determining a learning community. Often administrators or policymakers attempt to force the formation of a community by having the members associate with each other, but the sense of community is not discernible if the members do not build the necessary relational ties. In virtual communities, students may feel present and feel that others are likewise discernibly involved in the community, but still perceive a lack of emotional trust or connection.

In our review of the literature, we found what seem to be common relational characteristics of learning communities: (1) sense of belonging, (2) interdependence or reliance among the members, (3) trust among members, and (4) faith or trust in the shared purpose of the community.

**Belonging**

Members of a community need to feel that they belong in the community, which includes feeling like one is similar enough or somehow shares a connection to the others. Sarason (1974) gave an early argument for the psychological needs of a community, which he defined in part as the absence of a feeling of loneliness. Other researchers have agreed that an essential characteristic of learning communities is that students feel “connected” to each other.
(Baker and Pomerantz 2000 [https://edtechbooks.org/-qjV]) and that a characteristic of ineffective learning communities is that this sense of community is not present (Lichtenstein 2005 [https://edtechbooks.org/-gk]).

**Interdependence**

Sarason (1974 [https://edtechbooks.org/-MvQ]) believed that belonging to a community could best be described as being part of a “mutually supportive network of relationships upon which one could depend” (p. 1). In other words, the members of the community need each other and feel needed by others within the community; they feel that they belong to a group larger than the individual self. Rovai (2002 [https://edtechbooks.org/-IM]) added that members often feel that they have duties and obligations towards other members of the community and that they “matter” or are important to each other.

**Trust**

Some researchers have listed trust as a major characteristic of learning communities (Chen et al. 2007 [https://edtechbooks.org/-LZ]; Mayer et al. 1995 [https://edtechbooks.org/-uhV]; Rovai et al. 2004 [https://edtechbooks.org/-CR]). Booth’s (2012 [https://edtechbooks.org/-tDg]) focus on online learning communities is one example of how trust is instrumental to the emotional strength of the learning group. “Research has established that trust is among the key enablers for knowledge sharing in online communities” (Booth 2012 [https://edtechbooks.org/-tDg], p. 5). Related to trust is the feeling of being respected and valued within a community, which is often described as essential to a successful learning community (Lichtenstein 2005 [https://edtechbooks.org/-gk]). Other authors describe this feeling of trust or respect as feeling “safe” within the community (Baker and Pomerantz 2000 [https://edtechbooks.org/-qjV]). For example, negative or ineffective learning communities have been characterized by conflicts or instructors who were “detached or critical of students and unable or unwilling to help them” (Lichtenstein 2005 [https://edtechbooks.org/-gk], p. 348).

**Shared Faith**

Part of belonging to a community is believing in the community as a whole—that the community should exist and will be sufficient to meet the members’ individual needs. McMillan and Chavis (1986 [https://edtechbooks.org/-EP]) felt that it was important that there be “a shared faith that members’ needs will be met through their commitment to be together” (p. 9). Rovai et al. (2004 [https://edtechbooks.org/-CR]) agreed by saying that members “possess a shared faith that their educational needs will be met through their commitment to the shared goals and values of other students at the school” (p. 267).

These emotional boundaries not only define face-to-face learning communities, but they define virtual communities as well—perhaps more so. Because virtual communities do not have face-to-face interaction, the emotional bond that members feel with the persons beyond the computer screen may be even more important, and the emergence of video technologies is one method for increasing these bonds (Borup et al. 2014 [https://edtechbooks.org/-XQ]).

**Community Defined by Vision**

Communities defined by shared vision or sense of purpose are not as frequently discussed as boundaries based on relationships, but ways members of a community think about their group are
important. Rather than feeling like a member of a community—with a sense of belonging, shared faith, trust, and interdependence—people can define community by thinking they are a community. They conceptualize the same vision for what the community is about, share the same mission statements and goals, and believe they are progressing as a community towards the same end. In short, in terms many researchers use, they have a shared purpose based on concepts that define the boundaries of the community. Sharing a purpose is slightly different from the affective concept of sharing faith in the existence of the community and its ability to meet members’ needs. Community members may conceptualize a vision for their community and yet not have any faith that the community is useful (e.g., a member of a math community who hates math). Members may also disagree on whether the community is capable of reaching the goal even though they may agree on what the goal is (“my well intentioned study group is dysfunctional”). Thus conceptual boundaries of a community of learners are distinct from relational ties; they simply define ways members perceive the community’s vision. Occasionally the shared conception is the most salient or distinguishing characteristic of a particular learning community.

Schrum et al. (2005 [https://edtechbooks.org/-Eig]) summarized this characteristic of learning communities by saying that a community is “individuals who share common purposes related to education” (p. 282). Royal and Rossi (1996 [https://edtechbooks.org/-mw]) also described effective learning communities as rich environments for teamwork among those with a common vision for the future of their school and a common sense of purpose.

Community Defined by Function

Perhaps the most basic way to define the boundaries of a learning community is by what the members do. For example, a community of practice in a business would include business participants engaged in that work. This type of definition is often used in education which considers students members of communities simply because they are doing the same assignments: Participants’ associations are merely functional, and like work of research teams organized to achieve a particular goal, they hold together as long as the work is held in common. When the project is completed, these communities often disappear unless ties related to relationships, conceptions, or physical or virtual presence [access] continue to bind the members together.

The difference between functional boundaries and conceptual boundaries [boundaries of function and boundaries of vision or purpose] may be difficult to discern. These boundaries are often present simultaneously, but a functional community can exist in which the members work on similar projects but do not share the same vision or mental focus about the community’s purpose. Conversely, a group of people can have a shared vision and goals but be unable to actually work together towards this end (for example, if they are assigned to different work teams). Members of a functional community may work together without the emotional connections of a relational community, and members who are present in a community may occupy the same physical or virtual spaces but without working together on the same projects. For example, in co-working spaces, such as Open Gov Hub in Washington D.C., different companies share an open working space, creating in a physical sense a very real community, but members of these separate companies would not be considered a community according to functional boundaries. Thus all the proposed community boundaries sometimes overlap but often represent distinctive features.

The importance of functional cohesion in a learning community is one reason why freshman learning communities at universities usually place cohorts of students in the same classes so they are working on the same projects. Considering work settings, Hakkarainen et al. (2004)
[https://edtechbooks.org/-vmc] argued that the new information age in our society requires workers to be capable of quickly forming collaborative teams (or networked communities of expertise) to achieve a particular functional purpose and then be able to disband when the project is over and form new teams. They argued that these networked communities are increasingly necessary to accomplish work in the 21st Century.

Relying on functional boundaries to define a learning community is particularly useful with online communities. A distributed and asynchronously meeting group can still work on the same project and perhaps feel a shared purpose along with a shared functional assignment, sometimes despite not sharing much online social presence or interpersonal attachment.

Conclusion

Many scholars and practitioners agree that learning communities “set the ambience for life-giving and uplifting experiences necessary to advance an individual and a whole society” (Lenning and Ebbers [1999](https://edtechbooks.org/-MYC)). Because learning communities are so important to student learning and satisfaction, clear definitions that enable sharing of best practices are essential. By clarifying our understanding and expectations about what we hope students will be able to do, learn, and become in a learning community, we can more precisely identify what our ideal learning community would be like and distinguish this ideal from the less effective/efficient communities existing in everyday life and learning.

In this chapter we have discussed definitions for four potential boundaries of a learning community. Two of these can be observed externally: access (Who is present physically or virtually?) and function (Who has been organized specifically to achieve some goal?). Two of these potential boundaries are internal to the individuals involved and can only be researched by helping participants describe their feelings and thoughts about the community: relationships (Who feels connected and accepted?) and vision (who shares the same mission or purpose?).

Researchers have discussed learning communities according to each of these four boundaries, and often a particular learning community can be defined by more than one. By understanding more precisely what we mean when we describe a group of people as a learning community—whether we mean that they share the same goals, are assigned to work/learn together, or simply happen to be in the same class—we can better orient our research on the outcomes of learning communities by accounting for how we erected boundaries and defined the subjects. We can also develop better guidelines for cultivating learning communities by communicating more effectively what kinds of learning communities we are trying to develop.

Application Exercises

- Evaluate your current learning community. How can you strengthen your personal learning community? Make one commitment to accomplish this goal.
- Analyze an online group (Facebook users, Twitter users, NPR readers, Pinners on Pinterest, etc.) that you are part of to determine if it would fit within the four proposed boundaries of a community. Do you feel like an active member of this community? Why or why not?
References


Please complete this short survey to provide feedback on this chapter: http://bit.ly/CommunityBoundaries
Communities of Innovation

Individual, Group, and Organizational Characteristics Leading to Greater Potential for Innovation

Richard E. West

Editor's Note

The following was published in TechTrends as the 2013 Invited Paper/Presentation to the Research & Theory Division of AECT, available on Springer [here](https://edtechbooks.org/-qnZ).

**Video Abstract**

In this video abstract (available at [http://bit.ly/COIAbstract](http://bit.ly/COIAbstract)), Dr. West discusses the Communities of Innovation framework. Additionally, in this presentation (available at [http://bit.ly/CIDIPTSeminar](http://bit.ly/CIDIPTSeminar)), Dr. West and his collaborators share their efforts to implement ideas from this article in an interdisciplinary innovation studio at Brigham Young University as part of the CID effort [http://innovation.byu.edu/](http://innovation.byu.edu/).

**Introduction**

In 1950, in a memorable presidential address to the American Psychological Association, Guilford chided his colleagues for the period’s lack of research on creativity, noting that only 0.2% of published articles in *Psychology Abstracts* had discussed creativity. He then made a prescient prediction about the future, with the development of computers, which he called “thinking machines”:

> [It will] be necessary to develop an economic order in which sufficient employment and wage earning would still be available . . . eventually about the only economic value of brains left would be in the creative thinking of which they are capable. (p. 36)

The time that Guilford envisioned is quickly becoming the present, when the combination of powerful computers and the ability to network these computers through the Internet has created a different kind of employment marketplace, one where employees are being expected to produce innovations, where knowledge is not managed but created (Howkins, 2002; Sawyer, 2006a; Tepper, 2010). As a
sign of the times, patents granted in the United States have risen from about 49,000 in 1963 to over 276,000 in 2012 (U.S. Patent and Trademark Office, 2012). Patent filings are, of course, not a perfect measure of innovation for many reasons, but they reflect the current stress for innovation in business and industry.

**Creativity in Education**

Responding to this market need, educational organizations find it increasingly critical to develop creativity in their students. For example, the Partnership for 21st Century Skills has designated innovation as one of the skills students need (see [https://edtechbooks.org/-nt](https://edtechbooks.org/-nt)). Livingston (2010) argued, “Higher education needs to use its natural resources in ways that develop content knowledge and skills in a culture infused at new levels by investigation, cooperation, connection, integration, and synthesis. Creativity is necessary to accomplish this goal” (p. 59).

How are we doing at teaching this critical capability? Not as well as we perhaps should be. Berland (2012) surveyed 1,000 adult working college graduates in the United States and found that 78% felt creativity to be important to their current career, and 82% wished they had been more exposed to creative thinking in school. In addition, 88% felt creativity should be integrated into university curricula, with 71% thinking it should be a class in itself. Particularly interesting is the work done by Kyung Hee Kim, who in 2011 published an influential article on the “Creativity Crisis” in the prestigious *Creativity Research Journal*. Kim reported that results from the Torrance Test of Creative Thinking (TTCT), widely used to measure creative and gifted abilities in children, had dropped significantly since 1990 on nearly all of its subscales, which represent the qualities of creative thinking defined by Torrance in his extensive work on the topic.

**Collaborative Creativity and Communities of Innovation**

There is a critical need to teach and foster basic creative thinking among today’s students, but of particular importance is the need to develop their abilities to engage in collaborative creativity. Many of the current problems and challenges graduates will face in society and industry are too large to be faced alone. However, insufficient research is going into understanding, defining, and teaching collaborative creativity skills in educational contexts.

In seeking to understand what collaborative creativity would look like in education, I reviewed the literature on organizational and social creativity, along with social learning theory, to develop a framework of characteristics common to most environments that foster collaborative creativity in students (West, 2009). I see this framework, *Communities of Innovation*, as an evolution of popular conceptions about social activity within communities of practice (Lave & Wenger, 1991; Wenger, 1998). Since publishing my 2009 paper, I have been seeking to research and develop this framework. I am still in this process, but the purpose of this paper is to update the framework with currently expanded knowledge and experience.

A Community of Innovation (COI) is a group of people focused on producing innovative outputs in a collaborative environment. Different COIs may have varying attributes or qualities that make them successful, but in general COIs have similar characteristics at the individual, group, and organizational levels (see Figure 1).
Figure 1. Communities of Innovation

In this paper I will explain what I see as some of the core attributes of COIs at each level, including what we know from research about each attribute. The following section will consider characteristics of Communities of Innovation in the categories of general characteristics influenced by social creativity and learning, characteristics significant on the level of individual groups, and characteristics necessary on the organizational level.

Individual but Socially Influenced Characteristics

Hacker Motivation

*Hacker* has typically been used to describe “illicit computer intruders” (Jordan & Taylor, 1998, p. 757), but more recently the word has been expanded beyond computer programming or networking buffs to any potential expert or enthusiast (Chance, 2005). Identifying hackers now is less about the domain of their expertise than about their motivation in using it. The term *hacker ethic* was popularized by Himanen (2001), who used it to designate a work ethic emphasizing (a) the importance of a particular kind of work that is motivating to the hacker beyond financial gain because it is valuable to others, (b) a playful and passionate approach to working, and (c) equal access to information and tools through open sharing. Thus hackers, according to Himanen, are motivated by the complexity of real-world problems, deep concern and care for their work, and dedication to quality.

Computer programmers have responded to this type of deep, intrinsic motivation when they have developed open source tools like Linux, Apache, and Wikipedia and given them away without charge, being motivated not by money but by the challenge and the opportunity to produce something that improves their lives and society. Even though the motivation is not financial, people exhibiting the hacker ethic can produce amazingly creative products. As Raymond (2003) said:
To do the Unix philosophy right, you have to be loyal to excellence. You have to believe that software design is a craft worth all the intelligence and passion you can muster. . . . You need to care. You need to play. You need to be willing to explore. (p. 27)

One application of hacker motivation to creativity has been involving users to produce innovative consumer products. Jeppesen and Frederiksen (2006) reported that in various industries producing everything from electronics to computers to chemical processes/equipment, 11-76% of the innovation in the field came from actual users, not professionals, and that often products developed by collaborating lead users have been many times better than products generated in house (Lilien, Morrison, Searls, Sonnack, & von Hippel, 2003). Many companies have realized the power of hacker motivation and have tried to foster it with their employees by granting autonomy, resources, and access to collaborators for employees working on intrinsically motivating projects. Often these projects become some of the most creative products in the company. For example, Google has allowed its employees to work one day each week on their own intrinsically motivating projects, and from this hacker time have come AdSense, Gmail, Google Talk, Google News, and Google Reader.

Dynamic Expertise

Dynamic expertise, a term coined by Hakkarainen, Palonen, Paavola, & Lehtinen (2004), contrasts with traditional views of expertise as an accumulation of skills and knowledge in a particular domain. Dynamic expertise designates the ability to continually learn and surpass earlier achievements by “living on the edge” (Marianno & West, 2013) of one’s competence, pushing for new expertise in ever-evolving new ways and domains. Thus expertise is a dynamic, progressive ability to gain new skills and knowledge. In developing and validating a survey to measure dynamic expertise in creative groups, Marianno and West (2013) found three main relevant factors: awareness and understanding of the problems facing the group, motivation to pursue these challenging problems, and ability to gain new competencies in the process. In this study, groups in which the individual members exhibited more dynamic expertise were significantly more innovative than their peers.

