EdTechnica

The Open Encyclopedia of Educational Technology

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EdTech Books

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Robert W. Maloy

University of Massachusetts Amherst

Teachers, students, and community members will benefit immensely from this source of clear, concise, and up-to-date information about educational technologies and trends.

Like this? Endorse it and let others know.

Endorse

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Call for Proposals

EdTechnica: The Open Encyclopedia of Educational Technology

> *EdTechnica is currently accepting proposals for new encyclopedia articles on topics of interest to the educational technology community. This is an open and living volume intended to have wide impact and broad reach to practitioners and scholars throughout the world.*

Submit a Manuscript

What is this?

EdTechnica is a free encyclopedia for students and professionals to learn more about educational technology.

Why should you contribute?

By contributing to this free resource, you can help to improve learning opportunities and support to educational technology professionals throughout the world. All contributions are peer-reviewed and indexed by Google Scholar to help ensure quality and that you get credit for your efforts.

Who can contribute?

Any educational technology professional can contribute, and we encourage practitioners and scholars to work together to write articles that are useful to everyone.

What should my submission look like?

Use this template for creating your submission: Submission Template.

What language do I need to write in?

EdTechnica is trying something novel: **We don't require a specific source language.** Though most of our articles currently were originally written in English, we translate them into a variety of languages. We also accept submissions in most languages. So, feel free to submit your article in your native language, and we will do our best to have it reviewed, published, and translated into other languages.

What can I write about?

You can submit articles on pretty much anything that would be of interest to educational technology professionals. To see what counts as educational technology, see our Scope page and our Author Guide.

How long is each article?

Short. Our target length is 600 to 1,000 words. See these and other guidelines in the Author Guide.

Who manages the encyclopedia?

We are a diverse group of university faculty and other professionals who care about learning. So, we donate our time to create, edit, and share high-quality resources! You can find out more about who we are on the Organizational Structure page.

Are there any publication fees?

Nope. And all of our articles are provided ad-free to make our readers happy. We provide all of this as a public good to the world.

How do I submit an article?

Check out our easy steps to article submission.

How else can I help?

In addition to writing articles, we also need volunteers to help provide peer reviews.

When will the call for proposals end?

Our plan is to always accept proposals, so never. However, to make sure that you get to write on the topics you'd like, please consider submitting early!

Submit a Manuscript

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About the Encyclopedia

> *This encyclopedia is a living volume that provides an entry point for learning about the educational technology field and that evolves over time with additional contributions and resources. Representing the perspectives of educational technology researchers, instructors, designers, developers, and practitioners throughout the world, it includes short, focused articles on foundational topics ranging from learning and design concepts to emerging technologies to policies shaping the future of educational technology. Each article is peer-reviewed and intended to provide an expert and up-to-date understanding of the topic, while also providing a space for community contributors to share helpful resources related to the topic.*

As an open volume, all articles are free and accessible to all, and we provide publishing support as a public service, meaning that we do not charge publication fees from authors or anyone else.

- Scope
- Organizational Structure
- Author Guide
- Graphics and Styling
- Submit a Manuscript
- Reviewer Guide
- Publishing and Peer Review Process
- Student Internships
- Policy Information
- Meet the Authors
- Author Demographics

Scope

In this encyclopedia, we use the term "Educational Technology" broadly and inclusively to encompass any professional practices, research projects, areas of inquiry, or professional communities that work at the intersection of teaching/learning and technology.

Some related fields might include (but are not limited to) the following:

- Accessibility Studies
- Educational Psychology
- Educational Software Development/Engineering
- Educational Technology
- Instructional Design
- Learner Experience Design
- Learning Analytics
- Learning Design
- Learning Engineering
- Learning Sciences
- Learning Technologies
- Media Studies
- Technology in Education
- Technology Integration
- User Experience Design

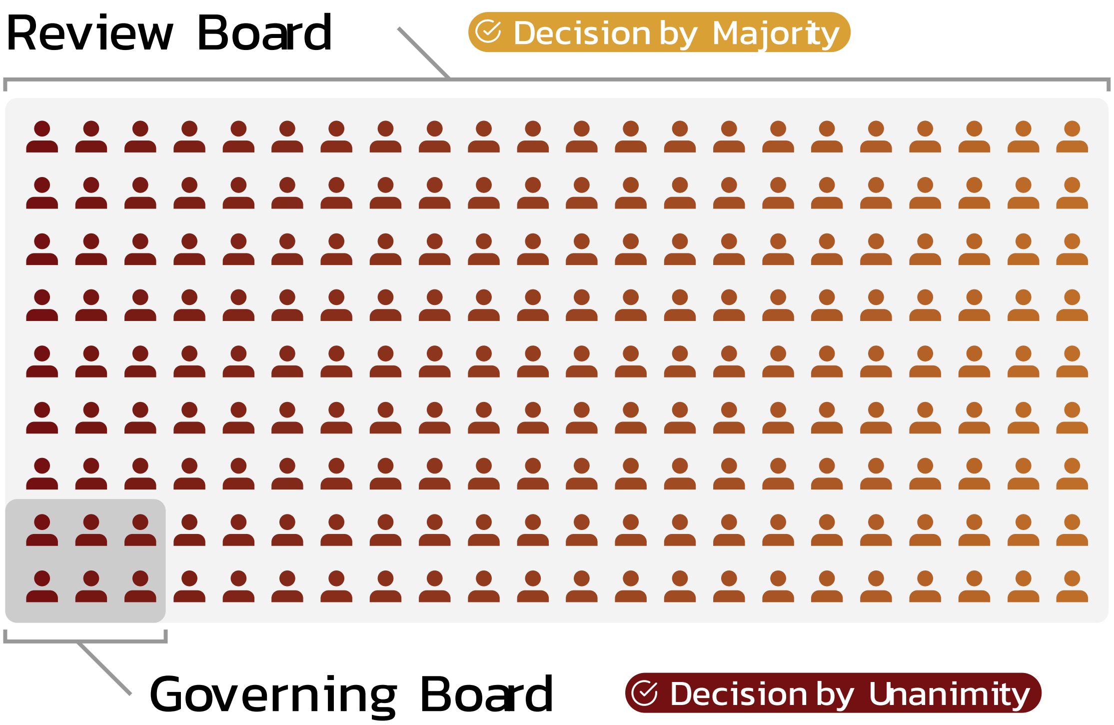
Organizational Structure

> *EdTechnica seeks to be a democratic, efficient, egalitarian, and ethical organization that allows educational technology professionals to harmoniously work together for the common good. It also seeks to be an open and transparent organization that welcomes individuals with diverse backgrounds and perspectives.*

At its heart, the governing body of EdTechnica is the Review Board, which constitutes all authors of articles and any professionals who donate their time to making the encyclopedia function. In addition to the general Review Board, a smaller Governing Board also works to streamline encyclopedia activities and to provide leadership on essential tasks. Associate editors and student interns may also be invited to support the efforts of either board.

Figure 1

Illustration of the Review Board and Governing Board



Review Board

The Review Board represents researchers and practitioners who have agreed to provide reviews of articles related to their expertise. Review Board members will be acknowledged in the encyclopedia for their service, but information regarding which articles they specifically reviewed will not be shared.

Review Board members are invited to attend all official meetings and to vote on leadership decisions and any other voting items proposed by the Governing Board. Generally, Review Board meetings are held twice each year, and all members are invited to attend and to vote on items.

Authors of accepted articles will automatically be invited to join the Review Board after initial acceptance of their first article. This will help to diversify and expand the Review Board over time. Members of the Governing Board may also invite new Review Board members.

The Review Board is intended to be a highly democratic organization, and there is no limit to its possible size.

There is no time limit to Review Board membership provided that the member remains active in the field and with the encyclopedia. If a Review Board member does not participate in the board for a year or longer (i.e., does not complete any reviews and does not attend any meetings), then they may be removed from the Review Board by the Governing Board with a letter of thanks. Former Review Board members may be invited to rejoin the Review Board by the Governing Board.

Through the Inclusive Contribution and Equity Strategy, the Governing Board also seeks to ensure that the Review Board is both representative of the field and diverse.

Review Board Selection and Acknowledgment

Any researcher or practitioner with expertise related to educational technology may request to join the Review Board by emailing the Governing Board and attaching a curriculum vitae. Generally, to serve on the Review Board, an individual should be actively engaged in the field either as a scholar, practitioner, or graduate student and have sufficient professional or research expertise. Some indicators of suitability to serve on the Review Board may include the following:

- Recent, first-authored publication of research in a peer-reviewed educational technology journal; or
- 10+ years of full-time professional experience in an educational technology position.

Reviews are blinded, meaning that authors will not know who reviewed their individual articles, but reviewers will be acknowledged for their participation with the overall volume by inclusion on the Review Board page and with a certificate of appreciation.

Governing Board

The Governing Board represents researchers and practitioners who have agreed to provide editing, leadership, and strategic support to the encyclopedia. Each member is elected to serve a 3-year term, and the size of the Governing Board is limited to six (6) people (though this may be adjusted by a Review Board vote). In its first year of operation, the two Governing Board members with the most votes will be elected to a term of 3 years, the next two will be elected to a term of 2 years, and the final two will be elected to a term of 1 year. This allows for staggering of elections and continuity of leadership. There are currently no limits on the number of terms an Governing Board member may serve, but each term must be decided by election.

Maha Bali

American University in Cairo

Maha Bali is Associate Professor of Practice at the Center for Learning and Teaching, American University in Cairo. She has ...

Aras Bozkurt

Anadolu University, Turkey

Aras Bozkurt is a researcher and faculty member in the Department of Distance Education, Open Education Faculty at Anadolu ...

Camille Dickson-Deane

University of Technology Sydney

Dr. Camille Dickson-Deane is a Senior Lecturer Higher Education Learning Design at the University of Technology, Sydney Australia. ...

Royce Kimmons

Brigham Young University

Royce Kimmons is an Associate Professor of Instructional Psychology and Technology at Brigham Young University where he studies ...