Entrepreneurship and Autonomy

Developing and using dynamic expertise requires that members of a community have a certain amount of entrepreneurship and autonomy. Gagne and Deci (2005) explained autonomy as acting with choice and purpose and engaging in an activity because one finds it enjoyable. McLean (2005) explained that freedom and autonomy within an organization will likely promote intrinsic motivation and, consequently, innovation (see also Oldham & Cummings, 1996). Similarly, scholars have found that promoting autonomy and self-directed activity can substantially improve student morale, motivation, learning, and performance (Gagne & Deci, 2005; Gelderen, 2010; Ryan & Deci, 2000). On the other hand, Amabile (1996) found that perception of organizational control over its members impedes creativity. This relationship is especially important when critiquing or evaluating the work within a COI, as evaluation is critical to improving the product (West, Williams, & Williams, 2013), but feedback must be given without the perception of limiting autonomy (Egan, 2005).

While members of a COI need to feel autonomy over how they accomplish their work, this does not mean constraints should not be given or particular tasks assigned. In fact, constraints are widely recognized for improving creativity to a degree (Dyer, Gregersen, & Christensen, 2009; Moreau & Dahl, 2005). However, creativity flourishes when COI members feel they have high autonomy and ownership over the everyday work, ideas, and manner of discovering how to accomplish their tasks.
Supporting autonomy can lead to the likelihood of group members internalizing and adopting the values and goals of the group (Gagne & Deci, 2005).

**Group Level Characteristics**

**Group Flow**

Keith Sawyer, whose graduate adviser was Mihalyi Csikszentmihalyi, adapted his mentor’s conception of flow (Csikszentmihalyi, 1990) to group collaboration. Sawyer (2008) explained that group flow was more likely to occur based on 10 important elements of effective group collaboration: a shared goal, close listening, complete concentration, the ability to be in control (related to what I call autonomy), blended egos, equal participation, familiarity, communication, effort to move ideas forward (often through improvisation, building on previous ideas), and risk that comes from the potential for failure. Sawyer (2006b) argued that when groups achieve flow, innovation is at its peak: “Performers are in interactional synchrony,” and “each of the group members can even feel as if they are able to anticipate what their fellow performers will do before they do it” (p. 158).

Research into group flow is still in the early stages, and few use the term besides Sawyer, but evidence has shown that Sawyer’s theory is solid. For example, Byrne, MacDonald, & Carlton (2003; see also MacDonald, Byrne, & Carlton, 2006) studied how group flow impacted creative output in musical compositions of 45 university students who were rated for their creativity. The authors found a significant correlation between the levels of flow the student groups experienced and the creativity of their group compositions.

The biggest challenge with group flow is how “fragile” (Armstrong, 2008) it is and how difficult to foster. It is also “hard to predict in advance” (Sawyer, 2006b, p. 158), which makes it difficult to research. Of particular interest to me is what happens when group collaboration moves online. Sawyer (2013) has argued that the Internet cannot support group flow at all, but more research is needed, including studies into whether group flow might emerge online but require circumstances entirely different than those Sawyer articulated for group flow in face-to-face settings.

**Idea Prototyping**

Design industries have long acknowledged the value of rapidly prototyping group ideas so that collaboration can continue by improvising (Tripp & Bichelmeyer, 1990) on the design. This significant application of the design thinking approach to group creativity is growing in popularity in both industry and education because of its perceived ability to “change how people learn and solve problems” (Razzouk & Shute, 2012, p. 331). Sutton and Kelley (1997) noted that IDEO prototypes not only their products, but also their spaces, organizational structures, and size—making prototyping a core feature of their successful approach to innovation.

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Idea prototyping

Brown (2008) explained, “[T]he goal of prototyping isn’t to finish. It is to learn about the strengths and weaknesses of the idea and to identify new directions that further prototypes might take” (p. 87). Thus group members are able to learn through the process of creation, which has been shown to be a powerful way to promote constructivist learning (Kafai & Resnick, 1996).

Second, prototyping can facilitate group reflection by putting a concept into tangible form for discussion. We have seen this in research into collaborative innovation at Brigham Young University’s Center for Animation, as much of the innovation in this highly successful studio emerges from group criticisms of designed prototypes in biweekly student-run meetings (see West, Williams & Williams, 2013). Third, Sawyer (2003b) has argued that improvisation is key to collaborative innovation, and prototyping can facilitate improvisation by providing an initial concept to begin experimentation.

Cognitive and Skill Diversity

Diversity is so critical to collaborative innovation that Justesen (2004) termed it “innoversity” (p. 79). Bielaczyc and Collins (2006) explained, “[M]ultiple perspectives . . . raise questions about what is the best approach. They provide different possible solutions . . . . They offer ingredients for new syntheses. . . . [and are] critical to the invention process” (p. 42). For innovation, the most important kind of diversity involves thinking abilities and design skills, so that a greater variety of ideas can be forged together for the most creative outcomes. Particularly valuable are individuals who have
connections not only within a group, but outside of it and can thus contribute outside perspectives. This is widely referred to as the “strength of weak ties,” since strength often comes from weaker but still important ties to others outside of the collaborating team, which can bring new perspectives into the collaborating group (e.g., Baer, 2010; Granovetter, 1973)

Individuals with diverse perspectives in a group must freely share these diverse viewpoints and ideas. Diversity can be inhibited by social constraints like hierarchies of power or even personal constraints like shyness; efforts must be made to bring out the diversity of the group. For example, research has found that traditional brainstorming does not produce better creativity (Pauhus et al., 1993; Taylor, Berry, & Block, 1958) because groupthink can emerge if a few individuals share opinions and the rest of the group is hesitant to challenge or offer their own. More effective are methods, such as the nominal group technique (Mullin et al., 1991; Putman & Paulus, 2009), which ask individuals to first do the hard work of developing their ideas and positions individually or in smaller teams before sharing them in an open, but critical and evaluative, collaboration where the ideas can be merged and improvised upon.

**Critique and Reflection**

An important quality of innovative communities is the ability of members to give and receive criticism in productive ways. This capacity is due in large measure to organizational-level efforts to support exploration and allow for failure with recoverability, as long as quality reflection enables learning from the failure, thus making it actually “productive” (Kapur & Rummel, 2012). As an organization creates a culture where failure is no longer devastating to the team, then at the group level teams have a greater opportunity to develop skills in critique, reflection, evaluation, and team learning.

One example of the role of critical evaluation and reflection in collaborative innovation was the Center for Animation that we studied (West, Williams & Williams, 2013). In that setting, evaluation was a top priority, and the design community met twice a week over a year and a half to showcase and critique weekly progress on their animated short. We found that the qualities that made evaluation successful in this community were the culture of high expectations, collaboration, and evaluation; the ability of the instructors to unite the students, teachers, and leaders as shared stakeholders in the success of the project; the important criteria for evaluating progress; and the frequent opportunities to question and discuss this progress.

In an earlier study (West & Hannafin, 2011), I learned that often the act of critiquing another’s work not only helps the person receiving the evaluation, but also the one giving it. One student in that study explained how she and her peers learned through the process of critique, quoting Nelson & Stolterman (2003): “[I]t is also possible to develop design skills by critiquing existing designs” (p. 217)

**Common Vision**

Essential to the ability of a group to collaborate and critique their progress effectively is that they have a common vision of what they are trying to do. This does not mean they know exactly what the design will look like, but only what they hope the design will accomplish. Anderson and West (1998) explained that a group’s shared vision is more effective when it is clear and understandable, is important to and widely shared by all members of the group, and is attainable so it is not demotivating. The importance of a common vision to a productive team climate has been shown in both business (Anderson & West, 1998) and education (West, Williams, & Williams, 2013). Wang &
Rafiq (2009) explained the tension in organizational learning between paradigms of exploration and exploitation, and argued that organizational diversity and shared vision are vital to balancing these competing views of group productivity.

**Organizational Level Characteristics**

**Flexible and Organic Organization**

Many scholars in organizational studies argue that a flexible organizational structure can promote innovation in a community. For example, Volberda (1996) argued, “Bureaucratic vertical forms severely hamper the ability to respond to accelerating competition. Flexible forms, in contrast, can respond to a wide variety of changes in the competitive environment in an appropriate and timely way” (p. 359). A classic example is the organizational structure of IDEO. In a 2001 interview with *Businessweek*, Beth Strong, IDEO’s Director of Recruiting, explained that IDEO’s organizational structure is “very flat” where “hot teams” can form on their own and work as a studio for a period of time to complete a project that the team members are all excited about. There is no expectation of an entire career within one studio, and movement between studios is encouraged, with leadership within the studios often being organic—emerging from within the group.

This type of organizational structure is radically different from that of many communities of practice. Some research has argued that the type of organizational structure is less important than expected, and that flat organizations can struggle with inefficiency due to interpersonal conflicts and inadequate effort coordination (Carzo & Yanouzas, 1969). Possibly what matters more than tall vs. flat organizational structure are characteristics of that organization, such as how quickly innovative ideas can be approved for prototyping, how much autonomy individuals and groups have for innovating, and how flexible the organization is in reorganizing teams according to emergent needs and situations.

**Mastery, Purpose, and Autonomy**

Pink (2011) popularized the idea that higher-order thinking tasks, such as creativity, are best motivated by organizations that promote mastery, purpose, and autonomy in employees. His ideas are based in large part on the work of Teresa Amabile of Harvard, who has found in her research that “when it comes to granting freedom, the key to creativity is giving people autonomy concerning the means . . . but not necessarily the ends” of a task (1998, p. 81) or, in other words, “choice in how to go about accomplishing the tasks that they are given” (Amabile, Conti, Coon, Lazenby, & Herron, 1996; see also Kurtzberg & Amabile, 2001). This finding holds true not only in business settings but in education (Gelderen, 2010) and research, where Parker & Hackett (2012) explained that research groups benefit from providing younger investigators autonomy, allowing them to be a group that is “getting-big-while-remaining-small” (p. 38): in other words, maintaining their entrepreneurial creativity.

An organization’s focus on individuals and groups working towards mastery and purpose in their work can also increase motivation, often more effectively than extrinsic rewards, which have been shown in many research studies to diminish creativity (Hennessey, 1989) and damage intrinsic motivation (Deci, Koestner, & Ryan, 1999). For this reason many innovative design companies encourage lifelong learning for their employees, even in areas not directly related to their work (consider, for example, Pixar University), and to work on projects that give them a sense of purpose,
so they feel they are accomplishing a greater good (see previous discussion on the importance of fostering a hacker ethic).

**Sense of Community and Psychological Safety**

The glue that unifies any community, particularly one with the differences in characteristics and structures of a community of innovation, is a strong sense of community and psychological safety among the members. Rogers (1954), well known for articulating the importance of psychological safety for creativity, explained that psychological safety depends on three separate processes: (1) accepting the individual as of unconditional worth, (2) providing a climate in which external evaluation is absent*[^1] and (3) empathically understanding the individual (referred to by Sawyer [2008] as close listening). Since Rogers’ work, many scholars have found evidence for the importance of a strong sense of community in education units (Rovai, 2002; West & Hannafin, 2011), work teams (Barczak, Lassk, & Mulki, 2010), and whole organizations (Baer & Frese, 2003).

**Discussion and Implications**

**Implications for Teaching**

Teaching in a way that builds communities of innovation is not easy, but it is increasingly important. Like many higher order skills, collaborative innovation skills are best taught through modeling, nurturing, and supporting students’ growth in ways specific to every context and group of individuals. Still the community of innovation characteristics outlined in this paper seem to lead to some suggested strategies.

First, our research in online learning needs to transition from a predominant focus on delivering content and testing information recall (I’m looking at you, MOOCs) and more on how to recapture the powerful improvisational and impromptu conversations and interactions that lead to group innovation. Tools like Mural.ly ([https://mural.ly/](https://mural.ly/)), Mendley ([http://mendeley.com](http://mendeley.com); see Zaugg, West, Tateishi, & Randall, 2011), and Chatter ([https://edtechbooks.org/-Dr](https://edtechbooks.org/-Dr)) are examples of the kinds of collaboration tools we need that foster people and ideas “bumping into each other” in unforeseen ways to foster innovation.

Second, we need to foster idea generation in effective ways by encouraging individual work and contribution first and then group evaluation and improvisation/prototyping afterward. We will have more group genius (Sawyer, 2008) instead of groupthink when we use strategies that utilize the diversity within a group and encourage open and critical dialogue in an atmosphere of psychological safety.

Third, one of our primary goals in education should be to encourage group flow, which is where the magic of collaborative innovation happens. This means focusing less on seat time and more on project goals. Studio-based approaches to teaching (Chen & You, 2010; Clinton & Rieber, 2010; Docherty, Sutton, Brereton, & Kaplan, 2001) work well because they tend to de-emphasize time on task in favor of work completed and creativity developed. Nothing disrupts a group’s flow worse than having the bell ring for the end of class. Instead, we should encourage students to work together in ways and on projects that are most likely to lead to flow, and when they are doing so effectively, we need to give them the space and time to keep it going!
Fourth, acknowledging the literature on autonomy and self-determination theory, we need to promote entrepreneurial attitudes among individuals and groups by allowing and rewarding choices within appropriate boundaries. Fifth, as instructors we need to be more flexible in allowing for self-organizing projects and teams and to create more opportunities for student communication. Sixth, reflection, critique, and learning from failure should be built into every assignment so that failure is productive, not destructive. Although there are many other strategies to explore, and much more to understand about effectively implementing the above strategies in ways that will work in our educational systems, I believe this is a fertile ground for additional research and theory development.

Implications for Research

To date, the research on teaching group- or community-based innovation strategies is nascent. Researching group innovation is challenging, particularly isolating variables and observing outcomes with no assurance of when or how the innovation will actually emerge. However, just because the research is difficult does not mean it should be avoided. Several areas of prospective research could be fruitful.

First, we need more concrete definitions and methods for measuring/observing the COI principles outlined in this paper, as well as any others that may also be important to collaborative innovation, using as many different research methods as possible. Although traditional creativity scholars have largely rejected qualitative methods, too much is still unknown about how to foster collaborative innovation for us to not use every potentially useful research method, including quantitative, qualitative, conversation analysis, and social network analysis.

Second, education is rapidly changing and transitioning towards online and blended environments. While this transition is clearly important and can provide many benefits, we need to be careful that we do not focus on what is easier to teach online (information) instead of what is more difficult but also important (collaboration, creativity, and critical thinking). Instructional designers and researchers need to lead out on setting the agenda for online education in ways that theory suggests will lead to better learning.

Third, we need to explore how to teach collaborative innovation skills on various educational levels. Most of the current research focuses on higher education, for example, and tight national standards for grade-school education often make it harder to justify spending time on skills such as creativity that do not readily show up on standardized tests. Still there is room in national standards for creativity, particularly in the upsurge of interest in teaching engineering practices to children. More research is needed on how to infuse group creativity into this type of curriculum effectively.

Unfortunately, education administrators’ and leaders’ talk about teaching creativity is often little more than “rhetorical flourishes in policy documents and/or relegated to the borderlands of the visual and performing arts” (McWilliam & Dawson, 2008, p. 634), perhaps because this capability is among the most “elusive” (p. 633) of skills. However, the scholar considered by many to be the father of creativity, E. Paul Torrance, encouraged creative persons to seek great teachers and mentors in their quest to develop their creativity (Torrance, 2002). As educators and instructional designers we are responsible to be those teachers and mentors as we design the kinds of learning environments that best foster creativity and innovation, especially in collaborative communities.
Application Exercises

- 71% of students surveyed by Berland (2012) felt that universities should offer a class on creativity. Using some of the guidelines and information from this chapter, create an outline of what you think a class on creativity would look like.
- Consider an organization that you are a part of. What are the ways in which you could integrate principles of communities of innovation?
- What is one thing you would do to create group flow in an online learning environment?

References


* [# ftntref1] I have previously argued for the importance of critique, but this critique must not reflect on the individual itself, but rather on the project.

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Motivation Theories and Instructional Design

Seung Won Park

Introduction

Motivation has been defined as a desire or disposition to engage and persist in a task (Schunk, Pintrich, & Meece, 2014). When a student wants to read a history book on the Civil War, we can say that he or she is motivated to learn about American history. The student may learn, however, of a TV program about his favorite singer and decide not to engage in reading the history book on this particular day. Motivation thus refers to a state of being moved to do something, a movement that drives a person’s behavior. Students without motivation feel no impetus or inspiration to learn a new behavior and will not engage in any learning activities.

Educational researchers have long recognized the role of motivation in learning and have studied motivation from various perspectives. Their efforts have produced a rich foundation of motivation theories. Early motivation theories reflected the traditional behaviorism approach, an approach that considered the basis of motivation to be rewards and punishments. Other theories looked at drives and needs. Over the last 30 years, however, researchers have studied motivation primarily from a social cognitive approach. This approach focuses on individuals’ beliefs and contextual factors that influence motivation. This chapter provides a brief overview of the major social-cognitive theories of motivation and discusses how the theories have informed the field of instructional design technology. The chapter concludes by introducing several technology examples designed to enhance student motivation.

Theories of Motivation

Expectancy-value Theory

Expectancy-value theory suggests that the two most immediate predictors of achievement behaviors are expectancies for success and task value beliefs (Wigfield & Eccles, 2000). Expectancies for success refer to students’ beliefs of whether they will do well on an upcoming task (Wigfield, 1992). The more students expect to succeed at a task, the more motivated they are to engage with it. Such beliefs are closely related to but conceptually distinguished from ability beliefs. Ability beliefs are defined as students’ evaluations of their current competence at a given task. Ability beliefs are concerned with present ability whereas expectancies for success are concerned with future potential.

Task value answers the question, “Why should I do this task?” There are four possible answers to the
question: intrinsic value, attainment value, utility value, and cost (Wigfield & Eccles, 1992). *Intrinsic value* is pure enjoyment a student feels from performing a task. When they are intrinsically interested in it, students are willing to become involved in a given task. *Attainment value* refers to the importance of doing well on a task. Tasks are perceived important when they reflect the important aspects of one’s self. *Utility value* is the perception that a task will be useful for meeting future goals, for instance, taking a Chinese class to get a job in China. The last component of task value, *cost*, refers to what an individual has to give up to engage in a task or the effort needed to accomplish the task. If the cost is too high, students will be less likely to engage in a given task. For instance, students may not decide to take an extra course when they need to reduce the hours of their part-time job.

Numerous studies have shown that students’ expectancies for success and subjective task values positively influenced achievement behaviors and outcomes (Dennissen, Zarret, & Eccles, 2007; Durik, Shechter, Noh, Rozek, & Harackiewicz, 2015; Wigfield & Eccles, 2000). For example, Bong (2001) reported that college students’ perceived competence was a significant predictor of their performance. Also, students’ perceived utility predicted future enrollment intentions. These relations have been also found in online learning environments. Joo, Lim, and Kim (2013) reported that perceived competence and task value of students enrolled in an online university significantly predicted learner satisfaction, persistence, and achievement.

**Self-efficacy Theory**

Self-efficacy is defined as people’s beliefs in their ability to perform a course of action required to achieve a specific task (Bandura, 1977). Self-efficacy is one of the strongest factors that drive one’s motivation. When students believe that they are competent to successfully accomplish a task, they are more motivated to engage in and complete the task. Numerous studies have shown that, compared to low-efficacy learners, high-efficacy students choose to engage in more challenging tasks, work harder, persist longer in the face of difficulties, and perform better (Bandura, 1997; Park & Huynh, 2015; Pintrich & De Groot, 1990).

The concept of self-efficacy is similar to expectancies for success in expectancy-value theory. Both refer to the individuals’ judgments of their competence to accomplish an upcoming task. One difference is that self-efficacy conceptually represents a task-specific view of perceived competence, whereas expectancies for success tend to be domain specific (Wigfield & Eccles, 2000). For example, self-efficacy would not merely be a self-judgment of being good at mathematics but rather feeling competent at correctly subtracting fractions. Despite such conceptual differences, self-efficacy and expectancies for success are often used interchangeably. Bandura (1997) also noted that self-efficacy is different from self-confidence. Self-confidence is a belief about a person’s general capability that is not related to a specific subject. In spite of demonstrations of high self-confidence, a person can fail to accomplish a specific task.

According to Bandura (1977), self-efficacy can be gauged through four sources—past performance, modeling, verbal persuasion, and psychological states. The strongest factor influencing self-efficacy is past experience with similar tasks. Successful performance on similar tasks enhances self-efficacy while failure experience lowers it. Self-efficacy can also be increased when one observes similar peers accomplishing similar tasks. Such experiences develop expectations that one can do the same thing as another person can. Although limited in its effectiveness, self-efficacy can be enhanced when a trustworthy person, such as a teacher, persuades or encourages students to try a challenging task. Finally, emotional states, such as anxiety, and bodily symptoms, such as sweating, can influence self-
efficacy by signaling that students are not capable of accomplishing the task. These four sources of self-efficacy information do not directly influence individuals’ beliefs of competence. Individuals make their own interpretations of the events, and these interpretations form the basis for self-efficacy beliefs.

Goals and Goal Orientations

Goal setting is a key motivational process (Locke & Latham, 1984). Goals are the outcome that a person is trying to accomplish. People engage in activities that are believed to lead to goal attainment. As learners pursue multiple goals such as academic goals and social goals, goal choice and the level at which learners commit to attaining the goals influence their motivation to learn (Locke & Latham, 2006; Wentzel, 2000).

Besides goal content (i.e., what a person wants to achieve), the reason that a person tries to achieve a certain goal also has a significant influence on learning and performance. Goal orientations refer to the reasons or purposes for engaging in learning activities and explain individuals’ different ways of approaching and responding to achievement situations (Ames & Archer, 1988; Meece, Anderman, & Anderman, 2006). The two most basic goal orientations are mastery and performance goals (Ames & Archer, 1988). Different researchers refer to these goals with the following terms: learning and performance goals (Elliot & Dweck, 1988), task-involved and ego-involved goals (Nicholls, 1984), and task-focused and ability-focused goals (Maehr & Midgley, 1991). A mastery goal orientation is defined as a focus on mastering new skills, trying to gain increased understanding, and improving competence (Ames & Archer, 1988). Students adopting mastery goals define success in terms of improvement and learning. In contrast, a performance goal orientation focuses on doing better than others and demonstrating competence, for example, by striving to best others, using social comparative standards to make judgments about their abilities while seeking favorable judgment from others (Dweck & Leggett, 1988).

In addition to the basic distinction between mastery and performance goals, performance goal orientations have been further differentiated into performance-approach and performance-avoidance goals (Elliot & Church, 1997; Elliot & Harackiewicz, 1996). Performance-approach goals represent individuals motivated to outperform others and demonstrate their superiority, whereas a performance-avoidance goal orientation refers to those who are motivated to avoid negative judgments and appearing inferior to others. Incorporating the same approach and avoidance distinction, some researchers have further distinguished mastery-approach and mastery-avoidance goals (Elliot & McGregor, 2001). Mastery-approach goals are related to attempts to improve knowledge, skills, and learning. In contrast, mastery-avoidance goals represent a focus on avoiding misunderstanding or the failure to master a task. For instance, athletes who are concerned about falling short of their past performances reflect a mastery-avoidance goal. Despite the confirmatory factor analyses of the 22 goal framework (Elliot & McGregor, 2001; see Table 1), the mastery-avoidance construct remains controversial and is in fact the least accepted construct in the field.

Table 1. The 22 model of goal orientations
<table>
<thead>
<tr>
<th>Approach</th>
<th>Mastery Goal</th>
<th>Performance Goal</th>
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<tbody>
<tr>
<td>Focus</td>
<td>Focus on mastery of learning</td>
<td>Focus on outperforming others</td>
</tr>
<tr>
<td></td>
<td>Learn from errors</td>
<td>Errors indicative of failure</td>
</tr>
<tr>
<td></td>
<td>Judge performance based on standards of self-improvement and progress</td>
<td>Judge performance based on normative standards of being the best performer</td>
</tr>
<tr>
<td>Avoidance</td>
<td>Focus on avoiding not mastering task</td>
<td>Focus on avoiding failure</td>
</tr>
<tr>
<td>Focus</td>
<td>Errors indicative of failure</td>
<td>Errors indicative of failure</td>
</tr>
<tr>
<td></td>
<td>Judge performance based on standards of not being wrong</td>
<td>Judge performance based on normative standards of not being the worst performer</td>
</tr>
</tbody>
</table>

Studies typically report that mastery-approach goals are associated with positive achievement outcomes such as high levels of effort, interest in the task, and use of deep learning strategies (e.g., Greene, Miller, Crowson, Duke, & Akey, 2004; Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002; Wolters, 2004). On the other hand, research on performance-avoidance goals has consistently reported that these goals induced detrimental effects, such as poor persistence, high anxiety, use of superficial strategies, and low achievement (Linnenbrink, 2005; Urdan, 2004; Wolters, 2003, 2004). With regard to performance-approach goals, the data have yielded a mix of outcomes. Some studies have reported modest positive relations between performance-approach goals and achievement (Linnenbrink-Garcia, Tyson, & Patall, 2008). Others have found maladaptive outcomes such as poor strategy use and test anxiety (Keys, Conley, Duncan, & Domina, 2012; Elliot & McGregor, 2001; Middleton & Midgley, 1997). Taken together, these findings suggest that students who adopt performance-approach goals demonstrate high levels of achievement but experience negative emotionality such as test anxiety. Mastery-avoidance goals are the least studied goal orientation thus far. However, some studies have found mastery-avoidance to be a positive predictor of anxiety and a negative predictor of performance (Howell & Watson, 2007; Hulleman, Schrager, Bodmann, & Harackiewicz, 2010).

**Attribution Theory**

Attribution theory considers the source of people’s motivation to be their perception of why they succeeded or failed. The theory assumes that people try to understand causal determinants of their own success and failures (Weiner, 1986). For example, people may attribute their success (or failure) to ability, effort, luck, task difficulty, mood, fatigue, and so on. These perceived causes of outcomes are called attributions (Weiner, 1986). Attributions may or may not be actual causes, and regardless of actual causes of the event, the perceived causes are what drive individuals’ motivation and behaviors.

According to Weiner (2010), attributed causes for success and failure can be classified along three dimensions: locus, stability, and controllability. The *locus* dimension concerns the location of the cause, or whether a cause is within or outside the individual. Effort is internal to the learner, for example, whereas luck is external. The *stability* dimension refers to whether or not the cause is constant. Effort and luck are unstable because they can vary across situations, whereas ability is regarded as relatively stable. Lastly, the *controllability* dimension concerns how much control an individual has over a cause. Learners can control effort but not luck or task difficulty.

The conceptual classification of causes for success and failure based on the three dimensions is
central to the attribution theory of motivation because each dimension is related to a set of motivational, affective, and behavioral consequences. Locus of causality, for example, influences learners’ self-esteem and esteem-related emotions (Weiner, 1986). When a successful outcome is attributed to internal causes (e.g., ability, effort) and not external causes (e.g., luck), the students are more likely to take pride in the success and their self-esteem tends to be heightened. On the other hand, failure attributed to internal causes usually results in feelings of shame or guilt and a lowering of self-esteem.

The stability dimension influences individuals’ expectancy for future success (Weiner, 1986). If success is attributed to a stable cause, one will expect to have the same outcome in the future. Failure attributed to a stable cause (e.g., low ability) will lower one’s expectancy for future success unless he or she believes the ability can and will increase. Attribution for failure to an unstable cause (e.g., “I did not try hard enough”) allows students to expect the outcome could change—as long as they put forth enough effort, they could succeed next time.

The controllability dimension is also related to self-directed emotions (Weiner, 1986). When failure is attributed to a controllable cause (e.g., effort), one is likely to experience guilt and the desire to alter the situation. One will experience a feeling of shame or humiliation when failure is attributed to causes that are internal and uncontrollable (e.g., low ability). When attribution for failure is made to the causes that are external and uncontrollable, one is likely to feel helpless and depressed because he or she believes that nothing can change the situation. Thus, failure attribution to uncontrollable causes tends to decrease motivation and engagement.

Self-determination Theory

Self-determination theory focuses on different orientations of motivation that influence the quality of engagement (Deci & Ryan, 1985). According to the theory, motivation can differ not only in strength but also in orientation. The orientations of motivation refer to the different reasons that give rise to an inclination for an individual to do something. Students can be motivated to learn a new skill because they gain their parents’ approval or because learning the skills is necessary for their dream job. Based on the orientations of motivation, the theory categorizes motivation into several types.

The two basic types of motivation are intrinsic motivation and extrinsic motivation (Ryan & Deci, 2000). Intrinsic motivation refers to a disposition to engage in a task for one’s inner pleasure. An example of intrinsic motivation is a student reading a history textbook for fun. It is human nature for people to engage in activities that they are intrinsically interested in. Intrinsic motivation often leads to high levels of engagement and performance (Deci & Ryan, 2000).

According to the theory, intrinsic motivation emerges spontaneously from satisfying the basic psychological needs of autonomy, competence, and relatedness (Deci & Ryan, 1985). Autonomy is the psychological need to experience one’s behaviors as volitional and is self-endorsed. It is closely related to a feeling of freedom to determine one’s own behaviors. For example, choice over one’s actions can satisfy the need for autonomy; a feeling of autonomy can be undermined, however, by external rewards and threats (Deci & Ryan, 2000). Competence is the psychological need to feel efficacious in one’s pursuits of goals. A feeling of competence is facilitated by optimal challenges and positive feedback (Ryan & Deci, 2000). Relatedness refers to the inherent desire to experience a feeling of being connected to others. The need for relatedness is satisfied by feeling respected and cared for.
Although it is clear that intrinsic motivation promotes learning, most learning activities are not intrinsically interesting to students. Students are often motivated to engage in an activity because it is instrumental to some outcomes separated from the activity itself, which indicates extrinsic motivation. An example of extrinsic motivation is a student who reads a history book for the exam in order to get good grades. In general, it is understood that because an action enacted by extrinsic motivation is controlled by an external factor, it leads to less productive learning behaviors and low-quality engagement compared to learning behaviors that ensue from intrinsic behaviors. However, self-determination theory asserts that extrinsic motivation is a differentiated construct. Extrinsic motivation can represent inner sources of an action and result in high-quality learning behaviors. The theory proposes four types of extrinsic motivation—external, introjected, identified, and integrated. These differ according to the degree to which the motivation is self-determined or autonomous (Ryan & Deci, 2000). The more autonomous a motivation is, the higher quality of engagement students demonstrate.

**Figure 1.** Illustrates the types of motivation in a continuum with regard to the degree of autonomy.

External motivation, located at the far left of the extrinsic motivation continuum in Figure 1, is characterized by behaviors enacted to achieve a reward or avoid a punishment. An example of external motivation is a student who skims a history book before an exam only to get good grades. Introjected motivation refers to behaviors performed to maintain a feeling of self-worth or to avoid a feeling of guilt. This type of motivation is still less autonomous because the behaviors are associated with an external locus of causality (e.g., pressure and obligation). On the other hand, identified motivation represents an autonomous type of extrinsic motivation. This type of motivation is signified when an individual perceives the value of an activity and considers it to be personally relevant. Finally, the most autonomous, self-determined form of extrinsic motivation is integrated motivation, which occurs when the identified value of an activity is fully integrated with a part of the self. Integrated regulation is similar to intrinsic motivation in terms of its degree of self-determination, though the two motivational constructs conceptually differ in their source of motivation. Integrated regulation is based on the internalized importance of the activity, whereas intrinsic motivation is based on inherent interest in the activity.
Self-determination theory is unique in that it differentiates the construct of extrinsic motivation. The theory explains how to motivate students to carry out learning tasks that are not inherently interesting. The theory specifies three psychological needs—autonomy, competence, and relatedness—as the basis for sustaining intrinsic motivation and more self-determined extrinsic motivation. To the extent that students internalize and integrate external regulations and values, they experience greater autonomy and demonstrate high-quality engagement in learning activities.

**Individual and Situational Interest**

The most well-known antecedent of motivation is probably interest. We often see students saying that they do not learn because classes are boring and they are not interested in the topic. While we generally refer to “feeling of enjoyment” as interest in everyday language, researchers have differentiated interest into two types—individual (personal) and situational. **Individual interest** is a relatively enduring and internally driven disposition of the person that involves enjoyment and willingness to reengage with a certain object over time (Hidi & Renninger, 2006; Krapp, 2005; Schiefele, 1991). Schiefele (2001) conceptualized individual interest as including both positive feelings (e.g., enjoyment) and the value-related belief that the object is personally important. **Situational interest**, on the other hand, refers to a temporary psychological state aroused by contextual features in the learning situation (Hidi & Renninger, 2006; Schiefele, 2009). When a student is lured by a catchy title to a news article, his or her interest is triggered by the environmental stimuli. Individual interest can also be supported by a particular situation, but it continues to be present without the situational cues.