Jill E. Stefaniak

University of Georgia

Jill Stefaniak is an Associate Professor in the Learning, Design, and Technology program in the Department of Career and ...

[Melissa Warr](#)

New Mexico State University

Dr. Melissa Warr is an Assistant Professor of Learning Design and Technology at University of Louisiana Monroe. Her research ...

Table 1

Current Governing Board Members

Name	Affiliation	Dates of Service
Maha Bali	American University in Cairo	2022-TBD
Aras Bozkurt	Anadolu University	2022-TBD
Camille Dickson-Deane	University of Technology Sydney	2022-TBD
Royce Kimmons	Brigham Young University	2022-2025
Jill E. Stefaniak	University of Georgia	2022-TBD
Melissa Warr	University of Louisiana at Monroe	2022-TBD

Governing Board Selection

Governing Board members are nominated and elected by the Review Board. Voting on open Governing Board membership positions is conducted in a proportional ranked-choice voting manner. Any Review Board member may nominate themselves or another Review Board member to serve on the Governing Board. Nominations should be made prior to the biannual meeting when voting will occur so that the Editor-in-Chief may privately see if nominees accept nominations prior to voting.

Editor-in-Chief Selection

The Editor-in-Chief is elected by the Governing Board via a simple majority vote and serves until the end of their Governing Board term. In the case of a tie, the selection of the Editor-in-Chief must be decided by the Review Board. Nominations are accepted from current Governing Board members. If re-elected to the Governing Board, the former Editor-in-Chief may be considered for additional terms as Editor-in-Chief.

Governing Board Governance

All Governing Board members are considered to be editors of the encyclopedia, even though specific editorial and administrative duties may vary by position. In addition, all encyclopedia activities and decisions should be approached in a collaborative manner and in a spirit of cooperation. So, although each editor leads specific efforts associated with the encyclopedia, they can and should constantly collaborate with other editors.

The Governing Board will have a scheduled meeting each month, but meetings may be canceled at the discretion of the board if there are no agenda items or due to other circumstances. These are not public meetings, but Review Board members may be invited by a Governing Board member to attend Governing Board meetings as observers.

The Governing Board has the authority to make all decisions related to the encyclopedia and its personnel provided that decisions are unanimous. Given the small size of the Governing Board, this ensures that each member has an equal and powerful voice and prevents the development of factions or groups within the board. Any vote requires the presence of a majority of Governing Board members to be valid, and any vote conducted in the absence of an Governing Board member may be brought to a revote by that member.

Whether or not a decision requires a board vote is determined by the board itself, and if any Governing Board member requests a vote on any matter, then the matter must be decided by a vote.

If the Governing Board cannot achieve unanimity in a decision, then the decision must be made by the Review Board, who must decide by a majority vote how to proceed, either during a biannual meeting or via email (with a two-week opportunity to vote). It is expected that these instances will be rare, but in such cases, the Editor-in-Chief will provide the Review Board with an explanation of the voting item and a list of the Governing Board members' votes on the matter including a short rationale from each member explaining their vote.

The Editor-in-Chief or an assigned Governing Board member is responsible for making agendas, taking notes of all meetings, and distributing them to members in a timely manner.

Governing Board Duties

Duty 1: Ethics, Equity, and Inclusion

Each Governing Board member ensures that the governing practices of the encyclopedia are ethical, equitable, and inclusive and also that the resulting encyclopedia itself reflects these values. The Governing Board constantly updates and engages in an Inclusive Contribution and Equity Strategy to ensure that these values and effective practices are interwoven into all aspects of the encyclopedia.

Duty 2: Editorial Review

Designated Governing Board members conduct initial reviews of submitted articles to ensure that they fit the encyclopedia's aims and scope and that they follow necessary guidelines and conventions.

Duty 3: Author Support

Designated Governing Board members provide necessary support to authors of articles both in the pre-publication phase and the post-publication phase. This may include technical support, stylistic guidance, data interpretation, and other forms of assistance.

Duty 4: Peer Review Management

Designated Governing Board members organize, invite, and remind reviewers and make final determinations on article publishability, notifying authors of decisions. The Governing Board also solicits and manages requests for new articles, solicits article contributions, and releases calls for proposals.

Duty 5: Quality Assurance and Accessibility

Designated Governing Board members manage Micro-Revisions to existing articles and the inclusion of Additional Resources. The Governing Board also initiates and administers usability and accessibility testing on articles and corrects technical problems as needed.

Duty 6: Translations

Designated Governing Board members or an assigned committee manages the publication of proposed Translations.

Duty 7: Continuous Improvement

Designated Governing Board members manage the consideration of Major Updates to existing articles and also engage in ongoing Continuous Improvement efforts to correct and improve the content, veracity, practicality, and timeliness of articles.

Duty 8: Communications

The Governing Board should manage email lists and announcements to the Review Board and authors and should also engage in an active Social Outreach and Marketing Strategy. The Governing Board should also manage official social media, email, and other accounts.

Supporting Editors

Supporting Editors are invited by the Governing Board to fulfill specific duties related to the encyclopedia.

Bohdana Allman

Dr. Bohdana Allman has taught various undergraduate and graduate-level courses ranging from methodology and pedagogy courses ...

Fanny Eliza Bondah

Brigham Young University

Fanny Bondah is a Masters student at Brigham Young University studying Instructional Psychology & Technology.

[Monalisa Dash]

Brajrajnagar College

[Rebeca Peacock](#)

Boise State University

Rebeca Peacock is an Instructional Designer and Assistant Professor, Librarian at Boise State University. She has an MEd ...

Table 2

Current Associate Editors

Name	Affiliation	Role
Bohdana Allman	Brigham Young University	Associate Editor
Fanny Eliza Bondah	Brigham Young University	Assistant (Student) Editor
Monalisa Dash	Brajrajnagar College	Associate Editor
Rebecca Peacock	Boise State University	Associate Editor

Review Board Members

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Author Guide

> *This encyclopedia utilizes a blend of traditional and new approaches to editing and publishing. Contributing authors should leverage diverse expertise to create a resource that is of the greatest possible value to the field.*
>
> *As a peer-reviewed volume, the encyclopedia is designed to ensure the publication of articles of the highest quality and practical use to the field. As an open encyclopedia, the educational technology community should continually suggest improvements to existing articles in the form of revisions, updates, and supplements. And as a living resource, editors and authors should seek to continuously improve content, processes, and user experiences.*

The encyclopedia includes the following contribution types. More detailed descriptions of each content type are available in their individual sections below:

- Encyclopedia Articles
- Additional Resources as supplements to existing articles
- Micro-Revisions of existing articles
- Major Updates of existing articles
- Translations of existing articles

Encyclopedia Articles

Articles comprise the primary content of the encyclopedia. All articles address a suitable topic, are peer-reviewed prior to publication, and strictly follow targeted stylistic and other guidelines.

Suitable Topics

Like any encyclopedia, this volume seeks to summarize concepts, events, and other topics pertinent to educational technology in a manner that is readily consumable and allows a reader to gain a general understanding.

Any concept, model, theory, framework, debate, or issue related to educational technology may be a suitable topic. Topics need not strictly be unique to “educational technology,” per se, but should be topics of importance to educational technology professionals that are specifically written for their needs, interests, and use. For example, “Feminism” and “Accessibility” may not be universally considered to be educational technology topics, because they originated in other fields and are discussed at length in a variety of fields. However, they are nonetheless of deep interest to educational technology professionals, so they would be suitable topics for the encyclopedia.

To assist in topic selection, a public list of potential topics with committed authors is available here. If you would like to write a particular article, feel free to let the editors know that you will be working on it, and they would be happy to mark this on the public list for others to see. This will help to encourage collaboration and to reduce the duplication of efforts. If a topic is missing, you may contact the editors to suggest listing it, and you may also submit article submissions for unlisted topics.

Disambiguation

The encyclopedia should not be used to stake a claim for particular terms that may have multiple meanings. Rather, article titles and contents should disambiguate terms when necessary. For instance, if there are two theoretical models that use the same name or abbreviation (e.g., "The Triple E Framework"), then disambiguating language should be used in the title and link of the article (e.g., "The Triple E Framework (Kolb)" and "triple_e_kolb").

Additionally, care should be taken in the writing of articles to ensure that global perspectives are represented and that local uses of terms are not treated as universal (e.g., "content management system" may mean different things in different countries). The Editorial Board can assist authors in navigating these realities in a variety of ways, such as encouraging broader treatment of terms in the articles themselves or proposing the authorship of separate, localized definitions with appropriate cross-references.

Review Process

We seek to be swift in our review and publishing process with a goal of 1 month from initial submission to final decision and (if accepted) publication. All submissions will go through a first round of editorial review and a second round of peer review. If not accepted, articles may be returned to authors with guidance on how to effectively improve the article for resubmission and be considered for additional rounds of peer review.

All submitted articles will be reviewed by at least two reviewers, representing the perspectives of both researchers and practitioners.

Stylistic and Formatting Information

In general, articles should be as simply formatted as possible, and authors should use the provided template when composing their submissions in Google Docs. Submissions should also generally be formatted according to APA 7 requirements. For an overview of these requirements, see the APA 7 Job Aid (Kimmons, 2018).

Intended Audience

The intended audience for articles should be researchers, practitioners, and the general public. Technical language should be defined as necessary.

Context

It may be appropriate to consider contextual information and diverse applications within articles (e.g., application in K-12 vs. higher education), but articles should not be limited to a singular context (e.g., "Open Educational Resources" would be an appropriate article, but "Open Educational Resources in Higher Education" would not). All articles should be written for the educational technology context.

Titles

All titles should only include the topic, not the context. For instance, an article on "Feminism" is implied to mean "Feminism in Educational Technology," but the title would only be "Feminism." Subtitles and lengthy titles (e.g., those with semicolons) should be avoided.

Tone and Writing Style

Articles should be written in a professional and factual tone. They should generally be written in third-person language and should avoid personal anecdotes in favor of references to primary sources (e.g., foundational theoretical papers). In addition, all articles should be written at a reading level suitable for a general adult audience (e.g., 10th grade English).

Furthermore, encyclopedia articles are a type of academic writing, which is very different from other forms of writing (e.g., creative, technical). For a brief introduction to some of the expectations and norms of academic writing, please see The 5 C Guidelines of Academic Writing (Kimmons, 2018).

Length

Articles should be 600 to 1,000 words in length (excluding citations). Articles significantly longer than 1,000 words will generally not be reviewed but should rather be broken into multiple articles to further narrow their scope. If submissions exceed the word limit, authors should provide a justification to the editor.

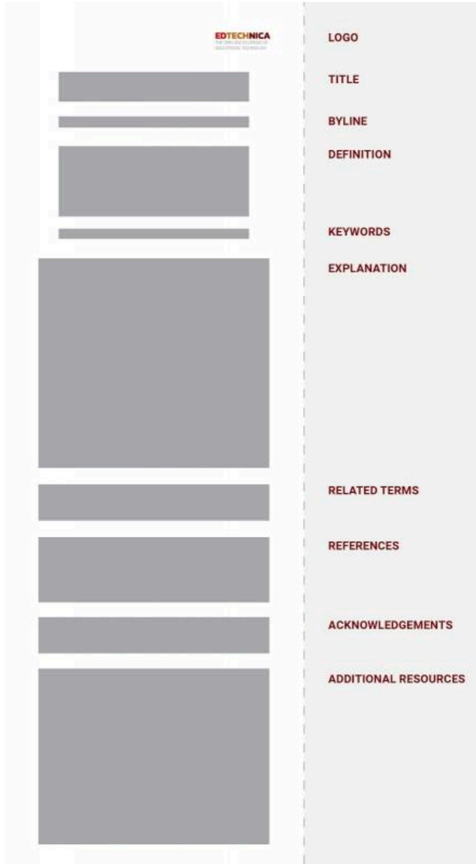
Structure

All articles should utilize the provided template and should have the following structure:

- Title
  - Typically only 1–3 words (e.g., "Blended Learning"), but no more than 8 in total length
  - Focused on the topic with no contextual modifiers or verbs (e.g, "Blended Learning" rather than "Blended Learning in K–12" or "What is Blended Learning?")
- Definition/Abstract
  - 150–200 words in length
  - The first sentence should succinctly define the term or topic, generally starting with the term followed by an "is" statement (e.g., "Blended learning is. . ."), thereby helping with search engine optimization
  - Should contain less than three citations, representing the most foundational work on the topic
- Keywords
  - 3–5 in total
  - Including abbreviations, synonyms, and related concepts
- Explanation/Lengthier Definition
  - 450–800 words in length
  - Should expand upon the Definition/Abstract without restating it
  - Should provide limited (but necessary) treatment of controversies or different understandings, with different understandings generally being addressed in separate (disambiguating) articles
- Related Terms
  - List any other published articles in the encyclopedia that are directly related to this topic (normally 1–5 in total)
- References
  - Should include all citations included in the article
  - The article should reference any foundational work on the topic (e.g., theoretical articles) as well as the most recent work related to the topic
  - Author self-citations are allowed but should generally be used only if they are the best possible citations for the claims being made
- Acknowledgments
  - List any additional contributors to the article that are not included in the author list
- Additional Resources
  - List any additional links, media, or files that may be helpful for readers, such as supporting documents (e.g., lesson plans, rubrics), explanatory aids (e.g., instructional videos), or project websites

Figure 1

The visual layout of each encyclopedia article



Copyediting

All submissions should be written in clean, clear, and precise English. It is the submitting author's responsibility to ensure that submissions are free of errors.

Citations

In-text citations should be used extensively to provide evidence for claims and should follow APA 7 requirements. Author self-citations are allowed but should only be used if they are the best possible citations for the claims being made.

Images, Charts, and Tables

Data, images, charts, and tables should not be included unless they serve a foundational illustrative purpose (e.g., the visual PICRAT matrix is appropriate to include in the PICRAT article, because it is necessary for illustrating the model). Stock photography, clipart, and other visuals focused on aesthetics should not be included.

Any images should include appropriate alt text descriptions, which may be added in Google Docs by right-clicking on the image and choosing "Alt text."

Included images should also be openly licensed either as a public domain or appropriate Creative Commons work. If the image is an original work, it will be assumed that the work is released under the same license as the article unless it is explicitly stated that it is released under another license. If authors have questions about licensing, they are welcome to contact the Editorial Board.

Blocks of text should not be included in tables unless the text represents information that is tabular in nature. If a list will do, please use a list.

Whenever possible, tables should also include a heading row that provides appropriate labels for information in columns.

When using text in tables, do not use returns or tabs in the text to provide separation. Rather, use new rows, columns, and cells for required separation. See Tables 1 and 2 for examples. If cells are blank, this means they should generally be merged with other cells to improve meaning.

In addition, most visual APA table formatting requirements (e.g., border sizing) may be ignored for new submissions because styling of tables will be overwritten by the publishing system.

Table 1

Poor example of text in a table that does not use proper cell separation

Letter	Meaning
X-Axis P I C	Passive Interactive Creative
Y-Axis R A T	Replacement Amplification Transformation

Table 2

Good example of text in a table that uses proper cell separation

Letter	Meaning
X-Axis	
P	Passive
I	Interactive
C	Creative
Y-Axis	
R	Replacement
A	Amplification
T	Transformation

Videos and Interactive Media

Videos and interactive media should generally not be included in the body of the article but may be included as additional resources.

International Style

Authors should seek to write their articles in a way that will be as accessible as possible to an international audience. Following APA 7, American spellings of English words are generally preferable to British spellings, but this might vary based on the context and scope of the article.

Headings and Styles

Articles should use the built-in styles feature of Google Docs for identifying headings, and authors should not manually apply visual formatting changes to headings (e.g., bolding, italicizing). If authors do not use the built-in heading styles, it is difficult for editors to programmatically tag headings in a way that makes them accessible and usable.

Furthermore, authors should ensure that their articles do not skip heading levels, that all headings are nested properly (e.g., a Heading 2 only comes after a Heading 1), and that headings in subsections are only included if there are at least two subsections (e.g., do not include a Heading 2 heading under a Heading 1 unless there are at least two Heading 2s). Examples of a correct heading structure and an incorrect heading structure follow:

Correct Structure Example

- Heading 1
  - Heading 2
  - Heading 2
- Heading 1
  - Heading 2
  - Heading 2
  - Heading 2

Incorrect Structure Example

- Heading 1
  - Heading 2 (Explanation: Only one Heading 2 under the Heading 1)
- Heading 1
    - Heading 3 (Explanation: Skipped Heading 2)

Pre-Publication Author Support

A designated member of the Editorial Board may serve as the primary contact person for interested authors or others seeking clarifying information about the encyclopedia. This includes potential authors who would like help in identifying potential collaborators (e.g., a classroom teacher looking for a scholar to serve as a co-author). To assist in these efforts, the Editorial Board may utilize a variety of strategies and tools to connect prospective authors to one another, including Twitter, Slack, Google Docs, etc.

Graphics and Styling

Beyond generic APA 7 formatting required of all submissions, the Editorial Board will also utilize the efforts of graphic designers and other professionals to make all visual content elements follow the EdTechnica Style Guide. This provides a sense of unity and an important level of production quality to all materials published in the encyclopedia.

Typography

Custom typography should not be used in encyclopedia articles, and all text should be represented as text as much as possible rather than as part of an image (e.g., figure captions should be cropped from images and provided as blocks of text).

Any text that is included in images, such as labels on charts, should generally utilize Arial or another san-serif font.

Colors

Content should effectively use whitespace, and color should only be used as a uniform accent in figures and other elements.

Figure 2

The color palette for encyclopedia visuals

Figure 3

A figure example of PICRAT that uses appropriate style guide colors

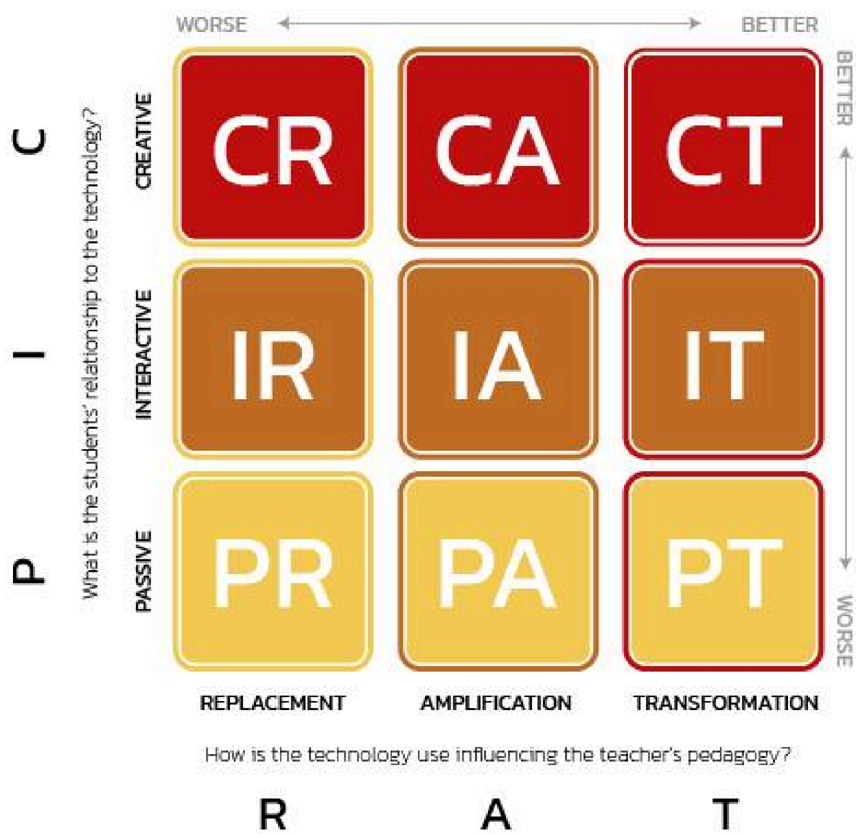
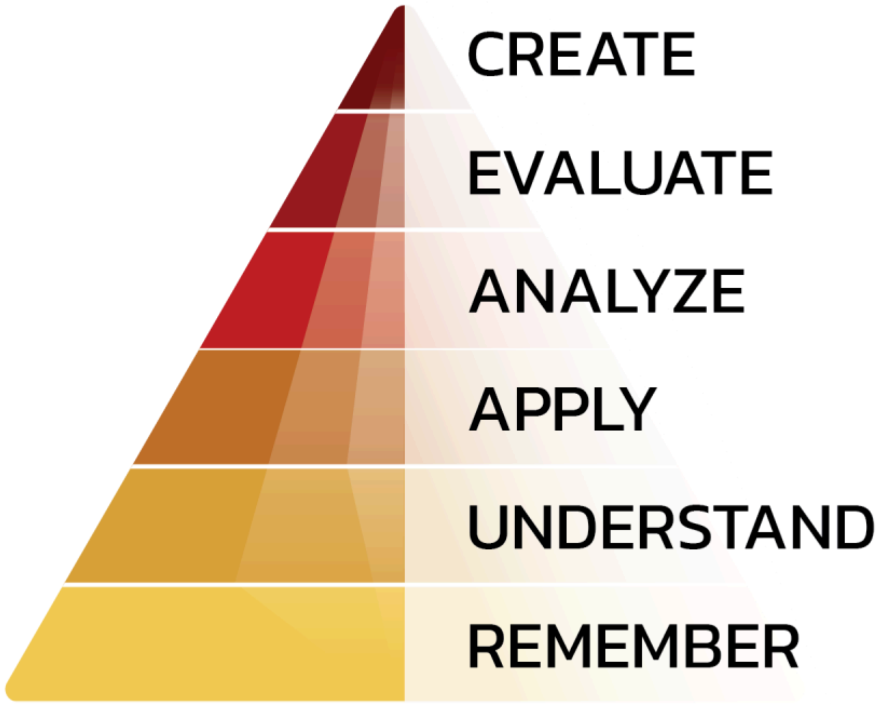