Hidi and Renninger (2006) proposed a four-phase model of interest development describing how interest develops from transient situational interest into stable individual interest. In the first phase, situational interest is sparked by environmental features such as novel, incongruous, or surprising information, which is called **triggered situational interest**. Triggered situational interest provokes attention and arousal only in the short term. The second phase is referred to as **maintained situational interest**, which involves focused attention and persistence over a longer period of time. Situational interest is sustained when a person finds the meaningfulness of tasks or personal connections to the tasks. Only maintained situational interest can develop into long-term individual interest. The third phase of interest development is called **emerging individual interest**, marking a transition to individual interest. This phase is characterized by an individual’s tendency to reengage with tasks and to generate his or her own curiosity questions without much external support as well as the individual’s (?) positive feelings. The last phase is referred to as **well-developed individual interest**, a person’s deep-seated interest that involves a tendency to engage, with positive feelings, with a topic over an extended period of time. Although the four-phase model of interest development has been generally accepted, the model is underspecified and has received limited empirical support. For example, the model does not provide a psychological mechanism explaining how the transition to the next phase occurs. More research is needed to achieve a better understanding of interest development.

Much research on interest has focused on examining the relationship between interest and text-based learning. Studies that have investigated the effects of situational interest have reported a moderate correlation between text learning and text-based features that facilitate situational interest; such a relation is independent of other text-based factors such as text length, nature of text, readability, and so on (Schiefele, 1996). Research on the effects of individual interest yielded results similar to those found with situational interest. Schiefele (1996) reported in his meta-analysis an average correlation of .27 between individual interest (i.e., topic interest) and text-based learning. The effects of
individual interest on text learning were not influenced by other factors (e.g., text length, reading ability) but were less prominent than the effects of prior knowledge on learning (Schiefele, 2009).

**Design for Motivation**

These various motivation theories show that motivation is complex and multidimensional. Also, motivational states can be influenced by various factors in an environment. This means that students’ lack of motivation can be caused by various sources. As such, in order to design an intervention to promote student motivation, it is indispensable to identify the sources of low motivation in a given situation. Designing strategies to influence people’s motivation is a problem-solving process. Like the traditional instructional design process, motivational design includes a systematic process of identifying goals (or motivational problems), developing strategies for goal attainment (of addressing motivational problems), and evaluating the outcome of the strategies. Within the instructional design and technology community, the most well-known motivational design model is John M. Keller’s (1987) ARCS model.

**Keller’s Arcs Model**

The shared attributes of the different motivational concepts constitute the acronym ARCS, *attention, relevance, confidence, and satisfaction*, representing Keller’s four categories of learner motivation (Keller, 2010). The ARCS model describes strategies for stimulating and sustaining motivation in each of the four categories as well as a systematic process of motivational design.

The first category, *attention*, is related to stimulating and maintaining learners’ interests. Learner’s attention is required before any learning can take place. This attention should also be sustained in order to keep learners focused and engaged. Keller (2010) describes three categories of attention-getting strategies: perceptual arousal, inquiry arousal, and variability. *Perceptual arousal* refers to capturing interest by arousing learners’ senses and emotions. This construct is conceptually similar to triggered situational interest in Hidi and Renninger’s (2006) development of interest. Likewise, perceptual arousal is usually transitory. One of the most common ways to provoke perceptual arousal is making an unexpected change in the environment. Example tactics include a change in light, a sudden pause, and presenting a video after text-based information in an online learning environment. *Inquiry arousal*, similar to the construct of maintained situational interest, refers to a cognitive level of curiosity. Students are cognitively attracted to learning materials, for instance, when they contain paradoxical facts. *Variability* concerns variation in instructional methods. No matter how effective motivational tactics are, they lose their potency when used unvaryingly.

The second category, *relevance*, refers to making the learning experience personally relevant or meaningful. According to the goal theory, students engage in learning activities that help to attain their goals (Locke & Latham, 1984). Also, as described in expectancy-value theory and self-determination theory, the perceived value of task is a critical antecedent of motivation (Deci & Ryan, 2000; Wigfield & Eccles, 1992). One way to establish the perceived relevance of the learning materials is to use authentic or real-world examples and assignments. Simply relating the instruction to what is familiar to learners (e.g., prior knowledge) can also help learners to perceive its relevance.

The *confidence* category is pertinent to self-efficacy and expectancies for success of the expectancy-value theory. According to self-determination theory, the feeling of competence is one of the basic human needs (Ryan & Deci, 2000). If the learners’ need for competence is not satisfied during learning, they would develop low expectancies for success and demonstrate low self-efficacy, which
results in poor motivation to learn (Bandura, 1997; Wigfield & Eccles, 2000). Strategies to enhance self-efficacy, such as experience of success, can be applied in order to build confidence in instruction. Another way to enhance confidence is to foster learners’ belief that they have control over their performance. Autonomy support such as providing choices and making internal, controllable attributions are a few examples.

The last category, satisfaction, concerns learner’s continued motivation to learn. If they experience satisfying outcomes, students are likely to develop a persistent desire to learn (Skinner, 1963). Satisfying or positive consequences of instruction can result from both extrinsic and intrinsic matters (Ryan & Deci, 2000). High grades, certificates, and other tangible rewards are the most common extrinsic outcomes. However, these extrinsic rewards may not always result in feelings of satisfaction. For example, a student is not pleased at the high score that he or she received on a final exam because the test was extremely easy and most students did well. If the extrinsic rewards fail to fulfill learners’ inner needs, students won’t be satisfied. Such intrinsic consequences that lead to satisfaction include a feeling of mastery and the pleasure of accomplishing a challenging task.

Besides identifying the four major categories of motivational design, the ARCS model describes 10 steps for a systematic process of motivational design (Keller, 2010). The first four steps are the analysis process. This includes acquisition of course and audience information and analysis of audience motivation and existing materials. The main goal of these steps is to identify motivational problems. The next four steps (Step 5 through Step 8) correspond to the design phase in the traditional instructional design process. The first task in the design phase is to determine the motivational behaviors of learners that you wish to observe based on the motivational problems identified in the previous steps. Then, you select or design motivational tactics that help to achieve the objectives and can be feasibly incorporated into instruction. One important task is to integrate these tactics into instructional materials. Designers are to determine where and how to insert the motivational tactics in the instruction. In this process, they may need to modify the design of instruction. Steps 9 and 10 are the development and evaluation phases. After identifying the motivational tactics to use, designers will develop the actual motivational materials. Lastly, they will evaluate the effectiveness of the embedded motivational tactics, for instance, by collecting learner’s reactions to the learning materials. Table 2 summarizes the steps of motivational design.

**Table 2.** Systematic process of motivational design (adapted from Keller, 2010)
There are various technologies that have been developed to enhance learners’ motivation. Educational games are one of them. Games contain many attributes that promote motivation and thus people tend to be intrinsically motivated to play games (Prensky, 2001; Tüzün, Yılmaz-Soylu, Karakus, & İnal, & Kizlkaya, 2009). As such, games have long been adopted within an educational context and been found to have a positive impact on learning. Not every game, though, is motivating; games should be designed carefully by applying motivational strategies grounded in theories of motivation (Butler, 2017; Dickey, 2007; Kirriemuir, 2002; Prensky, 2001). Here, I provide a few recent technologies that have been developed specifically to influence learner motivation.

Van der Meij, van der Meij, and Harmsen (2015) developed a motivational animated pedagogical agent (MAPA) to promote students’ perceived task relevance and self-efficacy in an inquiry learning environment. In the study, students used SimQuest to learn kinematics in a physics class and MAPA was presented in SimQuest with a face and an upper body visible. Acting as a fellow student, MAPA delivered motivational audible messages to students. The motivational messages were designed based on strategies for enhancing relevance and confidence described in the ARCS model. The study reported a significant increase in students’ self-efficacy after using MAPA (van der Meji et al. 2015).

Kim and Bennekin (2013, 2016) developed a Virtual Change Agent (VCA) that provided support for community college students’ motivation and persistence in online mathematics courses. The VCA was an animated, human-like, three-dimensional character that delivered messages containing strategies based on theories of motivation, volition, and emotional regulation. For example, the VCA told students a story of applying mathematics for comparing cell phone plans in order to arouse students’ interest and curiosity. After using the VCA, students showed a significant increase in their self-efficacy and perceived value of learning mathematics (Kim & Bennekin, 2013).

Another similar technology called Virtual Tutee System (VTS) was designed to facilitate college students’ reading motivation and engagement (Park & Kim, 2012). In the VTS, students become a tutor of a virtual tutee (a human-like virtual character) and teach the tutee about the content they

<table>
<thead>
<tr>
<th>Motivational Design Steps</th>
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<tbody>
<tr>
<td>1. Acquisition of course information</td>
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<tr>
<td>2. Acquisition of audience information</td>
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<tr>
<td>3. Analysis of audience motivation</td>
</tr>
<tr>
<td>4. Analysis of motivational tactics in existing materials</td>
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<tr>
<td>5. Description of motivational goals and assessment methods</td>
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<td>6. Identification of potential tactics</td>
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<tr>
<td>7. Design of tactics</td>
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<tr>
<td>8. Integration of motivational tactics with instructional plans</td>
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<tr>
<td>9. Development of materials</td>
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<tr>
<td>10. Evaluation of student reactions</td>
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</table>

**Technology Examples for Promoting Motivation**
have learned from readings. Capitalizing on the motivational aspects of learning-by-teaching effects, the VTS-embedded strategies support the needs for autonomy, competence, and relevance described in self-determination theory. The VTS was used in a few studies and found to promote students’ reading engagement and their deep learning (Park & Kim, 2015, 2016).

Summary

Motivation is a so-called prerequisite to learning. As such, it has long been of interest among many educational researchers. This chapter introduced social cognitive theories of motivation. These theories, which continue to expand, have contributed significantly to the understanding of learner motivation. The theories of motivation have also yielded important implications for the instructional design process. In particular, Keller’s ARCS model specifies how we take learner motivation into account when designing instruction. Expanding upon Keller’s work, researchers have devised many technologies that aim to boost learner motivation. This chapter has presented an introduction to a few of those technologies.

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Please complete this short survey to provide feedback on this chapter: [http://bit.ly/LIDTMotivation](http://bit.ly/LIDTMotivation)
III. Design

Andrew Gibbons and Vic Bunderson (2005) wrote a classic article on three ways of seeking knowledge about the real world: through exploration (often with qualitative research methods), through explanation (often through quantitative methods) and design. As LIDT professionals, we consider design and design knowledge to be core to our work, and key to our understanding of teaching and learning. At our core, we are interventionists: we do not simply observe the world, but seek to influence it in effective ways. This is done through design processes and design research, which is the focus of this section. This section begins with a chapter on classic instructional design approaches, followed by a look at more current perspectives on design thinking and agile design. You will also read about some current issues in the field around design, including design mindsets, design-based research, how to design for effective systemic change, makerspace design, and user experience design. Included also is a chapter on Human Performance Technology, which is a similar field to our own, applying many of the same skill sets and knowledge bases in slightly different ways to the world of corporate learning.

References

IV. Technology and Media

Technology and media has always been central to the field of LIDT. While many in the field have argued that technology can represent any tool, even conceptual ones, this section will discuss the more popular digital technologies. You will read about current research trends in technology integration, and frameworks for understanding what effective technology integration is. There is also a summary of the essential topic of distance education, and an older, but classic, cautionary article about how much of the research into distance education (and any new educational technology) falls into the classic "media comparison" trap that has plagued our field since the classic Clark versus Kozma debates in *Educational Technology Research and Development* and *Review of Educational Research* in the 1980s and 1990s (see this summary [https://edtechbooks.org/-HMN]). A few of the many current trends are also represented in this section, with articles on open educational resources, gamified learning, data mining, learning analytics, and open badges. While reading these articles, I refer you back to Andrew Gibbons' article in the design section, where he defines the various "centrisms" he has observed in our field. While it is common for many students to begin their careers media-centric, as you develop wisdom and expertise, you should come to see technology and media as a means, instead of an end, to your instructional design goals.
Editor’s Note

The following are sections 1 and 2 from the National Educational Technology Plan, published by the Office of Educational Technology in the United States Department of Education. The full document is available at https://tech.ed.gov/netp/

The references follow each section, as they do in the original OET report.

Section 1: Engaging and Empowering Learning Through Technology

Goal: All learners will have engaging and empowering learning experiences in both formal and informal settings that prepare them to be active, creative, knowledgeable, and ethical participants in our globally connected society.

To be successful in our daily lives and in a global workforce, Americans need pathways to acquire expertise and form meaningful connections to peers and mentors. This journey begins with a base of knowledge and abilities that can be augmented and enhanced throughout our lives. Fortunately, advances in learning sciences have provided new insights into how people learn.1 Technology can be a powerful tool to reimagine learning experiences on the basis of those insights.

Historically, a learner’s educational opportunities have been limited by the resources found within the walls of a school. Technology-enabled learning allows learners to tap resources and expertise anywhere in the world, starting with their own communities. For example:

- With high-speed Internet access, a student interested in learning computer science can take the course online in a school that lacks the budget or a faculty member with the appropriate skills to teach the course.
- Learners struggling with planning for college and careers can access high-quality online mentoring and advising programs where resources or geography present challenges to obtaining sufficient face-to-face mentoring.
- With mobile data collection tools and online collaboration platforms, students in a remote...
geographic area studying local phenomena can collaborate with peers doing similar work anywhere in the world.

- A school with connectivity but without robust science facilities can offer its students virtual chemistry, biology, anatomy, and physics labs—offering students learning experiences that approach those of peers with better resources.
- Students engaged in creative writing, music, or media production can publish their work to a broad global audience regardless of where they go to school.
- Technology-enabled learning environments allow less experienced learners to access and participate in specialized communities of practice, graduating to more complex activities and deeper participation as they gain the experience needed to become expert members of the community.2

These opportunities expand growth possibilities for all students while affording historically disadvantaged students greater equity of access to high-quality learning materials, expertise, personalized learning, and tools for planning for future education.3, 4 Such opportunities also can support increased capacity for educators to create blended learning opportunities for their students, rethinking when, where, and how students complete different components of a learning experience.

**Personalized Learning**

Personalized learning refers to instruction in which the pace of learning and the instructional approach are optimized for the needs of each learner. Learning objectives, instructional approaches, and instructional content (and its sequencing) all may vary based on learner needs. In addition, learning activities are meaningful and relevant to learners, driven by their interests, and often self-initiated.

**Blended Learning**

In a blended learning environment, learning occurs online and in person, augmenting and supporting teacher practice. This approach often allows students to have some control over time, place, path, or pace of learning. In many blended learning models, students spend some of their face-to-face time with the teacher in a large group, some face-to-face time with a teacher or tutor in a small group, and some time learning with and from peers. Blended learning often benefits from a reconfiguration of the physical learning space to facilitate learning activities, providing a variety of technology-enabled learning zones optimized for collaboration, informal learning, and individual-focused study.

**Agency in Learning**

Learners with agency can “intentionally make things happen by [their] actions,” and “agency enables people to play a part in their self-development, adaptation, and self-renewal with changing times.”6 To build this capacity, learners should have the opportunity to make meaningful choices about their learning, and they need practice at doing so effectively. Learners who successfully develop this ability lay the foundation for lifelong, self-directed learning.

**What People Need to Learn**

To remain globally competitive and develop engaged citizens, our schools should weave 21st century competencies and expertise throughout the learning experience. These include the development of...
critical thinking, complex problem solving, collaboration, and adding multimedia communication into
the teaching of traditional academic subjects. In addition, learners should have the opportunity to
develop a sense of agency in their learning and the belief that they are capable of succeeding in
school.

Beyond these essential core academic competencies, there is a growing body of research on the
importance of non-cognitive competencies as they relate to academic success. Non-cognitive
competencies include successful navigation through tasks such as forming relationships and solving
everyday problems. They also include development of self-awareness, control of impulsivity, executive
function, working cooperatively, and caring about oneself and others.