Figure 4

A figure example of Bloom's Taxonomy that uses appropriate style guide colors



Authorship

We encourage all new article submissions to (a) be co-written by at least two authors, (b) represent multiple institutions, (c) include both a researcher and practitioner perspective when relevant, and (d) provide an insider (or emic) perspective of experts on the topic, as opposed to outsider critiques (e.g., the article on Behaviorism should not be written from a Constructivist lens). Prior to peer review, a designated Editorial Board member will conduct an initial review of the article and determine whether the authorship plan is appropriate for the proposed article. In some cases, single authorship might be appropriate, but such exceptions will be evaluated on a case-by-case basis.

Our co-authorship guidelines are intended to serve at least three guiding purposes:

1. Helping to ensure that articles represent a wealth of perspectives,
2. Helping to bridge theory-practice and researcher-practitioner divides, and
3. Encouraging under-represented authors to contribute, such as authors from marginalized communities.

Researcher authors should have a significant track record of scholarship directly related to the topic of the article, as evidenced by peer-reviewed journal article publications, citations, and so forth. Whenever possible, they should represent expertise in theoretical work associated with the topic and not just the application of the topic.

Practitioner authors should have experience and expertise relevant to the topic. Some examples include (but are not limited to) the following:

- Classroom teachers with applied experiences directly related to the topic,
- Designers of training materials, projects, or solutions directly related to the topic,
- Administrators and managers of projects directly related to the topic.

Hybrid authors, or those representing both researcher and practitioner expertise, are welcome, but articles should still seek to include at least two authors.

Authors should seek to represent at least two institutions (e.g., two teacher educators at the same university would not be appropriate) and whenever possible should provide perspectival diversity in terms of gender, race, ethnicity, ability, and nation of origin.

Authors with commercial conflicts of interest may not contribute articles. For instance, employees of or teacher ambassadors for a commercial educational technology company may not submit articles about the company's products.

Authorship order should be determined by the authors themselves and should reflect relative scholarly contribution to the article and follow the APA 7 guidelines for authorship and acknowledgment. Consultants and others involved in the authorship process may be identified as an acknowledgment, even if their contributions do not merit full authorship consideration.

All articles should be written from an insider (or emic) perspective rather than an outsider (or etic) perspective (Williams & Kimmons, 2022). This should be discernible both in the tone and content of the article and also in representation among authors, especially when articles focus on social groups or topics. For example, an article on "Constructivism" should be primarily authored by professionals who engage in constructivist work, an article on "Feminism" should be primarily authored by women, an article on "Social Justice" should be primarily authored by traditionally marginalized groups of individuals, and so forth. A good rule of thumb is that all articles should be written by members of the communities being represented and should represent them in ways that they would represent themselves and would embrace.

If you have questions about whether your authorship plan will meet our requirements, please consider how well your plan addresses the three guiding purposes above. If you are a practitioner wishing to find a scholar to co-author with, please consider searching for your topic on Google Scholar to find someone with a track record in your area. Additionally, if you would like assistance in connecting with other prospective authors to collaborate with you, please consider reaching out to the Editorial Board or posting a request to Twitter using the #edtechnica and #edtech hashtags.

Corporate Branding and Marketing

This encyclopedia is not a marketing tool. Proposed topics should not focus on a specific brand of technology but should instead be focused on the type. For example, an article on "Interactive Whiteboards" would be appropriate, but an article on "Promethean Boards" or "SmartBoards" would not. Similarly, an article on "Tablets" would be appropriate, but an article on "iPads" or "Galaxy Tabs" would not, and an article on "Social Networking Sites" would be appropriate, but an article on "Twitter" or "Facebook" would not. Within articles, specific brands may be mentioned as examples, but care should be taken to make treatment broadly applicable and inclusive of different brand options. Comparisons between products can be made in articles, but care should be taken to make these comparisons as objective as possible.

Originality

Articles should generally represent original works and should not be copied or reprinted from other sources. Remixes or adaptations of previously published works are allowed if the following conditions are met:

1. The new article must be released under the same copyright license as the rest of the encyclopedia; so, the license under which the original content was released must be consulted to see if this is permissible.
2. The article must follow all other encyclopedia guidelines to ensure fit with the volume (e.g., length, tone, structure).

Original Research and Theoretical Work

Original (unpublished) research and original (unpublished) theoretical work should not be proposed in articles. An encyclopedia is a secondary source, not a primary source.

Copyright

All articles will be released under a Creative Commons Attribution 4.0 International License and will be made publicly available on the internet. Authors retain the copyright of their works, but they must agree to release their articles under this open license to be included in the volume. This license allows anyone to share, remix, or reuse the article provided that they cite the original author. Please note that the encyclopedia only uses the base CC BY license and does not add additional stipulations on use (e.g., non-commercial, share-alike, no-derivatives). This is intended to allow for the greatest possible use of encyclopedia articles in the field. Please consult the Creative Commons site for more information about licenses.

Access to Usage Data and Analytics

Usage data and analytics will be collected on all articles. Editorial Board members will have access to view data for the entire volume, and article authors will have access to view data for their chapters. Additionally, Review Board members or others can request access to view analytics for the volume by asking the site administrator to grant data analyst permissions. These data can be used for research or other purposes that benefit the field, and access may be granted by requesting permission from info@edtechnica.org. For more information on available data, please see Analytics and Metrics.

Requests for Articles

In addition to a revolving open call for submissions, anyone viewing the encyclopedia (including students) may submit a request for an article topic and suggest potential authors or resources. A current list of desired and planned articles may be found on the Article Planning Sheet. A designated Editorial Board member will manage these requests and invite appropriate authors to write articles of interest to the community. To request a term or topic, please email the editors.

Micro-Revisions

All published articles in the encyclopedia will have the capacity to collect focused suggestions and corrections from the general public in the form of micro-revisions. Article authors will be notified when micro-revisions are suggested, and they will have the ability to accept or reject these suggestions as appropriate. Article authors and Editorial Board members will also be provided with a dashboard to track suggested revisions. Anyone making suggested edits that are rejected by article authors may request a review by a designee of the Editorial Board to ensure that legitimate, contradictory viewpoints are accounted for. However, in most cases, such edits should be submitted as Major Updates, which will undergo peer review and editorial scrutiny.

If the editor or original author chooses to update the article with micro-revisions, then individuals who suggest the revisions may be added to the Acknowledgments section in the article, but this is not required.

Additional Resources

All published articles will have a form where the general public can submit URLs and brief descriptions of resources related to the topic of the article. These might include links to explanatory videos, lesson plans, tools, products, or anything else that could be useful to a reader learning about the topic. Article authors will be notified when artifacts are submitted, and they will have the ability to accept or reject the resource as appropriate as well as to organize resources on the article page. Article authors and Editorial Board members will also be provided with a dashboard to track submitted artifacts and their current status.

When determining whether to include a submitted resource, authors and editors should follow the provided rubric (see Table 3). When considering the rubric, any resource scoring 8 or more points should definitely included, and any resource scoring 5–7 points may be included at the evaluator's discretion. Any resource scoring less than 5 points should not be included. Additionally, anyone submitting suggested artifacts that are rejected by article authors may request a review by a designee of the Editorial Board, who may override the authors' decision.

Table 3

Rubric for Additional Resource Inclusion

	Do Not Include **0 points**	**Perhaps Include** **1 point**	**Definitely Include** **2 points**
Longevity	The resource link may stop working in the next two years.	The resource link points to a reputable site and will probably continue to work for the next two years.	The resource link points to a reputable site and uses a persistent link (e.g., DOI).
Accuracy	The resource includes information that is highly inaccurate.	The resource includes information that is generally accurate.	The resource includes information that is highly accurate.
Practicality	The resource is not of practical value to researchers or practitioners.	The resource is of practical value to researchers or practitioners.	The resource is of practical value to researchers and practitioners.
Accessibility	The resource is in an inaccessible format.	The resource is in a generally accessible format but has some errors.	The resource is in an accessible format.
Commercial Incentive	Inclusion of the resource would serve primarily commercial goals.	Inclusion of the resource may provide commercial incentive to someone, but this is not the primary reason for its inclusion.	Inclusion of the resource would not provide commercial incentive to anyone.
Overall Score	**0 – 4 points**	**5 – 7 points**	**8 – 10 points**

Usability and Accessibility

The platform the encyclopedia is hosted on and all articles should be designed with a mobile-first mindset to ensure compatibility and usability across all devices. In addition, the Editorial Board should conduct annual checks of all articles in the encyclopedia using standard (e.g., WebAIM Wave) or customized tools to ensure that all materials are usable and accessible. In cases of poor usability or accessibility, the Editorial Board should work with article authors to make required changes.

Major Updates

All published articles will provide the opportunity for anyone to submit a major update to the article. Though micro-revisions will tend to be grammatical or factual in nature, major updates will consist of robust content changes to articles deemed necessary due to changes of definitions, new ideations, or other factors. All major updates will be managed by a member of the Editorial Board who will first decide whether the suggested update constitutes a micro-revision or a major update. Major updates should substantially improve the content of the article by updating contextual information, clarifying misconceptions, or correcting content mistakes, while still adhering to other stylistic guidelines of the encyclopedia (e.g., word length). Grammatical, spelling, type editing, and stylistic updates do not constitute a major update, but because what constitutes a major update is somewhat fluid, this determination is left to the Editorial Board designee to make an informed judgment call. The guiding principle for this determination should be whether the suggested edit is sufficient enough to merit authorship credit: suggestions meriting authorship credit on the final article are considered major updates, while suggestions not meriting authorship credit would be considered micro-revisions.

In the case of major updates, a member of the Editorial Board will initiate a new round of reviews that includes the original authors as reviewers (except in cases where a conflict of interest might be expected) and an equal number of anonymous reviewers with relevant expertise. Based on their reviews, the editor will determine to either (a) update the original article to reflect the major update, (b) update the article with parts of the major update as micro-revisions, or (c) reject the major update. If the editor chooses to update the original article as a major update, then revising authors will be added to the end of the author list for the article.

Translations

The encyclopedia has a perpetual open call for translations of existing chapters into any language.

Though the primary language of the encyclopedia is English, translations of articles are welcome and can be published alongside their English versions. Since articles are openly-licensed, prospective translators have permission to conduct and submit translations for inclusion without seeking permission. Translators of accepted translations will be listed as additional authors on articles so that they receive credit as contributing authors.

Translations do not need to undergo an additional process of formal peer review, but the Editorial Board or a designated committee should rely upon professionals with expertise in the second language to ensure that translations are of sufficient quality to publish.

Cross-Referencing and Indexing

All articles will be indexed by Google Scholar and search engines.

All articles will also provide cross-references to other articles in the volume of interest (e.g., “Copyright” would cross-reference “Open Educational Resources”).

Continuous Improvement

All published articles will provide an end-of-article survey for readers to rate the quality of the article and to provide feedback. The Editorial Board should use these ratings and suggestions to work with article editors on improving article quality. The editor may also choose to invite either the original authors or a revising author to submit a major revision of targeted articles to improve quality. Original authors may make such revisions directly to articles, but revising authors’ submissions will need to undergo the peer review process outlined for major revisions.

The Editorial Board should make goals related to article quality (e.g., 90% of articles should have a quality rating of 4.0 or above) and should engage in efforts to continuously improve them. This includes reaching out to authors of articles with dated materials or articles that have not been updated in at least two years to ensure that contents are up-to-date. Any major updates to articles will be accompanied by an updated publication date, which may be included in curriculum vitaes and resumes.

Publishing and Peer Review Process

Open in Google Slides

Graphics and Styling

This encyclopedia seeks to provide a uniform aesthetic and user experience and uses a basic style guide to ensure that visuals follow a common theme between articles. Beyond generic APA 7 formatting required of all submissions, the Editorial Board employs the efforts of graphic designers and other professionals to make all visual content elements follow the EdTechnica Style Guide. This provides a sense of unity and an important level of production quality to all materials published in the encyclopedia.

Typography

Custom typography should not be used in encyclopedia articles, and all text should be represented as text as much as possible rather than as part of an image (e.g., figure captions should be cropped from images and provided as blocks of text).

Any text that is included in images, such as labels on charts, should generally utilize Arial or another san-serif font.

Colors

Content should effectively use whitespace, and color should only be used as a uniform accent in figures and other elements. Whenever possible, figures should use grayscale and the approved color palette for the encyclopedia. Text, tables, and other elements should never have color.

Figure 1

The color palette for encyclopedia visuals

Figure 2

A figure example of PICRAT that uses appropriate style guide colors

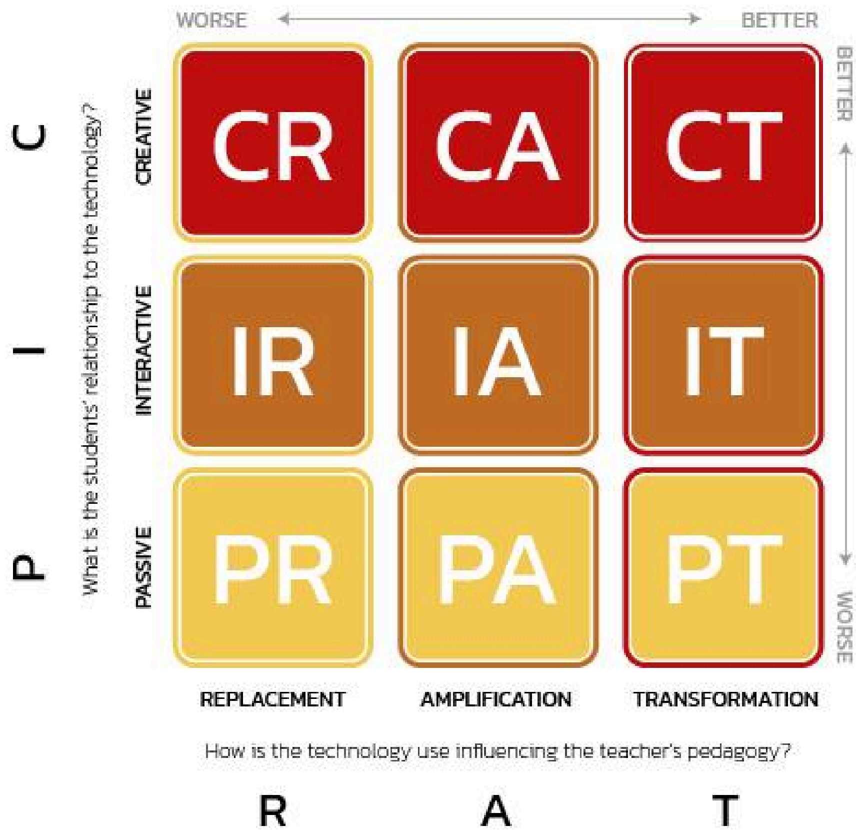
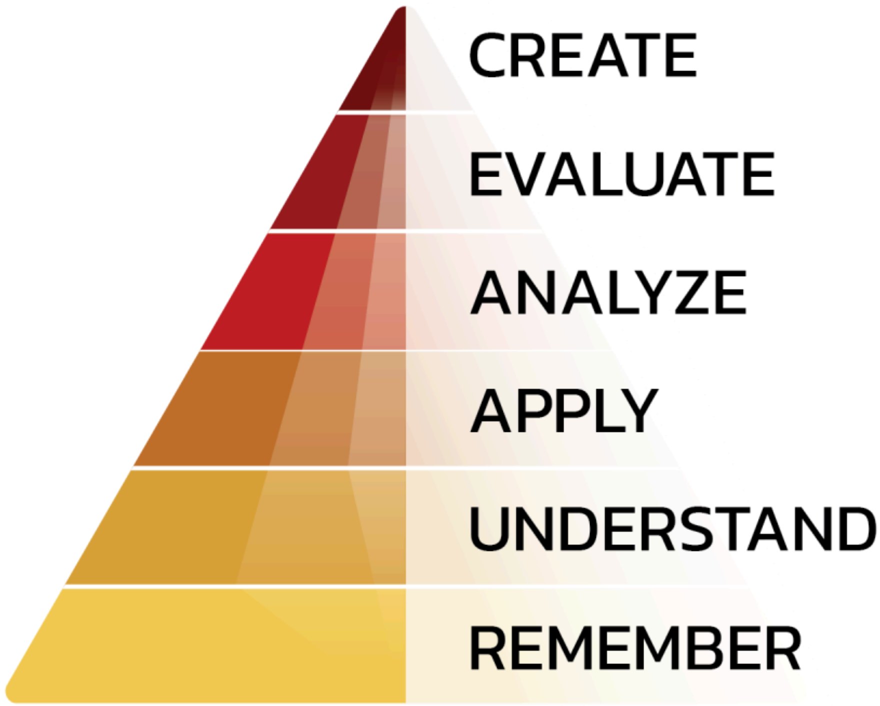


Figure 3

A figure example of Bloom's Taxonomy that uses appropriate style guide colors


CREATE
EVALUATE
ANALYZE
APPLY
UNDERSTAND
REMEMBER

Submit a Manuscript

EdTechnica uses an open call for submissions. However, to help authors to know what topics we are interested in receiving and to facilitate collaboration between prospective authors, we provide this Article Planning Sheet for anyone to view. Additionally, if you would like to propose a term/topic or would like to commit to writing an article, please contact the editors at editor@edtechnica.org.

Submission Steps

1. If submitting an Encyclopedia Article, check the Article Planning Sheet to see if your topic has already been proposed by another author. If it has, please consider choosing a different topic or contacting the committed authors to see if they might be open to collaboration.
2. Submit the Interest Form to let editors know you are interested in a topic. They will then add you to the Article Planning Sheet.
3. Create an account on EdTech Books by logging in with your Google or ORCID account.
4. Ensure that you have an email address listed in your profile. This is necessary so that we can communicate with you.
5. Review all guidelines for the type of submission you are proposing.
6. Submit your manuscript.