Building Non-cognitive Competencies: Providing Opportunities for Practice

Interacting with peers, handling conflicts, resolving disputes, or persisting through a challenging
problem are all experiences that are important to academic success.

Digital games can allow students to try out varied responses and roles and gauge the outcomes
without fear of negative consequences. Accumulating evidence suggests that virtual environments
and games can help increase empathy, self-awareness, emotional regulation, social awareness,
cooperation, and problem solving while decreasing the number of behavior referrals and in-school
suspensions.

Games such as Ripple Effects [http://rippleeffects.com/] and The Social Express
[http://thesocialexpress.com/] use virtual environments, storytelling, and interactive experiences to
assess a student’s social skill competencies and provide opportunities to practice. Other apps help
bridge the gap between the virtual environment and the real world by providing just-in-time supports
for emotional regulation and conflict resolution. A number of apps are available to help students
name and identify how they are feeling, express their emotions, and receive targeted suggestions or
strategies for self-regulation. Examples include Breathe, Think, Do with Sesame; Smiling Mind; Stop,
Breathe & Think; Touch and Learn—Emotions [https://edtechbooks.org/-taL]; and Digital Problem
Solver [https://edtechbooks.org/-EqV].

Fostering Growth Mindset: Technology-based Program to Fuel Student
Achievement

A key part of non-cognitive development is fostering a growth mindset about learning. Growth
mindset is the understanding that abilities can be developed through effort and practice and leads to
increased motivation and achievement. The U.S. Department of Education has funded several growth
mindset–related projects, including a grant to develop and evaluate SchoolKit
[https://edtechbooks.org/-wqL], a suite of resources developed to teach growth mindset quickly and
efficiently in schools.

Jill Balzer, a middle school principal in Killeen, Texas, has seen success from using SchoolKit in her
school. Balzer spoke with an eighth grader who achieved academic distinction for the first time in five
years after using the program. “When I asked him what the difference was,” recalled
Balzer, “he said that now he understood that even though learning was not always going to come
easy to him it didn’t mean he was stupid, it just meant he needed to work harder on that subject.”

District of Columbia Public Schools also have made the SchoolKit available to all middle schools.
Principal Dawn Clemens of Stuart-Hobson Middle School saw increases in reading scores for their seventh-grade students after using the program. “With middle-schoolers, there are always excuses,” Clemens said. “But this shifts the language to be about payoff from effort, rather than ‘the test was too hard’ or ‘the teacher doesn’t like me.’”

Increased connectivity also increases the importance of teaching learners how to become responsible digital citizens. We need to guide the development of competencies to use technology in ways that are meaningful, productive, respectful, and safe. For example, helping students learn to use proper online etiquette, recognize how their personal information may be collected and used online, and leverage access to a global community to improve the world around them can help prepare them for successfully navigating life in a connected world. Mastering these skills requires a basic understanding of the technology tools and the ability to make increasingly sound judgments about the use of them in learning and daily life. For the development of digital citizenship, educators can turn to resources such as Common Sense Education’s digital citizenship curriculum or the student technology standards from the International Society for Technology in Education (ISTE).

**Technology-enabled Learning in Action**

Learning principles transcend specific technologies. However, when carefully designed and thoughtfully applied, technology has the potential to accelerate, amplify, and expand the impact of powerful principles of learning. Because the process of learning is not directly observable, the study of learning often produces models and conclusions that evolve across time. The recommendations in this plan are based on current assumptions and theories of how people learn even while education researchers, learning scientists, and educators continue to work toward a deeper understanding.

The NETP focuses on how technology can help learners unlock the power of some of the most potent learning principles discovered to date. For example, we know that technology can help learners think about an idea in more than one way and in more than one context, reflect on what is learned, and adjust understanding accordingly. Technology also can help capture learners’ attention by tapping into their interests and passions. It can help us align how we learn with what we learn.

Following are five ways technology can improve and enhance learning, both in formal learning and in informal settings. Each is accompanied by examples of transformational learning in action.

1. **Technology can enable personalized learning or experiences that are more engaging and relevant.** Mindful of the learning objectives, educators might design learning experiences that allow students in a class to choose from a menu of learning experiences—writing essays, producing media, building websites, collaborating with experts across the globe in data collection—assessed via a common rubric to demonstrate their learning. Such technology-enabled learning experiences can be more engaging and relevant to learners.

**Scaling Up Personalized Learning: Massachusetts’ Innovation Schools Create Multiple Pathways to Learning**

As part of Massachusetts’ Achievement Gap Act of 2010, funding was set aside to give schools the opportunity to implement innovative strategies to improve learning. Through this legislation, educators can create Innovation Schools that can operate with increased flexibility in key areas such as schedule, curriculum, instruction, and professional development.
As of 2015, there were 54 approved Innovation Schools and Academies in 26 school districts across Massachusetts. Some schools implemented a science, technology, engineering, and mathematics (STEM) or STEM-plus-arts model, and others implemented a combination of one or more of the following educational models: multiple pathways, early college, dual-language immersion, or expanded learning time.

Students in a Safety and Public Service Academy combine rigorous college-style coursework available in a variety of formats (in class, online, blended learning, off-site for internships and job shadows) in areas such as forensics, computer science, criminal law, crisis management, psychology, and video production. Students at the Arts Academy may combine their coursework with off-site learning opportunities at local universities, combining high-tech design skills and knowledge of the creative arts to prepare them for post-secondary education and a career in the arts.

Pentucket Regional School District’s program has scaled their innovation approach to every elementary school in the district. Their approach is centered on student choice and the use of opportunities for learning that extend beyond the classroom walls. Through the redesign of the school day and year, students engage in hands-on experiential learning with in-class lessons; online and blended coursework; and off-campus academic opportunities, internships, and apprenticeships.

2. **Technology can help organize learning around real-world challenges and project-based learning**—using a wide variety of digital learning devices and resources to show competency with complex concepts and content. Rather than writing a research report to be read only by her biology teacher and a small group of classmates, a student might publish her findings online where she receives feedback from researchers and other members of communities of practice around the country. In an attempt to understand the construction of persuasive arguments, another student might draft, produce, and share a public service announcement via online video streaming sites, asking his audience for constructive feedback every step of the way.

**Project-based Learning**

Project-based learning takes place in the context of authentic problems, continues across time, and brings in knowledge from many subjects. Project-based learning, if properly implemented and supported, helps students develop 21st century skills, including creativity, collaboration, and leadership, and engages them in complex, real-world challenges that help them meet expectations for critical thinking.

**Engaged Creation: Exploratorium Creates a Massive Open Online Course (mooc) for Exploring Circuits and Electricity**

In the summer of 2015, the Exploratorium in San Francisco launched its first MOOC, working with Coursera, called Tinkering Fundamentals to inspire STEM-rich tinkering; introduce a set of high-quality activities that could be replicated easily in the classroom; and foster robust discussions of the learning.

The six-week course included a blend of hands-on activities, short videos of five to eight minutes each, an active discussion forum, live Web chats, social media, and other resources. Each week the videos highlighted an introduction to a new tinkering activity, the learning goals, and tips for facilitation; step-by-step instructions for how to build and support others to build the tinkering
contraption; classroom video and interviews with teachers about classroom implementation and student learning; profiles of artists; and comments by learning experts. Reflective prompts generated extensive conversation in the discussion forums.

To facilitate these online activities, the Exploratorium integrated multiple platforms, including Coursera and live video streaming tools. Instructors used these online platforms and spaces to reflect on the week’s activities and forum posts and to provide real-time feedback to participants. In videoconferences, the instructors positioned themselves as questioners rather than as experts, enhancing a strong sense of camaraderie and collaborative exploration.

The Exploratorium used a social media aggregator to showcase photos and videos of participants’ tinkering creations, underscoring the hands-on and material nature of the work of the MOOC. The course attracted more than 7,000 participants from 150 countries, of whom approximately 4,400 were active participants, resulting in more than 66,000 video views and 6,700 forum posts. For more information, visit the Exploratorium and Coursera on the Web.

**Building Projects for Real Audiences: National Parks Service Deepens Engagement Through Technology**

Journey Through Hallowed Ground is a partnership project of the National Park Service that encourages students to create rich connections to history through project-based learning, specifically making videos about their visits to historical sites. The students take the roles of writers, actors, directors, producers, costume designers, music directors, editors, and filmmakers with the support of professional video editors. The videos allow the students to speak about history in their own words as well as share their knowledge with their peers. In addition to learning about history, participating in the projects also teaches students to refine their skills of leadership and teamwork. All videos become official material of the National Park Service and are licensed openly for use by other students and teachers around the world.

3. **Technology can help learning move beyond the classroom and take advantage of learning opportunities available in museums, libraries, and other out-of-school settings.** Coordinated events such as the Global Read Aloud allow classrooms from all over the world to come together through literacy. One book is chosen, and participating classrooms have six weeks in which teachers read the book aloud to students and then connect their classrooms to other participants across the world. Although the book is the same for each student, the interpretation, thoughts, and connections are different. This setting helps support learners through the shared experience of reading and builds a perception of learners as existing within a world of readers. The shared experience of connecting globally to read can lead to deeper understanding of not only the literature but also of their peers with whom students are learning.

**Upskilling Adult Learners: at Peer-to-peer University (p2pu), Everyone is a Teacher and a Learner**

P2PU and the Chicago Public Library (CPL) have partnered to pilot Learning Circles—lightly facilitated study groups for adult learners taking online courses together at their local library. In spring 2015, the partnership ran a pilot program in two CPL branches,
facilitating in-person study groups around a number of free, online courses. The pilot program has expanded to 10 CPL branches in fall 2015, with the ultimate goal of developing an open-source, off-the-shelf solution that can be deployed by other public libraries, allowing all libraries and their communities to harness the potential of blended learning for little to no expertise or cost.

Meeting once a week in two-hour sessions, a non-content expert librarian helps facilitate a peer-learning environment, with the goal that after six weeks the Learning Circles become self-sustainable. P2PU has designed a number of software tools and guidelines to help onboard learners and facilitators, easing administrative burdens and integrating deeper learning principles into existing online learning content. Initial results suggest that students in Learning Circles have far higher retention than do students in most online courses, participants acquire non-cognitive skills often absent from pure online learning environments, and a diverse audience is participating. By working with libraries and building in additional learning support, P2PU also is able to reach first-time online learners, many of whom do not have a post-secondary degree.

P2PU measures success in terms of both the progress of individual learners and the viability of the model. In addition to the number of branches involved, cost per user, and number of learners, attributes such as retention, returning to additional Learning Circles, advancing from the role of learner to that of facilitator, and transitioning from Learning Circles into other fields (formal education, new job) are all other factors that contribute to success. Furthermore, P2PU designs for and measures academic mindsets (community, self-efficacy, growth mindsets, relevance) as a proxy for learner success.

**Helping Parents Navigate a Technological World: a Resource for Making Informed Technology Decisions**

Family Time With Apps: A Guide to Using Apps With Your Kids is an interactive resource for parents seeking to select and use apps in the most effective ways with their children. The guide informs parents of the variety of ways that apps can support children’s healthy development and family learning, communication, and connection with eight strategies. These strategies are playing games together, reading together every day, creating media projects, preparing for new experiences, connecting with distant family, exploring the outside world, making travel more fun, and creating a predictable routine. Tips on how to find the best apps to meet a child’s particular needs and an explanation of how and why to use apps together also are included.

The guide references specific apps, which connect parents with the resources to select appropriate apps for their children. This online community is connected with various app stores and gives parents a menu for app selection on the basis of learning topic, age, connectivity, and device capability. Information also is included that describes exactly what other elements are attached to each app—for example, privacy settings, information collection, advertisements allowed, related apps, and so on.

The Joan Ganz Cooney Center at Sesame Workshop also recommends the Parents’ Choice Award Winners as a tool for selecting child-appropriate apps. These apps, reviewed by the Parents’ Choice Awards Committee within the Parents’ Choice Foundation, have gone through a rigorous, multi-tiered evaluation process. The committee looks for apps that help children grow socially, intellectually, emotionally, and ethically while inspiring creativity and imagination and connecting parents and children.

4. **Technology can help learners pursue passions and personal interests.** A student who
learns Spanish to read the works of Gabriel García Márquez in the original language and a student who collects data and creates visualizations of wind patterns in the San Francisco Bay in anticipation of a sailing trip are learning skills that are of unique interest to them. This ability to learn topics of personal interest teaches students to practice exploration and research that can help instill a mindset of lifelong learning.

**Leveraging the Power of Networks: Cultivating Connections Between Schools and Community Institutions**

Cities of LRNG [https://www.lrng.org/cities] helps close the opportunity gap by connecting young people with a wide range of learning opportunities throughout their cities. The program makes learning activities from hundreds of community organizations easily discoverable to youth and their families on a single online platform.

Each LRNG city has a website where partner organizations can make their offerings visible. Young people receive recommended activities on the basis of their personal passions. For example, in Chicago through the local Chicago Cities of Learning initiative [https://edtechbooks.org/-ru], more than 120 organizations have provided a collective 4,500 engaging learning opportunities for tens of thousands of young people in all areas of the city through the platform.

As students participate in learning activities, they earn digital badges that showcase their skills and achievements. These digital badges signify mastery of a skill—for example, coding, games, design, or fashion—giving out-of-school learning greater currency by documenting and archiving learning wherever it occurs. Each time a young person earns a badge, he or she is recommended additional learning experiences and invited to broaden or deepen skills to propel him or her along academic, civic, or career trajectories. Because digital badges contain in-depth information about each individual’s learning experiences, schools and potential employers can gain a comprehensive view of each person’s interests and competencies.

Hive Learning Networks [https://edtechbooks.org/-sQX], a project of the Mozilla Foundation, organize and support city-based, peer-to-peer professional development networks and champion connected learning, digital skills, and Web literacy in youth-serving organizations in urban centers around the world. Using a laboratory approach and catalytic funding model, Hive re-imagines learning as interest based and empowers learners through collaboration with peer educators, youth, technology experts, and entrepreneurs.

Similar to Cities of LRNG, Hive networks are made up of community-based organizations, including libraries; museums; schools; after-school programs; and individuals, such as educators, designers, and artists. Hive participants work together to create learning opportunities for youth within and beyond the confines of traditional classroom experiences, design innovative practices and tools that leverage digital literacy skills for greater impact, and advance their own professional development.

The Hive model supports three levels of engagement:

1. **Events.** Organizations with shared learning goals unite to provide fun, engaging events, such as maker parties, as a first step toward exploring longer term collaborations.
2. **Learning Communities.** Community organizers with an interest in Hive’s core principles come together in regular meet-ups and events to explore how to apply connected learning tools and practices. Learning communities are in seven cities in the United States, Canada, and
3. **Learning Networks.** With an operational budget and staff, Hive Learning Networks commit to promoting innovative, open-source learning models in partnership with a community's civic and cultural organizations, businesses, entrepreneurs, educators, and learners. Learning Networks are in New York, Chicago, and Pittsburgh.

For more information about Hive Learning Networks, visit Hive [https://edtechbooks.org/-sQX] on the Web.

5. **Technology access when equitable can help close the digital divide and make transformative learning opportunities available to all learners.** An adult learner with limited physical access to continuing education can upskill by taking advantage of online programs to earn new certifications and can accomplish these goals regardless of location.

**Building Equal Experiences: Black Girls Code (bgc) Informs and Inspires**

Introducing girls of color to technology at an early age is one key to unlocking opportunities that mostly have eluded this underserved group. BGC [http://www.blackgirlscode.com/], founded in 2001 by Kimberly Bryant, an electrical engineer, aims to “increase the number of women of color in the digital space by empowering girls of color to become innovators in STEM subjects, leaders in their communities, and builders of their own futures through exposure to computer science and technology.”