Submit a Manuscript

Interest Form

Open in a New Window

Planning Sheet

Open in Google Spreadsheets

ED
TECH
NICA

Reviewer Guide

This page provides guided instructions on how reviews should be conducted on new submissions and major revisions that are being considered for the encyclopedia. Submissions are only sent out for review after an initial editorial review has been conducted to ensure general content and stylistic alignment with the encyclopedia.

Signing Up

To volunteer as a reviewer, please send a resume or short CV to the Editorial Board.

Time Limit

To help streamline article reviews and to safeguard the donated time of our reviewers, we request that reviewers limit the amount of time they devote to reviews. Each review should take less than 30 minutes to complete, and time should be allotted as follows:

1. Receive the invitation to review email
2. Login to https://edtechbooks.org/-Rtr and accept or decline the review invitation (1 minute)
3. Read the article (less than 10 minutes)
4. Provide feedback to the authors answering the following questions (less than 15 minutes)
    a. Overall: How well does the article provide a general introduction to the topic for a novice adult, representing an international audience of educational technology researchers and practitioners?
    b. Concision: Does the article include any non-essential elements? If so, what?
    c. Completeness: Does the article leave out any essential elements (e.g., foundational work)? If so, what?
    d. Clarity: How well-written is the article (in terms of flow, readability, understandability)?
    e. Guidance: What changes should the author make prior to publication?
5. Provide feedback directly to the editor (optional, but less than 3 minutes)
6. Make a determination (1 minute)

If the review is taking longer than 30 minutes, then this is a sign that the article needs to be revised to improve flow, quality, or readability, and it should be marked for resubmission.

Grammar, Spelling, Formatting, and Punctuation

If grammatical, spelling, punctuation, or formatting changes should be made, please note this in generic terms in the author feedback and do not spend time correcting the manuscript. Such corrections are the responsibility of the original author (not the reviewer), and encyclopedia copyeditors can assist in some cases.

Timeline

Given the short length of articles in the encyclopedia and our streamlined review process, we encourage reviewers to accept and complete a review within 2 weeks of invitation.

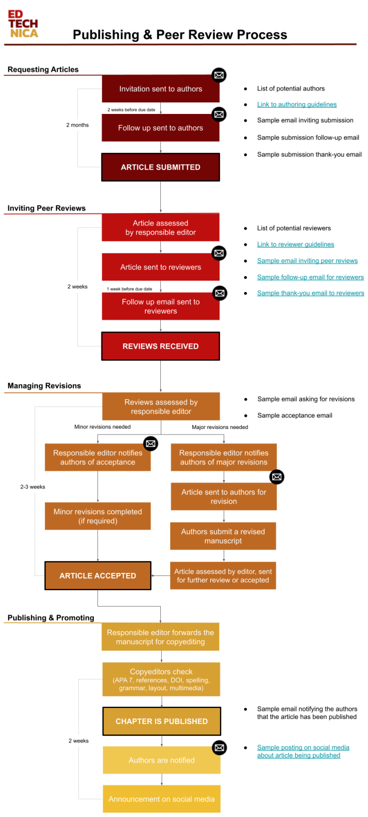
Acknowledgment

Every Review Board member will be acknowledged in the encyclopedia and will also receive an annual certificate documenting their participation and highlighting pertinent impact metrics of their efforts.

Figure 1

Example Award and Appreciation Certificates

Publishing and Peer Review Process



Student Internships

Student interns may be invited to assist the Review Board or Editorial Board for a term of one year with the possibility of renewal. Student interns will be acknowledged on the encyclopedia and receive a certificate of participation. Duties of interns may vary, but most will focus on editing support, graphic design, and manuscript management. Relevant skills for prospective interns include the following:

- Content Editing
- HTML/CSS Formatting
- Graphic Design (Adobe Illustrator)
- Communication
- Community Engagement
- Social Media Management
- Project Management
- Data Analysis

Some internships may be paid, depending upon funding availability. Interested students may reach out to the editorial board for information on current internship opportunities.

Current and Previous Student Interns

Policy Information

The information on this page is provided primarily for the benefit of Editorial Board members to assist in the administration and future development of the encyclopedia.

Contact Information

If you would like to contact encyclopedia personnel, please use one of the email addresses below:

- editor@edtechnica.org—Forwards to the current Editor-in-Chief
- info@edtechnica.org—Forwards to a designated Editorial Board member

The primary method of communication among the Editorial and Review Boards will be via Slack or email. The Slack channel may be accessed by board members here: https://edtechnica.slack.com/

Communications

EdTechnica uses a variety of opt-in/out email notifications, including the following:

- Alerts to readers for new articles.
- Alerts to reviewers (e.g., invitation to review, reminder, notification of decision).
- Alerts to authors for outdated articles that need updates.
- Alerts to authors of revisions and additional resources regarding decisions.

Inclusive Contribution and Equity Strategy

This encyclopedia seeks both (a) to be authoritative for the field by providing original authors and invested professionals with the ability to establish and explain the meanings of terms and concepts and (b) to be intentionally and proactively inclusive of various perspectives and contexts. Tension exists between these two aims as any attempt at providing a platform for authoritative voice can quickly lead to hegemonic power structures wherein the wealthy, privileged, or more-highly-educated can marginalize those with dissenting (or simply different) views, such as researchers at elite universities minoritizing the voices of K-12 teachers or North American and European scholars minoritizing the voices of other scholars throughout the world.

To help navigate this tension, the Editorial Board will lead efforts to ensure that the encyclopedia grows and evolves to become increasingly representative of and useful to educational technology professionals throughout the world. Some of these efforts are expected to include the following:

- Soliciting new articles from diverse researchers and practitioners.
- Requesting major revisions of articles and soliciting co-authors to incorporate missing and essential viewpoints.
- Inviting diverse scholars and practitioners to participate as reviewers.
- Ensuring that encyclopedia policies and practices are inclusive and do not place additional burdens or expectations upon minoritized contributors.
- Honoring the contributions of diverse authors via acknowledgments, certificates of contribution, and other meaningful recognitions.
- Leading grant-seeking efforts to provide stipends to under-represented and economically disadvantaged authors and reviewers (e.g., contributors from low-income countries, adjunct faculty, school teachers).

Strategic Invitation Planning Document

To help organize invitation campaigns of authors, editors may use the Strategic Invitation Planning Document. This document is not visible to the public.

Contributor Demographics Dashboard

To help ensure transparency and to support the encyclopedia’s commitment to inclusivity and representation, all reviewers and authors will be invited to provide simple demographic identifiers (e.g., gender, race, nationality). Aggregations of these data will be publicly available via a demographics dashboard and will help to inform the Editorial Board’s execution of the Inclusive Contribution and Equity Strategy.

Social Outreach and Marketing Strategy

The Editorial Board will maintain dedicated accounts on prominent social media platforms (e.g., Twitter, Instagram), promoting and sharing articles and announcements. Such communication might include the following:

- Spotlighting newly added or newly updated articles.
- Requesting nominations for the Editorial or Review Board.
- Requesting new articles, artifacts, or revisions.

All posts should include the #edtech and #edtechnica hashtags. Additionally, any shared images should include alternative text, and videos should provide captions to ensure accessibility.

Analytics and Metrics

Google Analytics will be enabled for the volume, and internal analytics will be enabled for the overall volume and each article.

Article authors will have access to their own article metrics, such as the following:

- Views
- Downloads
- Backlinks
- Ratings
- Feedback
- Citations

Editors will have access to the Google Analytics dashboard, which will provide additional metrics of use, including locations of users, relative popularity of articles, and so forth.

Others may also request access to data for scholarly purposes by contacting a site administrator.

Awards

Scholarly Excellence Award

This award is presented each year to authors of the highest quality and most impactful articles in the encyclopedia. Recipients are selected by the Editorial Board using relevant metrics (e.g., ratings, read counts). Each article may only receive this award once.

Reviewer Excellence Award

This award is presented each year to outstanding reviewers, and the recipient is selected by the Editorial Board.

EdTech Books Badges

In addition to these awards, EdTech Books also provides platform-level badges that are automatically awarded to authors. Some of these badges include the following:

- Four-star Author: Awarded if the author's articles have received at least 100 reader evaluations with an average score of 4.0 or higher on a 5.0 quality scale.
- Silver/Golden Book: Awarded if the author's works have been accessed a certain number of times (10,000/100,000).
- Silver/Golden Pen: Awarded if the author writes a certain amount of original content (10,000/100,000).

Digital Hosting and Technical Support

Digital hosting and technical support will be provided as a public service by EdTechBooks.org. Additionally, the EdTech Books platform will continue to be developed to meet the ongoing needs of the encyclopedia and its editorial and review boards.

Funding for this technological infrastructure is currently provided by Dr. Royce Kimmons and the Instructional Psychology and Technology department at Brigham Young University. As an openly-licensed volume, however, the encyclopedia can be copied to other hosting services as desired and is not restricted to this platform or funding structure in the future.

Access Methods

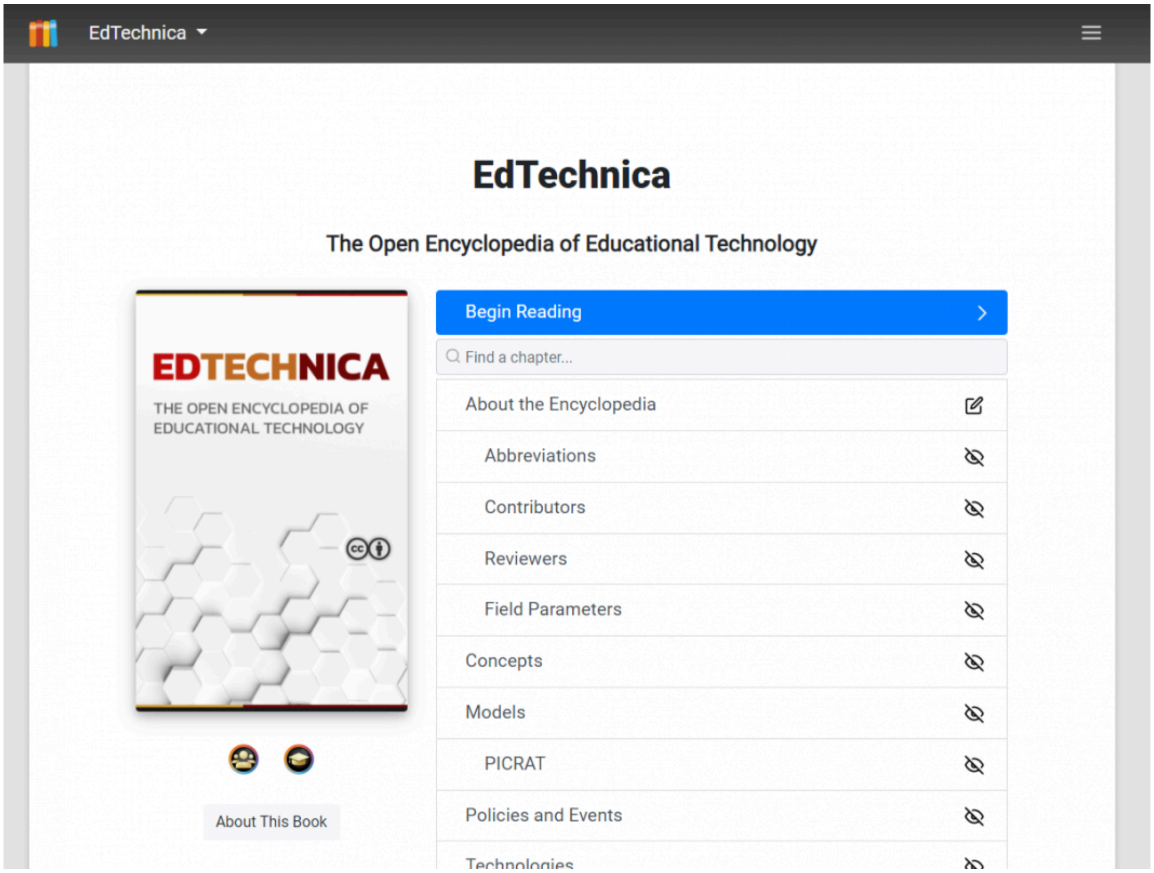
To improve usefulness and usability, it is anticipated that encyclopedia articles will be accessed via a variety of methods.

EdTech Books Generic Interface

EdTech Books has a generic book interface that lists all book contents on a single page here: https://edtechbooks.org/encyclopedia. This will be the default interface used by most editors and reviewers.

Figure 1

The generic EdTech Books interface

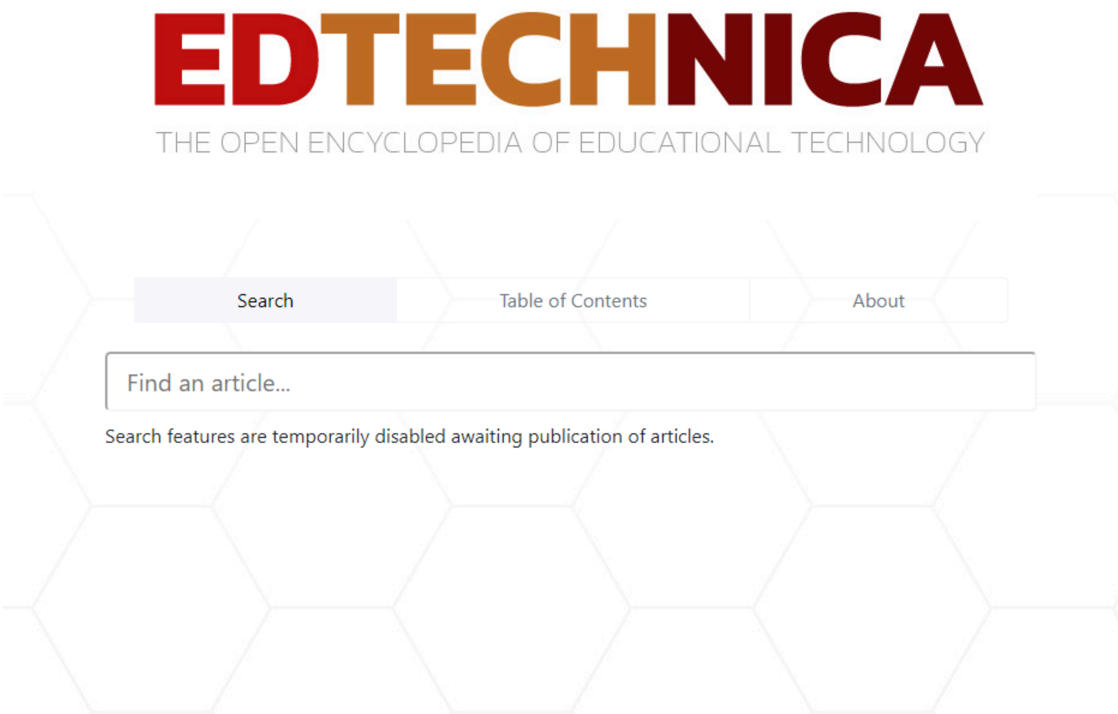


Quick-Search Interface on EdTechnica.org

Given the volume of articles we anticipate publishing, a quick-search interface will also be provided on EdTechnica.org, which will use caching and client-side javascript-enabled searching to allow for fast filtering of articles and definitions. It is anticipated this will be the primary interface used by most readers.

Figure 2

The EdTechnica.org quick-search interface



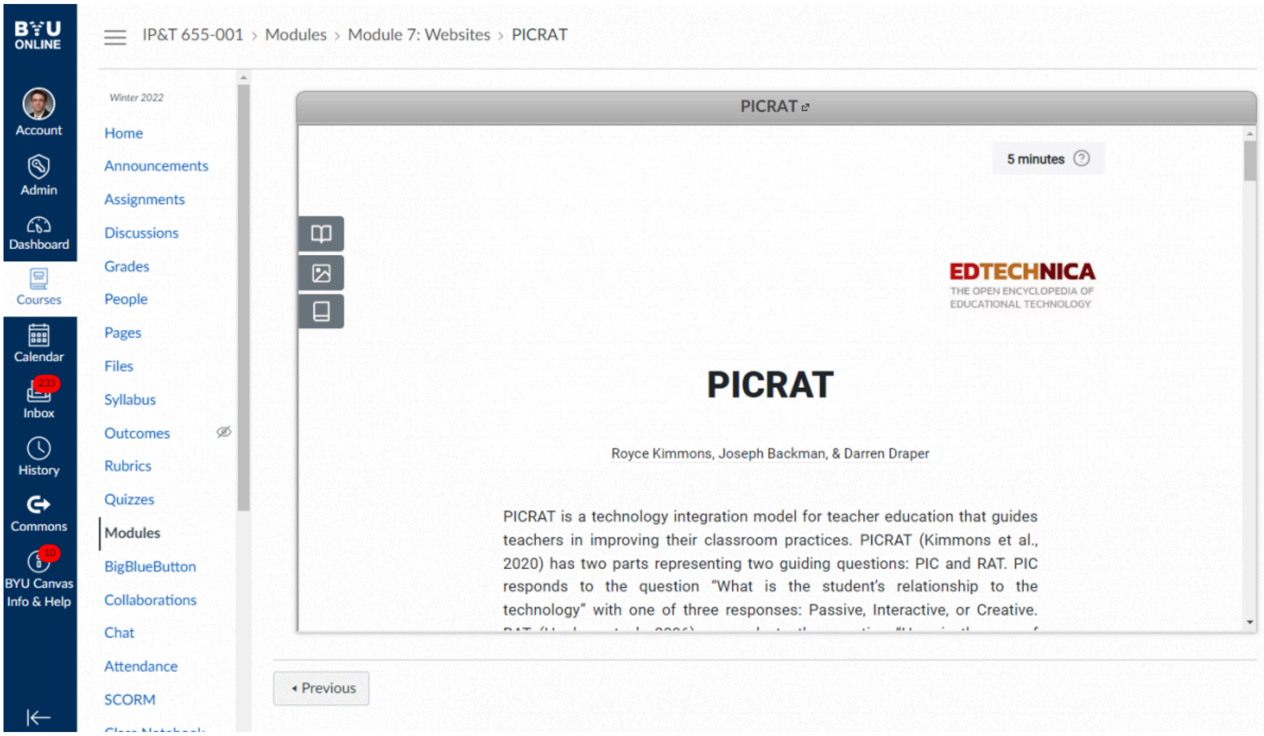
Embedding

All articles may be easily embedded via iframe into other sites. This means that content may be used in a variety of contexts and is the preferred method for including articles in learning management systems.

When embedding, either the normal view of the article or the simple view may be used. To use the simple view, add “/simple” to the end of the URL.

Figure 3

An example of an encyclopedia page embedded on Canvas using the simple view



EdTech Books Partner Cross-Listings

The encyclopedia may also be cross-listed on partner and institutional sites.

Other Apps

In addition, other apps and websites may provide access to encyclopedia articles using the EdTech Books API, provided that they display suggested citations and abide by licensing requirements.

Printed Versions

PDFs and other versions of articles and the entire encyclopedia will be available for download and printing, though there is currently no plan to provide a constantly-updated, print-on-demand version of the entire encyclopedia for 1-click orders. As the encyclopedia grows, however, abridged versions of the encyclopedia that provide targeted collections of articles may be compiled and made available via Amazon KDP or other services.

Collaborative Volumes

Professional organizations may collaborate with the Editorial Board to create joint calls for articles or to produce focused compilations of select articles. Such collaborations are encouraged and may be useful for providing focused, timely materials to a professional community.

Collaborative volumes should adhere to the following guidelines:

1. Articles should follow the same authoring guidelines and reviewing procedures as other articles in the Encyclopedia.
2. Articles should be released under a Creative Commons Attribution 4.0 license so that they can be cross-listed in multiple volumes.
3. Articles in focused volumes should cite EdTechnica as the original source.