Through a combination of workshops and field trips, BGC gives girls of color a chance to learn computer programming and connects them to role models in the technology space. BGC also hosts events and workshops across the country designed to help girls develop a wide range of other skills such as ideation, teamwork, and presenting while exploring social justice issues and engaging in creating solutions to those issues through technology. One example of such an event occurred at DeVry University where 100 girls between the ages of 7 and 17 learned how to build a webpage in a day. Tech industry volunteers led sessions in how to code using HTML, change the look and formatting of webpages using CCS, and design a basic Web structure. The girls developed webpages that integrated text, images, videos, and music, according to their interests and creativity. Toward the end of the day, participants presented their websites to cheering parents, volunteers, and other attendees. Between 10 and 12 similar events by BGC are held in Oakland each year.

BGC is headquartered in San Francisco, and BGC chapters are located in Chicago; Detroit; Memphis; New York; Oakland; Raleigh; and Washington, D.C., with more in development.

**Creating for Accessibility: Hello Navi for the Visually Impaired**

When Maggie Bolado, a teacher at Resaca Middle School in Los Fresnos, Texas, was approached about the unique challenge of helping a visually impaired student navigate the school’s campus, she had not imagined the innovation that was about to happen. Bolado helped guide a group of seventh- and eighth-grade students to develop an app to navigate the school grounds called Hello Navi. Working mostly during extracurricular time, the students learned bracket coding via online tutorials that enabled them to develop the app. As they learned to program, they also were developing problem-solving skills and becoming more detail oriented.

When the app was made available for download, requests came in to tailor the app to the needs of
other particular users, including one parent who wanted to know how to make it work for her two-
year-old child. The students participated in a developers’ forum to go through requests and questions
on the app and problem-solve challenges and issues together. The students also interpreted various
data sets, tracking the number of times the app was downloaded and monitoring the number of total
potential users, making possible an improved next iteration of the app.

The Future of Learning Technologies

Although these examples help provide understanding of the current state of educational technologies,
it is also important to note the research being done on early stage educational technology and how
this research might be applied more widely in the future to learning.

As part of their work in cyberlearning, the National Science Foundation (NSF) is researching
opportunities offered by integrating emerging technologies with advances in the learning sciences.
Following are examples of the projects being funded by the NSF as part of this effort:

**Increased use of games and simulations** to give students the experience of working together on a
project without leaving their classrooms. Students are involved actively in a situation that feels
urgent and must decide what to measure and how to analyze data in order to solve a challenging
problem. Examples include RoomQuake, in which an entire classroom becomes a scaled-down
simulation of an earthquake. As speakers play the sounds of an earthquake, the students can take
readings on simulated seismographs at different locations in the room, inspect an emerging fault line,
and stretch twine to identify the epicenter. Another example is Robot-Assisted Language Learning in
Education (RALL-E), in which students learning Mandarin converse with a robot that exhibits a range
of facial expressions and gestures, coupled with language dialogue software. Such robots will allow
students to engage in a social role-playing experience with a new language without the usual
anxieties of speaking a new language. The RALL-E also encourages cultural awareness while
encouraging good use of language skills and building student confidence through practice.

**New ways to connect physical and virtual interaction with learning technologies** that bridge
the tangible and the abstract. For example, the In Touch With Molecules project has students
manipulate a physical ball-and-stick model of a molecule such as hemoglobin, while a camera senses
the model and visualizes it with related scientific phenomena, such as the energy field around the
molecule. Students’ tangible engagement with a physical model is connected to more abstract,
conceptual models, supporting students’ growth of understanding. Toward a similar goal, elementary
school students sketch pictures of mathematical situations by using a pen on a tablet surface with
representational tools and freehand sketching, much as they would on paper. Unlike with paper, they
easily copy, move, group, and transform their pictures and representations in ways that help them to
express what they are learning about mathematics. These can be shared with the teacher, and, via
artificial intelligence, the computer can help the teacher see patterns in the sketches and support the
teacher’s using student expression as a powerful instructional resource.

**Interactive three-dimensional imaging software**, such as zSpace, is creating potentially
transformational learning experiences. With three-dimensional glasses and a stylus, students are able
to work with a wide range of images from the layers of the earth to the human heart. The zSpace
program’s noble failure feature allows students constructing a motor or building a battery to make
mistakes and retry, learning throughout the process. Although the content and curriculum are
supplied, teachers can customize and tailor lesson plans to fit the needs of their classes. This type of
versatile technology allows students to work with objects schools typically would not be able to
afford, providing a richer, more engaging learning experience.

**Augmented reality (AR) as a new way of investigating our context and history** In the Cyberlearning: Transforming Education EXP project, researchers are addressing how and for what purposes AR technologies can be used to support the learning of critical inquiry strategies and processes. The question is being explored in the context of history education and the Summarizing, Contextualizing, Inferring, Monitoring, and Corroborating (SCIM-C) framework developed for historical inquiry education. A combined hardware and software platform is being built to support SCIM-C pedagogy. Students use a mobile device with AR to augment their “field” experience at a local historical site. In addition to experiencing the site as it exists, AR technology allows students to view and experience the site from several social perspectives and to view its structure and uses across several time periods. Research focuses on the potential of AR technology in inquiry-based fieldwork for disciplines in which analysis of change across time is important to promote understanding of how very small changes across long periods of time may add up to very large changes.

**E-rate: Source of Funding for Connectivity**

The Schools and Libraries Universal Service Support Program, commonly known as E-rate, is a source of federal funding for Internet connectivity for U.S. schools and libraries. Created by Congress in 1996, E-rate provides schools and libraries with discounted Internet service based on need. The program was modernized in 2014 to allow schools to prioritize funding high-speed wireless connectivity in schools. For more information about E-rate, visit the website of the Federal Communications Commission (FCC) [https://edtechbooks.org/-nk].

Across these examples, we see that learning is not contained within screens or classrooms and that technology can enrich how students engage in the world around them.

To see additional examples of cyberlearning, visit The Center for Innovative Research in CyberLearning [https://edtechbooks.org/-tz].

**Bringing Equity to Learning Through Technology**

**Closing the Digital Use Divide**

Traditionally, the digital divide in education referred to schools and communities in which access to devices and Internet connectivity were either unavailable or unaffordable. Although there is still much work to be done, great progress has been made providing connectivity and device access. The modernization of the federal E-rate program has made billions of dollars available to provide high-speed wireless access in schools across the country.

However, we have to be cognizant of a new digital divide—the disparity between students who use technology to create, design, build, explore, and collaborate and those who simply use technology to consume media passively.

On its own, access to connectivity and devices does not guarantee access to engaging educational experiences or a quality education. Without thoughtful intervention and attention to the way technology is used for learning, the digital use divide could grow even as access to technology in
Providing Technology Accessibility for All Learners

Learning experiences enabled by technology should be accessible for all learners, including those with special needs. Supports to make learning accessible should be built into learning software and hardware by default. The approach of including accessibility features from the beginning of the development process, also known as universal design, is a concept well established in the field of architecture. Modern public buildings include features such as ramps, automatic doors, or braille on signs to make them accessible by everyone. In the same way, features such as text-to-speech, speech-to-text, enlarged font sizes, color contrast, dictionaries, and glossaries should be built into educational hardware and software to make learning accessible to everyone.

Three main principles drive application of universal design for learning (UDL):

1. **Provide multiple means of representation so that students can approach information in more than one way.** Examples include digital books, specialized software and websites, and screen readers that include features such as text-to-speech, changeable color contrast, alterable text size, or selection of different reading levels.

2. **Provide multiple means of expression so that all students can demonstrate and express what they know.** Examples include providing options in how they express their learning, where appropriate, which can include options such as writing, online concept mapping, or speech-to-text programs.

3. **Provide multiple means of engagement to stimulate interest in and motivation for learning.** Examples include providing options among several different learning activities or content for a particular competency or skill and providing opportunities for increased collaboration or scaffolding.

Digital learning tools can offer more flexibility and learning supports than can traditional formats. Using mobile devices, laptops, and networked systems, educators are better able to personalize and customize learning experiences to align with the needs of each student. They also can expand communication with mentors, peers, and colleagues through social media tools. Digital tools also can make it possible to modify content, such as raising or lowering the complexity level of a text or changing the presentation rate.

At a higher level of engagement, digital tools such as games, websites, and digital books can be designed to meet the needs of a range of learners, from novices to experts. Learners with little understanding might approach the experience first as a novice and then move up to an intermediate level as they gain more knowledge and skills. One example is McGill University’s The Brain from Top to Bottom [http://thebrain.mcgill.ca/]. The site includes options to engage with the content as a beginner, intermediate, or advanced learner and adjusts the learning activities accordingly.

To help in the selection of appropriate universally designed products and tools, the National Center on Universal Design [http://www.udlcenter.org/] for Learning has developed a resource linking each guideline to information about digital supports that can help a teacher put UDL into practice.
Reaching All Learners: Tools for Udl

Developed with support from the U.S. Department of Education, the tools listed here were designed to help educators implement UDL principles into classroom practice and make learning activities more accessible:

- Nimble Assessment Systems developed Nimble Tools [https://edtechbooks.org/-HGp], to deliver standard versions of assessment instruments that are tailored with embedded accommodation tools to meet the specific needs of students with disabilities. Some examples of the accommodation tools include a keyboard with custom keyboard overlays, the capacity of the system to read text aloud for students, an on-screen avatar presenting questions in American Sign Language (ASL) or Signed English, and the magnification of text and images for students with visual impairments.

- The Information Research Corporation developed eTouchSciences [https://edtechbooks.org/-ote], an integrated software and hardware assistive technology platform to support STEM learning among middle school students with (or without) visual impairments. The product includes a haptic sensing controller device to provide real-time tactile, visual, and audio feedback. See video [https://edtechbooks.org/-crm].

- Filament Games developed the Game-enhanced Interactive Life Science [https://edtechbooks.org/-ipa] suite of learning games to introduce middle school students to key scientific concepts and practices in the life sciences. These games, aligned to UDL, provide students with multiple means of representation, expression, and engagement and provide assistive features such as in-game glossaries and optional voice-over for all in-game text. See video [https://edtechbooks.org/-oRw].

- Institute for Disabilities Research and Training developed the myASL Quizmaker [https://edtechbooks.org/-LA] to provide Web-based assessments for deaf or hard of hearing students who use ASL. This product provides automatic ASL graphic and video translations for students; enables teachers to create customized tests, exams, and quizzes that are scored automatically; and provides teacher reports with grades and corrected quizzes. See video [https://edtechbooks.org/-LwX].

Design in Practice: Indiana School District Adopts Udl for All Instruction for All Students

Bartholomew Consolidated School Corporation is a public school district in Columbus, Indiana, serving approximately 12,000 students. The student population consists of 13 percent in special education, 50 percent receive free or reduced-price lunch, and more than 54 languages are spoken. UDL has been helpful as a decision-making tool in the deployment of technologies such as computers and other networked devices. The UDL guidelines help educators determine what strategies, accessible technologies, and teaching methods will enable all students to achieve lesson goals.

In one instance, a social studies teacher held an online discussion during a presidential debate. Realizing that some students were not taking part in class discussions, the teacher used technology to provide multiple means of representation, expression, and engagement. Some students who were reluctant to speak up in a face-to-face setting felt safe to do so online, becoming engaged participants in the class discussion.

Since they adopted a universal design approach, graduation rates increased by 8 percent for general education students and 22 percent for special education students. Also, the number of students
taking and passing Advanced Placement tests has increased.

Physical Spaces and Technology-enabled Learning

Blended learning and other models of learning enabled by technology require educators to rethink how they organize physical spaces to facilitate best collaborative learning using digital tools. Considerations include the following:

- Are the design and layout of the physical space dynamic and flexible enough to facilitate the technology-enabled learning models and practices selected? Can a space in which an educator delivers whole-class instruction also be shifted to facilitate individual online practice and research?
- Do the physical spaces align in their ability to facilitate individual and collaborative work? When practices such as project-based learning require students to be working together with multiple devices for research and presentation building, is the space as useful as when individual learners need time and space to connect with information and experts online for personalized learning?
- Can the physical spaces and tools be shaped to provide multiple contexts and learning experiences such as Wi-Fi access for outdoor classrooms? Are library spaces able to become laboratories? Can a space used as a history lecture hall for one class become a maker space for engineering the next period?

For more information and tools for aligning physical spaces, visit the Centre for Effective Learning Environments [https://edtechbooks.org/-VS] and the Clayton Christensen Institute’s Blended Learning Universe [https://edtechbooks.org/-NTP].

Innovation From the Ground Up: Denver School for Science and Technology (dsst) Uses Space to Promote Student Achievement

The DSST is an innovative high school located in Stapleton, Colorado, a redeveloped neighborhood near downtown Denver. Behind the bright colors and unique geometry of spaces at DSST lies a relationship to the way academic subjects are taught and community is formed at the high school. The school is designed to be flexible and aims to support student achievement through the design of its physical spaces.

The school features a series of gathering spaces that can be used for various academic and social purposes throughout the day. The largest of the gathering areas, near the school’s entrance, is where the school’s daily morning meeting for both students and faculty is held. Student and faculty announcements, skits, and other community functions are all encouraged in this communal setting.

Each of the three academic pods also includes informal spaces for gathering, studying, and socializing. These academic clusters are linked by a galleria, or large open hallway, that is lined with skylights and also serves as a gathering place for students and faculty members.

DSST has demonstrated results in the academic achievement of its students and in its attendance record. In 2005, the school’s founding Grade 9 class was the highest scoring Grade 9 class in Denver in mathematics and the second highest scoring class in reading and writing. DSST was also the only Denver high school to earn a significant growth rating on the Colorado Student Assessment Program.
test scores from one year to the next. Student attendance at the school is typically about 96 percent.

**Recommendations**

**States, districts, and post-secondary institutions should develop and implement learning resources that embody the flexibility and power of technology to create equitable and accessible learning ecosystems that make learning possible everywhere and all the time for all students.** Whether creating learning resources internally, drawing on collaborative networks, or using traditional procurement procedures, institutions should insist on the use of resources and the design of learning experiences that use UD practices to ensure accessibility and increased equity of learning opportunities.

**States, districts, and post-secondary institutions should develop and implement learning resources that use technology to embody design principles from the learning sciences.** Educational systems have access to cutting-edge learning sciences research. To make better use of the existing body of research literature, however, educators and researchers will need to work together to determine the most useful dissemination methods for easy incorporation and synthesis of research findings into teachers’ instructional practices.

**States, districts, and post-secondary institutions should take inventory of and align all learning technology resources to intended educational outcomes.** Using this inventory, they should document all possible learner pathways to expertise, such as combinations of formal and informal learning, blended learning, and distance learning. Without thoughtful accounting of the available tools and resources within formal and informal learning spaces within a community, matching learners to high-quality pathways to expertise is left to chance. Such an undertaking will require increased capacity within organizations that have never considered such a mapping of educational pathways. To aid in these efforts, networks such as LRNG, the Hive Learning Networks, and education innovation clusters can serve as models for cross-stakeholder collaboration in the interest of best using existing resources to present learners with pathways to learning and expertise.

**Education stakeholders should develop a born accessible standard of learning resource design to help educators select and evaluate learning resources for accessibility and equity of learning experience.** Born accessible is a play on the term born digital and is used to convey the idea that materials that are born digital also can and should be born accessible. If producers adopt current industry standards for producing educational materials, materials will be accessible out of the box. Using the principles and research-base of UD and UDL, this standard would serve as a commonly accepted framework and language around design for accessibility and offer guidance to vendors and third-party technology developers in interactions with states, districts, and institutions of higher education.

**References**


Ibid.


Section 2: Teaching With Technology

Goal: Educators will be supported by technology that connects them to people, data, content, resources, expertise, and learning experiences that can empower and inspire them to provide more effective teaching for all learners.

Technology offers the opportunity for teachers to become more collaborative and extend learning beyond the classroom. Educators can create learning communities composed of students; fellow educators in schools, museums, libraries, and after-school programs; experts in various disciplines around the world; members of community organizations; and families. This enhanced collaboration, enabled by technology offers access to instructional materials as well as the resources and tools to create, manage, and assess their quality and usefulness.

To enact this vision, schools need to support teachers in accessing needed technology and in learning how to use it effectively. Although research indicates that teachers have the biggest impact on student learning out of all other school-level factors, we cannot expect individual educators to assume full responsibility for bringing technology-based learning experiences into schools. They need continuous, just-in-time support that includes professional development, mentors, and informal collaborations. In fact, more than two thirds of teachers say they would like more technology in their classrooms, and roughly half say that lack of training is one of the biggest barriers to incorporating technology into their teaching.

Institutions responsible for pre-service and in-service professional development for educators should focus explicitly on ensuring all educators are capable of selecting, evaluating, and using appropriate technologies and resources to create experiences that advance student engagement and learning. They also should pay special care to make certain that educators understand the privacy and security concerns associated with technology. This goal cannot be achieved without incorporating technology-based learning into the programs themselves.

For many teacher preparation institutions, state offices of education, and school districts, the transition to technology-enabled preparation and professional development will entail rethinking instructional approaches and techniques, tools, and the skills and expertise of educators who teach in these programs. This rethinking should be based on a deep understanding of the roles and practices of educators in environments in which learning is supported by technology.

Roles and Practices of Educators in Technology-supported Learning

Technology can empower educators to become co-learners with their students by building new experiences for deeper exploration of content. This enhanced learning experience embodies John Dewey’s notion of creating “more mature learners.” Side-by-side, students and teachers can become engineers of collaboration, designers of learning experiences, leaders, guides, and catalysts of change. Following are some descriptions of these educator roles and examples of how technology can play an integral part.
Authentic Learning

Authentic learning experiences are those that place learners in the context of real-world experiences and challenges.

Educators can collaborate far beyond the walls of their schools. Through technology, educators are no longer restricted to collaborating only with other educators in their schools. They now can connect with other educators and experts across their communities or around the world to expand their perspectives and create opportunities for student learning. They can connect with community organizations specializing in real-world concerns to design learning experiences that allow students to explore local needs and priorities. All of these elements make classroom learning more relevant and authentic.

In addition, by using tools such as videoconferencing, online chats, and social media sites, educators, from large urban to small rural districts, can connect and collaborate with experts and peers from around the world to form online professional learning communities.

Building Communities for Educators: International Education and Resource Network (iEARN) Fosters Global Collaborative Teaching and Learning

Through technology, educators can create global communities of practice that enable their students to collaborate with students around the world. Technology enables collaborative teaching regardless of geographic location, as demonstrated by the global nature of the Solar Cooking Project organized by earth and environmental science teacher Kathy Bosiak.

Bosiak teaches at Lincolnton High School in Lincolnton, North Carolina, and is a contributing educator for iEARN [http://www.iearn.org/], a nonprofit organization made up of more than 30,000 schools and youth organizations in more than 140 countries. iEARN offers technology-enabled resources that enable teachers and students around the world to collaborate on educational projects, all designed and facilitated by teachers and students to fit their curriculum, classroom needs, and schedules.

In addition to its student programs, iEARN offers professional face-to-face workshops for teachers that combine technology and continued engagement through virtual networks and online professional learning opportunities. The workshops focus on the skills needed to engage in Internet-based collaborative learning projects, including peer review, team building, joining regional and international learning communities, and developing project-based curricula that integrate national education standards.

Educators can design highly engaging and relevant learning experiences through technology. Educators have nearly limitless opportunities to select and apply technology in ways that connect with the interests of their students and achieve their learning goals. For example, a classroom teacher beginning a new unit on fractions might choose to have his students play a learning game such as Factor Samurai, Wuzzit Trouble, or Sushi Monster as a way to introduce the concept. Later, the teacher might direct students to practice the concept by using manipulatives so they can start to develop some grounded ideas about equivalence.

To create an engaging and relevant lesson that requires students to use content knowledge and critical thinking skills, an educator might ask students to solve a community problem by using
Technology. Students may create an online community forum, public presentation, or call to action related to their proposed solution. They can use social networking platforms to gather information and suggestions of resources from their contacts. Students can draft and present their work by using animated presentation software or through multimedia formats such as videos and blogs. This work can be shared in virtual discussions with content experts and stored in online learning portfolios.

A school without access to science labs or equipment can use virtual simulations to offer learners those experiences that are currently unavailable because of limited resources. In addition, these simulations are safe places for students to learn and practice effective processes before they conduct research in the field. Just as technology can enhance science learning for schools lacking equipment, it can enable deep learning once students are in the field as well. Students can collect data for their own use via mobile devices and probes and sync their findings with those of collaborators and researchers anywhere in the world to create large, authentic data sets for study.

Educators can lead the evaluation and implementations of new technologies for learning. Lower price points for learning technologies make it easier for educators to pilot new technologies and approaches before attempting a school-wide adoption. These educators also can lead and model practices around evaluating new tools for privacy and security risks, as well as compliance with federal privacy regulations. (For more on these regulations, see Section 5: Infrastructure. Teacher-leaders with a broad understanding of their own educational technology needs, as well as those of students and colleagues, can design short pilot studies that impact a small number of students to ensure the chosen technology and the implementation approach have the desired outcomes. This allows schools to gain experience with and confidence in these technologies before committing entire schools or districts to purchases and use.

Teacher-leaders and those with experience supporting learning with technology can work with administrators to determine how to share their learning with other teachers. They also can provide support to their peers by answering questions and modeling practical uses of technology to support learning.

Evaluating Technology Through Rapid-cycle Technology Evaluations

As schools continue to invest heavily in education technology, there is a pressing need to generate evidence about the effectiveness of these investments and also to develop evaluation tools that developers and practitioners can use to conduct their own evaluations that take less time and incur lower costs than do traditional evaluations. The U.S. Department of Education is funding a rapid cycle technology evaluation project that will design research approaches for evaluating apps, platforms, and tools; conduct pilots and disseminate the resulting short reports; and create an interactive guide and implementation support tools for conducting rapid cycle technology evaluations to be used by schools, districts, developers, and researchers.

Rapid cycle technology evaluations will help provide results in a timely manner so that evidence of effectiveness is available to school and district leaders when they need to make purchasing decisions.

Teach to Lead: Developing Teachers as Leaders

Teach to Lead [http://teachtolead.org/], a joint program of the National Board for Professional Teaching Standards, ASCD, and the U.S. Department of Education, aims to advance student outcomes by expanding opportunities for teacher leadership, particularly opportunities that allow
teachers to stay in the classroom. With the help of supporting organizations, Teach to Lead provides a platform for teacher-leaders and allies across the country (and around the world) to create and expand on their ideas.

Teach to Lead participants are invested personally in the development of their teacher leadership action plans because the ideas are their own. Participants identify a current problem within their school, district, or community and develop a theory of action to solve that problem. Since its inception in March 2014, Teach to Lead has engaged more than 3,000 educators, in person and virtually through its online platform, with more than 850 teacher leadership ideas spanning 38 states. Teach to Lead regional Teacher Leadership Summits brought together teams of teacher-leaders and supporting organizations to strengthen their teacher leadership ideas, share resources, and develop the skills necessary to make their projects a reality.

Marcia Hudson and Serena Stock, teacher-leaders at Avondale Elementary School in Michigan, identified a need for teacher-led professional development at their school and created a module for teachers to collect and analyze student outcome data to drive new professional development opportunities. The teachers now are holding engagement meetings with teacher-leaders to develop and fund professional development and data collection further.

Chris Todd teaches at Windsor High School in Connecticut and is a Teacher-Leader-in-Residence for the Connecticut State Department of Education. Chris’s team is developing the Connecticut Educator Network, a database of teacher-leaders who are readily available to advise on policy development. The group intends to provide training and policy briefings to continue to hone the teachers’ leadership skills.

**Educators can be guides, facilitators, and motivators of learners.** The information available to educators through high-speed Internet means teachers do not have to be content experts across all possible subjects. By understanding how to help students access online information, engage in simulations of real-world events, and use technology to document their world, educators can help their students examine problems and think deeply about their learning. Using digital tools, they can help students create spaces to experiment, iterate, and take intellectual risks with all of the information they need at their fingertips. Teachers also can take advantage of these spaces for themselves as they navigate new understandings of teaching that move beyond a focus on what they teach to a much broader menu of how students can learn and show what they know.

Educators can help students make connections across subject areas and decide on the best tools for collecting and showcasing learning through activities such as contributing to online forums, producing webinars, or publishing their findings to relevant websites. These teachers can advise students on how to build an online learning portfolio to demonstrate their learning progression. Within these portfolios, students can catalog resources that they can review and share as they move into deeper and more complex thinking about a particular issue. With such portfolios, learners will be able to transition through their education careers with robust examples of their learning histories as well as evidence of what they know and are able to do. These become compelling records of achievement as they apply for entrance into career and technical education institutions, community colleges, and four-year colleges and universities or for employment.
Deepening Student Understanding: Using Interactive Video to Improve Learning

Reflective teachers can search for new ways for their students to engage with technology effectively, especially when students are not optimizing their learning experiences. Every year at Crocker Middle School, Ryan Carroll would ask his sixth-grade world history students to watch a variety of online videos for homework. He found that no matter how entertaining or interesting the videos were, his students were not retaining much of the information being presented, and often they were confused about key concepts. After learning about Zaption[https://edtechbooks.org/-Vk], a teaching tool funded by the U.S. Department of Education, Carroll realized his students could get more out of the videos he assigned. Using Zaption’s interactive video platform, he added images, text, drawings, and questions to clarify tricky concepts and check for understanding as students watched the video.

Zaption’s analytics allow educators to review individual student responses and class-wide engagement data quickly, giving greater insight on how students are mastering key concepts as they watch and enabling teachers to address misconceptions quickly.

Educators can be co-learners with students and peers. The availability of technology-based learning tools gives educators a chance be co-learners alongside their students and peers. Although educators should not be expected to know everything there is to know in their disciplines, they should be expected to model how to leverage available tools to engage content with curiosity and a mindset bent on problem solving and how to be co-creators of knowledge. In short, teachers should be the students they hope to inspire in their classrooms.

Co-learning in the Classroom: Teacher User Groups Provide Peer Learning for Adult Education Educators

Recognizing the power of virtual peer learning, the U.S. Department of Education’s Office of Career, Technical, and Adult Education has funded projects that have established teacher user groups to explore the introduction of openly licensed educational resources into adult education. This model of professional development recognizes that virtual peer learning can support teachers to change their practice and provide leadership and growth opportunities. The small groups of far-flung teachers work with a group moderator to identify, use, and review openly licensed resources in mathematics, science, and English language arts.

Reviews referenced the embedded evaluation criteria in OER Commons [https://www.oercommons.org/], a repository of open educational resources (OER) that can be used or reused freely at no cost and that align to the College- and Career-Readiness mathematics and language arts and Next Generation Science Standards. They also included practice tips for teaching the content to adult learners. The reviews are posted on OER Commons and tagged as Adult Basic Education or Adult English for Speakers of Other Languages to facilitate the discovery by other teachers of these high-quality, standards-aligned teaching and learning materials.

Learning Out Loud Online: Jennie Magiera, District Chief Technology Officer and Classroom Teacher

Planning a lesson on how elevation and other environmental influences affect the boiling point of water, Jennie Magiera realized that many of the students in her fourth-grade class in Cook County,
Illinois, had never seen a mountain. So Magiera reached out to her network of fellow educators through social media to find a teacher in a mountainous area of the country interested in working with her on the lesson.

Soon, Magiera and a teacher in Denver were collaborating on a lesson plan. Using tablets and online videconferencing, the students in Denver showed Magiera’s students the mountains that they could see outside of their classrooms every day. After a discussion of elevation, the two teachers engaged their students in a competition to see which class could boil water faster. By interacting with students in the other class, Magiera’s students became engaged more deeply in the project, which led them to develop a richer understanding of ecosystems and environments than they might have otherwise.

**Educators can become catalysts to serve the underserved.** Technology provides a new opportunity for traditionally underserved populations to have equitable access to high-quality educational experiences. When connectivity and access are uneven, the digital divide in education is widened, undermining the positive aspects of learning with technology.

All students deserve equal access to (1) the Internet, high-quality content, and devices when they need them and (2) educators skilled at teaching in a technology-enabled learning environment. When this occurs, it increases the likelihood that learners have personalized learning experiences, choice in tools and activities, and access to adaptive assessments that identify their individual abilities, needs, and interests.

**Connected Educators: Exemplars**

Technology can transform learning when used by teachers who know how to create engaging and effective learning experiences for their students. In 2014, a group of educators collaborated on a report entitled, [Teaching in the Connected Learning Classroom](https://edtechbooks.org/-Xt). Not a how-to guide or a set of discrete tools, it draws together narratives from a group of educators within the National Writing Project who are working to implement and refine practices around technology-enabled learning. The goal was to rethink, iterate on, and assess how education can be made more relevant to today’s youth.

**Producing Student Films With Online Audiences: Katie McKay: Lights, Camera, Social Action!**

In Katie McKay’s diverse, fourth-grade transitional bilingual class, encouraging her students to work together on a project helped them build literacy skills while simultaneously giving them the opportunity to pursue culturally relevant questions related to equity.

McKay recognized that her students were searching for the language to talk about complicated issues of race, gender, power, and equity. To address the competing priorities of preparing her students for the state test and providing them with authentic opportunities to develop as readers and writers, McKay started a project-based unit on the history of discrimination in the United States.

Students worked in heterogeneously mixed groups to develop comic strips that eventually were turned into two videos, one showing micro-aggressions students commonly see today and one about the history of discrimination in the United States. The movie on micro-aggressions portrayed current scenarios that included characters who acted as agents of change, bravely and respectfully defending
the rights of others.

According to McKay, students who previously were disengaged found themselves drawn into the classroom community in meaningful and engaging ways. While reflecting on this unit, McKay wrote:

*We were not only working to promote tolerance and appreciation for diversity in our community. We also were resisting an oppressive educational context. In the midst of the pressure to perform on tests that were isolating and divisive, we united in collaborative work that required critical thinking and troubleshooting. In a climate that valued silence, antiquated skills, and high-stakes testing, we engaged in peer-connected learning that highlighted 21st century skills and made an impact on our community.*

**Just-in-time Learning: Janelle Bence: How Do I Teach What I Do Not Know?**

Texas teacher Janelle Bence was looking for new ways to engage and challenge her students, the majority of whom are English language learners from low-income families. After observing her students’ motivation to persist through game challenges, she wondered if games held a key to getting them similarly engaged in classwork. After attending a session on gaming at a National Writing Project Annual Meeting, Bence was inspired to incorporate gaming into her classroom. She did not know anything about gaming and so, as is the case for many teachers seeking to bridge the gap between students’ social interests and academic subjects, she had to figure out how to teach what she did not know.

Bence started by reading a book about using video games to teach literacy. As she read, she shared her ideas and questions on her blog and talked to other educators, game designers, and systems thinkers. Through these collaborations, she decided that by creating games, her students would be required to become informed experts in the content of the game as well as to become powerful storytellers.

As she explored games as a way to make academic tasks more engaging and accessible for her students, Bence found it was important to take advantage of professional learning and peer networks, take risks by moving from a passive consumer of knowledge to actually trying the tasks that she planned to use with students, and put herself in her students’ shoes.

Bence shared that “finding a way to connect to students and their passions—by investigating what makes them tick and bridging [those passions] to academic tasks—educators are modeling risks that encourage the same behavior in their learners.”

**Building Student Agency: Jason Sellers: Text-based Video Games**

Aware of the popularity of video games among his students, and as a longtime fan of video games himself, teacher Jason Sellers decided to use gaming to develop his 10th-grade students’ ability to use descriptive imagery in their writing. Specifically, Sellers introduced his students to text-based video games. Unlike graphics-based games in which users can view graphics and maneuver through the game by using controller buttons, text-based games require players to read descriptions and maneuver by typing commands such as go north or unlock the door with a key. Sellers decided his students could practice using descriptive imagery by developing their own text-based games.
Using tutorials and other resources found on Playfic, an interactive fiction online community, Sellers created lessons that allowed students to play and eventually create interactive fiction games. Prior to the creation of the games, Sellers’s class analyzed several essays that skillfully used descriptive imagery, such as David Foster Wallace’s *A Ticket to the Fair*, and composed short pieces of descriptive writing about their favorite locations in San Francisco.

Students then transferred their newly honed descriptive storytelling skills to the development of an entertaining text-based game. Because Sellers’s students wanted to develop games their peers would want to play, they focused on ways to make their games more appealing, including, as Sellers described, “using familiar settings (local or popular culture), familiar characters (fellow students or popular culture), and tricky puzzles.”

According to Sellers, this project allowed students to work through problems collaboratively with peers from their classroom and the Playfic online community and motivated them to move beyond basic requirements to create projects worthy of entering competitions.

**Rethinking Teacher Preparation**

Teachers need to leave their teacher preparation programs with a solid understanding of how to use technology to support learning. Effective use of technology is not an optional add-on or a skill that we simply can expect teachers to pick up once they get into the classroom. Teachers need to know how to use technology to realize each state’s learning standards from day one. Most states have adopted and are implementing college- and career-ready standards to ensure that their students graduate high school with the knowledge and skills necessary to succeed.

For states that have voluntarily adopted the [Common Core State Standards](http://www.corestandards.org/), there are more than 100 direct mentions of technology expectations, and similar expectations exist in states adopting other college- and career-ready standards. Many federal, state, and district leaders have made significant investments in providing infrastructure and devices to schools. Without a well-prepared and empowered teaching force, our country will not experience the full benefits of those investments for transformative learning.

Schools should be able to rely on teacher preparation programs to ensure that new teachers come to them prepared to use technology in meaningful ways. No new teacher exiting a preparation program should require remediation by his or her hiring school or district. Instead, every new teacher should be prepared to model how to select and use the most appropriate apps and tools to support learning and evaluate these tools against basic privacy and security standards. It is inaccurate to assume that because pre-service teachers are tech savvy in their personal lives they will understand how to use technology effectively to support learning without specific training and practice. This expertise does not come through the completion of one educational technology course separate from other methods courses but through the inclusion of experiences with educational technology in all courses modeled by the faculty in teacher preparation programs.

**Aligning Education With Technology Standards: University of Michigan**

Pre-service teachers at the University of Michigan School of Education are experiencing the kind of learning with technology their students will one day know. The curriculum addresses each of the five [ISTE Standards for Teachers](https://edtechbooks.org/-QMb) and aligns with skills from the
Partnership for 21st Century Skills. Each standard also has related course projects designed for teacher candidates to use technology actively to demonstrate their understanding of the material through practice and feedback. For example, teacher candidates are asked to design and teach a 20-minute webinar for fourth graders that is based on Next Generation Science Standards and to design and teach a lesson that uses technology and meets the needs of their learners as part of their student teaching placement.

Preparing to Teach in Technology-enabled Environments: Saint Leo University

A 2006 survey of Saint Leo University teacher preparation program alumni showed satisfaction with their preparation with one notable exception—technology in the classroom. As a result, the education department established a long-term goal of making technology innovation a keystone of its program. Saint Leo faculty redesigned their program on the basis of the Technological Pedagogical and Content Knowledge model, in which pre-service teachers learned to blend content, pedagogical, and technological knowledge in their PK-12 instruction.

Faculty developed their expertise with different technologies so that every course models the use of technology to support teaching and learning. The school built an education technology lab where teacher candidates can practice using devices, apps, and other digital learning resources. Students regularly reflect on their experience using technology to increase effectiveness and efficiency as well as its value in the learning process.

Perhaps most notably, Saint Leo ensures all pre-service teachers have basic technologies available at their student teaching placements. Each pre-service teacher is given a digital backpack with a tablet, portable projector, speakers, and a portable interactive whiteboard. A student response system is also available for pre-service teachers to use in their field placements.

Advancing Knowledge and Practice of Assistive Technologies for New Teachers: Illinois State University

Illinois State University’s Department of Special Education is one of the largest special education training programs in the nation. Recognizing the value of assistive technology in meeting the needs of each student, the special education teacher preparation program at the University includes an extensive emphasis on selection and use of assistive technologies.

Classroom learning is brought to life through ongoing clinical and field-based experiences in schools and at the university’s Special Education Assistive Technology Center. The center provides hands-on experiences to pre-service teachers enrolled in the special education programs at Illinois as well as opportunities for teachers, school administrators, family members, and businesses to learn about assistive technologies. Furthermore, faculty work in partnership with a variety of public, private, and residential schools to enhance student field experiences and provide opportunities for students to work with learners with a range of disabilities and in a variety of settings, including rural, urban, and suburban areas.

Building Digital Literacy in Teaching: University of Rhode Island (uri)

A critical aspect of ensuring that young Americans learn appropriate digital literacy skills is equipping educators at all levels with the same skills. To that end, URI offers a graduate certificate in digital literacy [https://edtechbooks.org/-mK] for graduate students, classroom teachers, librarians,
and college faculty. By targeting a broad audience to participate in the program, URI is expanding the number of educators with the professional capacity to help students to learn, access, analyze, create, reflect, and take action using digital tools, texts, and technologies in all aspects of their lives.

During the program, students are introduced to key theories of digital literacy in inquiry-driven learning and given time to experiment with and explore a wide range of digital texts, tools, and technologies. In collaboration with a partner, they create a project-based instructional unit that enables them to demonstrate their digital skills in the context of an authentic learning situation. Throughout the program, students participate in hands-on, minds-on learning experiences; participants build a deeper understanding of digital literacy while developing practical skills and have time to reflect on the implications of the digital shift in education, leisure, citizenship, and society.

In its evaluation of the program, URI has found that participants experienced a dramatic increase in digital skills associated with implementing project-based learning with digital media and technology. Their understanding of digital literacy also shifted to focus more on inquiry, collaboration, and creativity.

**Fostering Ongoing Professional Learning**

The same imperatives for teacher preparation apply to ongoing professional learning. Professional learning and development programs should transition to support and develop educators’ identities as fluent users of technology; creative and collaborative problem solvers; and adaptive, socially aware experts throughout their careers. Programs also should address challenges when it comes to using technology learning: ongoing professional development should be job embedded and available just in time.

**Increasing Online Professional Learning: Connected Educator Month Builds Collaboration Across the Country**

Connected Educator Month, part of the U.S. Department of Education’s Connected Educators project, began with a monthlong online conference that included a centralized guiding structure, kickoff and closing events, engagement resources, and an open calendar to which organizations of all types could submit professional learning events and activities. Educators used these resources and the calendar to create their own professional development plan for the month. Available activities included webinars, Twitter chats, forum discussions, and actively moderated blog discussions based on personal learning needs and interests.

In the first year, more than 170 organizations provided more than 450 events and activities, with educators completing an estimated 90,000 hours of professional learning across the month. More than 4 million people followed the #ce12 hashtag on Twitter, generating 1.4 million impressions per day.

Now led by partner organizations from the original Connected Educators project—American Institutes for Research (AIR), Grunwald Associates LLC, and Powerful Learning Practice—Connected Educator Month features more than 800 organizations and has provided more than 1,000 events and activities. Australia, New Zealand, and Norway hosted their own iterations of Connected Educator Month, and educators in more than 125 countries participated in some way.
Putting Learning in Teachers’ Hands: Denver Public Schools Personalizes Professional Development

In 2014, 80 teachers from 45 schools engaged in the pilot year of Project Cam Opener, an initiative of the Personalized Professional Learning team in Denver Public Schools. Now in its second year with 425 teachers and leaders, Project Cam Opener allows educators to record their teaching with customized video toolkits and share those videos for self-reflection and feedback within an online community of practice.

In the program’s pilot year, the first 80 teachers recorded hundreds of videos using tools such as Swivls, iPads, high-definition webcams, and microphones. The videos were uploaded to private YouTube channels and shared via a Google+ community for feedback. For many of these teachers, it was the first time that they had seen the teaching practices of other teachers in their district. The videos sparked daily conversations and sharing of ideas.

Three measures are used to determine the effectiveness of Project Cam Opener: engagement, retention, and observation. In the first end-of-year survey, 90 percent of respondents said that taking part in Project Cam Opener made them more engaged in their own professional learning and growth. In addition, not a single teacher from the pilot group left Denver Public Schools after their year with Project Cam Opener (the overall district rate of turnover is 20 percent). Although teacher observation scores are harder to attribute to this project specifically, the growth of this cohort of teachers outpaced that of their non–Project Cam Opener counterparts, according to the district’s Framework for Effective Teaching.

Micro-credentialing Teacher Learning: Kettle Moraine Introduces Teacher-led Professional Learning

Kettle Moraine School District in Wisconsin is creating a professional learning environment in which practicing teachers can be the masters and architects of their own learning. Using the Digital Promise educator micro-credentialing framework as a guide (for more information on Digital Promise’s micro-credentialing work, see Section 4: Leadership [https://edtechbooks.org/-vMe]), teachers in the district take a technology proficiency self-assessment, which they use as a baseline for their personal professional growth. The teachers then work by themselves and in collaborative teams to develop specific professional learning goals aligned to district strategic goals, which they submit to district leadership for approval.

Once these goals are approved, the teachers establish measurable benchmarks against which they can assess their progress. Both the goals and benchmarks are mapped to specific competencies, which, in turn, are tied to micro-credentials that can be earned once teachers have demonstrated mastery. Demonstrations of mastery include specific samples of their work, personal reflections, classroom artifacts, and student work and reflections, which are submitted via Google Forms to a committee of 7 to 10 teachers who review them and award micro-credentials.

Currently, 49 staff members are working to earn a micro-credential for personalized learning, which requires them to conduct their own background research and engage in regularly scheduled Twitter chats as well as blogging, networking, and other forms of self-guided learning using technology. Many also have begun to engage with teachers across the country, allowing them to give and receive ideas, resources, and support.
Embracing the Unconference: Going to Edcamp

An educator attending an Edcamp [http://www.edcamp.org/] event engages in a professional learning experience vastly different from traditional professional development. Sessions are built on the interests and needs of the people who attend and are created on the day by using a cloud-based collaborative application that is open to all (including those unable to participate in person). Each teacher chooses which sessions to attend on the basis of individual interests or needs.

Because using technology in learning effectively is one of the challenges facing teachers, sessions frequently are organized around sharing practices and overcoming common challenges when improving practices around the use of technology. Teachers collaborate to overcome challenges together, often making connections that lead beyond the single session or day, as partnerships are formed to engage their students with each other. The shared documents created at these events become an archive and resource for whoever attended, in person or virtually.

The first Edcamp was organized in Philadelphia by a group of local educators interested in new unconference (self-organizing) approaches to a conference for professional learning. The model took off, and five years later there have been more than 750 Edcamps all organized by local educators. The enormous popularity of the format has led to the formation of the Edcamp Foundation, a nonprofit organization that will formalize much of the ad hoc support that has been provided to Edcamp organizers until now.

Recommendations

Provide pre-service and in-service educators with professional learning experiences powered by technology to increase their digital literacy and enable them to create compelling learning activities that improve learning and teaching, assessment, and instructional practices. To make this goal a reality, teacher preparation programs, school systems, state and local policymakers, and educators should come together in the interest of designing pre- and in-service professional learning opportunities that are aligned specifically with technology expectations outlined within state standards and that are reflective of the increased connectivity of and access to devices in schools. Technology should not be separate from content area learning but used to transform and expand pre- and in-service learning as an integral part of teacher learning.

Use technology to provide all learners with online access to effective teaching and better learning opportunities with options in places where they are not otherwise available. This goal will require leveraging partner organizations and building institutional and teacher capacity to take advantage of free and openly licensed educational content such as that indexed on LearningRegistry.org [http://learningregistry.org/]. Adequate connectivity will increase equitable access to resources, instruction, expertise, and learning pathways regardless of learners’ geography, socio-economic status, or other factors that historically may have put them at an educational disadvantage.

Develop a teaching force skilled in online and blended instruction. Our education system continues to see a marked increase in online learning opportunities and blended learning models in traditional schools. To meet the need this represents better, institutions of higher education, school districts, classroom educators, and researchers need to come together to ensure practitioners have access to current information regarding research-supported practices and an understanding of the
best use of emerging online technologies to support learning in online and blended spaces.

**Develop a common set of technology competency expectations for university professors and candidates exiting teacher preparation programs for teaching in technologically enabled schools and post-secondary education institutions.** There should be no uncertainty of whether a learner entering a PK–12 classroom or college lecture hall will encounter a teacher or instructor fully capable of taking advantage of technology to transform learning. Accrediting institutions, advocacy organizations, state policymakers, administrators, and educators have to collaborate on a set of clear and common expectations and credentialing regarding educators’ abilities to design and implement technology-enabled learning environments effectively.

**References**


Rowan, B., Correnti, R., & Miller, R. (2002). What large-scale survey research tells us about teacher effects on student achievement: Insights from the Prospects Study of Elementary Schools. Teachers College Record, 104(8), 1525-1567.


Please complete this short survey to provide feedback on this chapter: http://bit.ly/NETPlan
V. Becoming an LIDT Professional

Becoming an LIDT professional is more than knowing some theory, and having some design or technical skills. You must learn how to network with other professionals, engage with professional organizations, and perhaps (hopefully!) contribute your growing insights back to the research and design literature through publication. These chapters will seek to guide you on this journey, as well as in establishing a moral foundation for your work as an LIDT professional.
VI. Preparing for an LIDT Career

Two of the most common questions students have when they enter an LIDT graduate program is what kinds of careers will be available to them after graduation, and how can they prepare for those careers? This section focuses on answering those questions. There are many more careers possible with an LIDT degree than those represented here, and additional chapters may be added in the future. The next question is for you to answer: What type of career do you want to have?

LIDT Careers

For further information about career paths in the LIDT field, including videos about different job sectors within the field, focused on BYU IPT alumni, please visit the EdTech Careers Job Sectors page.
Final Reading Assignment

Now that you are concluding this book, you should know . . . that you still know very little about the field of Learning and Instructional Design Technology. This is a “meta” field after all! One of the best pieces of advice I received as a student was to “read everything.” As you progress in your studies, you will need to focus your reading specifically on the body of literature influencing your own work. However, take time to also read broadly, because often we need to step outside of our narrow research and design agendas to spark our creativity. The following are some recommended readings for you (with link addresses provided for those reading this book in pdf form), although any person in the field will have a different list—so ask them what they have read that influenced them, and you will be led down a fruitful path.

Open-access

- The Design of Everyday Things by Donald Norman
- LIDT open access books available on https://edtechbooks.org/-ycR.
- An Open Education Reader: https://opened.pressbooks.com [https://opened.pressbooks.com/]
- Teaching in a Digital Age (https://edtechbooks.org/-qL)
- Seminal Papers in Educational Psychology: https://3starlearningexperiences.wordpress.com/2017/02/28/seminal-papers-in-educational-psychology/ [https://edtechbooks.org/-HM]
- Psychological Science by Mikle South [https://edtechbooks.org/-Rz] (an open text for Psychology 101, but also useful for revisiting classic psychological ideas) https://edtechbooks.org/-Rz
- Interaction and User Experience Design articles from interaction-design.org [https://edtechbooks.org/-xMz]. This is an excellent collection of openly available articles by leading scholars in the areas of user experience design, research methods, and innovation research.
- Video Interviews with senior “legends” within AECT. http://aectlegends.org
- Learning-theories.com [https://edtechbooks.org/-VDW] — brief summaries of many different theories
- How People Learn [https://edtechbooks.org/-eb] — grant-funded summary of learning theories by leading learning scientists
- The Cathedral and the Bazaar [https://edtechbooks.org/-qf] — Famous essay by Eric Steven Raymond that is widely regarded as the essay that launched the Mozilla foundation and open source movement.
Book Editors
Dr. Richard E. West is an associate professor of Instructional Psychology and Technology at Brigham Young University. He teaches courses in instructional design, academic writing, qualitative research methods, program/product evaluation, psychology, creativity and innovation, technology integration skills for preservice teachers, and the foundations of the field of learning and instructional design technology.

Dr. West’s research focuses on developing educational institutions that support 21st century learning. This includes teaching interdisciplinary and collaborative creativity and design thinking skills, personalizing learning through open badges, increasing access through open education, and developing social learning communities in online and blended environments. He has published over 90 articles, co-authoring with over 80 different graduate and undergraduate students, and received scholarship awards from the American Educational Research Association, Association for Educational Communications and Technology, and Brigham Young University.

He tweets @richardewest, and his research can be found on Google Scholar, his CV (http://bit.ly/RickWestCV) and his website: http://richardewest.com.

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