Professional Partnerships

The encyclopedia currently has no professional partnerships.

Goals

Year 1: 2022

- Form Review Board
- Elect Editorial Board
- Initiate biannual meetings
- Publish 10 new articles

Year 2: 2023

- Publish 20 new articles

Year 3: 2024

- Publish 30 new articles
- Revise/update articles published prior to 2023

Year 4: 2025

- Publish 30 new articles
- Revise/update articles published prior to 2024

Year 5: 2026

- Publish 30 new articles
- Revise/update articles published or updated prior to 2025

Ideas for the Future and Technical Roadmap

- Add micro-revision suggestion capability
- Add additional resources submission capability
- Add opt-in alerts features for readers, authors, and reviewers
- Allow viewing of historical versions and revisions of articles
- Add a contribution type of Short Entry or Essay
- Add a contribution type of Critique
    - Critiques are short articles focused on critical dialogue—correcting misconceptions, dispelling popular myths, or challenging theories or other beliefs—that would be helpful for the community.
- Further streamline review system to use a form
- Add automatic text-to-speech conversion using Amazon Polly or another service

References

Kimmons, R. (2018). The 5 C Guidelines: Prioritizing Principles for Good Academic Writing. In R. Kimmons & R. E. West, Rapid Academic Writing. EdTech Books. https://edtechbooks.org/rapidwriting/5Cs

Williams, D. D., & Kimmons, R. (2022). Qualitative Rigor: How do I conduct qualitative research in a rigorous manner? In R. Kimmons, Education Research: Across Multiple Paradigms. EdTech Books.

https://edtechbooks.org/education_research/qualitative_rigor

Authorship Acknowledgement

Most of the encyclopedia's policy documents were originally drafted by Dr. Royce Kimmons. They were then shared with members of the educational technology community, who made many suggestions, edits, and comments. As such they reflect the collaborative work of many individuals, including the following:

- Royce Kimmons
- Maha Bali
- Aras Bozkurt
- Emily Bradshaw
- Jeffrey P. Carpenter
- Camille Dickson-Deane
- Karen D. French
- Theresa Holmes
- Isa Jahnke
- Gloria Mora
- Angelica Pazurek
- Enilda Romero-Hall
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- Cassie Scharber
- Jill E. Stefaniak
- Bon Stewart
- Andrew Tawfik
- Torrey Trust
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- Duane Wilson

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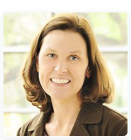

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Matthew Armstrong

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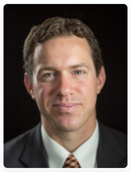

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Professor Clark Asay joined the BYU Law faculty in June 2014. Before coming to BYU, Professor Asay was a Visiting Assistant Professor and Shughart Scholar at Penn State's Dickinson School of Law fro...

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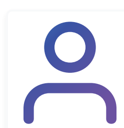
Anu is an Instructional Designer (MS. Instructional Design & Tech) currently working in the healthcare sector. Her career background is in education and training. Her inspiration for course design is ...



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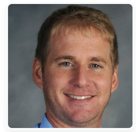
Professor Mark Brown is Ireland's first Chair in Digital Learning and Director of the National Institute for Digital Learning (NIDL). He has over 30-years of experience working in the area of blended,...



Jeffrey P. Carpenter

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I study educators' self-directed professional learning experiences via social media and have published on educators' uses of Instagram, Twitter, Pinterest, and Reddit. I have multiple research pro...

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Bradley University

Chad Clark is an Assistant Professor and Director of the Doctor of Education in Educational Technology program at Bradley University. Dr. Clark seeks to harmonize established educational theories with...

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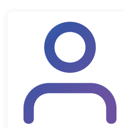

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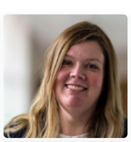

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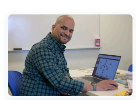

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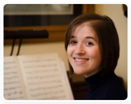

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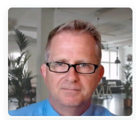

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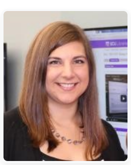

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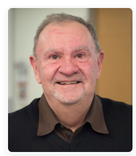

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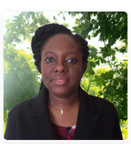

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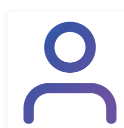

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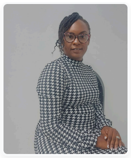

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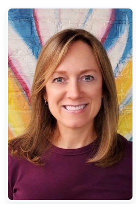

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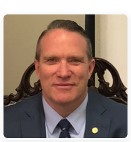

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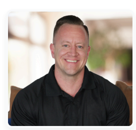

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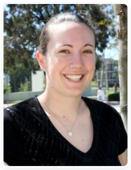

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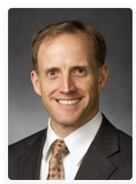

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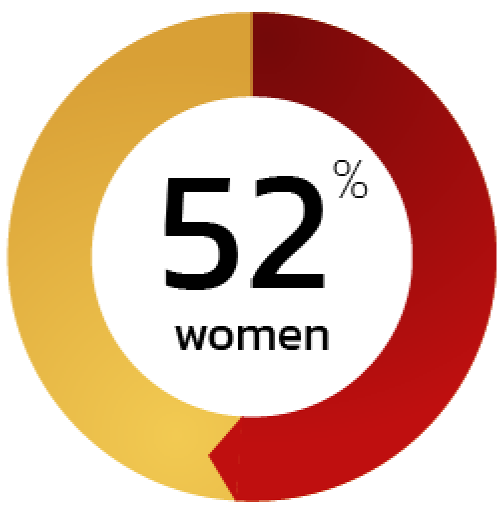

Nada Alsayegh

Camey L. Andersen

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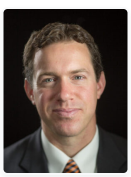

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Professor Clark Asay joined the BYU Law faculty in June 2014. Before coming to BYU, Professor Asay was a Visiting Assistant Professor and Shughart Scholar at Penn State's Dickinson School of Law fro...

Joe Backman

Alpine School District

Dr. Joe Backman, Curriculum Director of Professional Learning and Elementary Mathematics for Alpine School District (largest in Utah) has led out on professional learning in all 62 elementary schools ...

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Idaho State Board of Education

TJ Bliss is a change-maker in higher education. He focuses on making change with people by building strong relationships of trust, and has proven track records in education leadership, philanthropy, f...

Fanny Eliza Bondah

Brigham Young University

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Jered Borup

George Mason University

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Aras Bozkurt

Anadolu University, Turkey

Aras Bozkurt is a researcher and faculty member in the Department of Distance Education, Open Education Faculty at Anadolu University, Turkey. He holds MA and PhD degrees in distance education. Dr. Bo...

Anuoluwapo (Anu) Brahim

University of Tampa, Florida

Anu is an Instructional Designer (MS. Instructional Design & Tech) currently working in the healthcare sector. Her career background is in education and training. Her inspiration for course design is ...

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Mark Brown

Dublin City University

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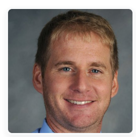

Jeffrey P. Carpenter

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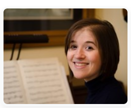

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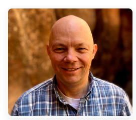

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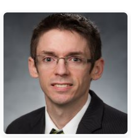

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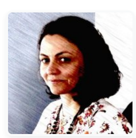

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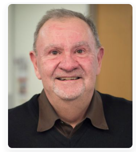

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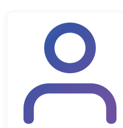

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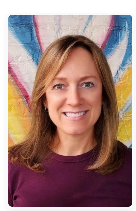

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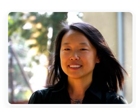

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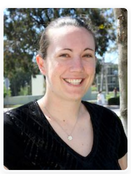

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Abbreviations

The educational technology field relies upon many abbreviations (e.g., acronyms, initialisms) in both technical literature and common language that may be difficult for novices to decipher. This page provides a simple key for interpreting many common abbreviations that community members are likely to encounter.

Abbreviation	Meaning(s)	Acronymic Pronunciation
AI	Artificial Intelligence	
AR	Augmented Reality	
CC	Creative Commons	
CT	Computational Thinking	
CMS	Content Management System	
DBL	Decision-based Learning	
DBR	Design-based Research OR Design Research	
FERPA	Family Educational Rights and Privacy Act (U.S.)	*FEHR-puh*
FOSS	Free and Open-Source Software	*FOHS*
HEI	Higher Education Institution	
ID	Instructional Design	
ISD	Instructional Systems Design	
IHE	Institution of Higher Education	
IT	Instructional Technology or Information Technology	
LMS	Learning Management System	
LD	Learning Design	
LX	Learner Experience	
LXD	Learner Experience Design	
ML	Machine Learning	

Abbreviation	Meaning(s)	Acronymic Pronunciation
MOOC	Massive Open Online Course	*MOOHK*
NLS	New Literacy Studies	
NPS	Networked Participatory Scholarship	
OER	Open Educational Resource	
OEP	Open Educational Practice	
OPM	Online Program Management	
PBL	Project-based Learning OR Problem-based Learning OR Practice-Based Learning	
PCK	Pedagogical Content Knowledge	
PICRAT	Passive, Interactive, Creative, Replacement, Amplification, Transformation	*PICK-rat*
PLE	Personal Learning Environment	
PLN	Professional Learning Network	
PM	Project Management	
RAT	Replacement, Amplification, Transformation	*RAT*
SAMR	Substitution, Augmentation, Modification, Redefinition	*SAM-ehr*
SME	Subject Matter Expert	*SMEE*
SNS	Social Networking Site	
SWAYAM	Study Webs of Active-Learning for Young Aspiring Minds	*SWAI-yahm*
TAM	Technology Acceptance Model	*TAM*
TPACK	Technological Pedagogical Content Knowledge	*TEE-pack*
UDL	Universal Design for Learning	
UX	User Experience	
UXD	User Experience Design	
VR	Virtual Reality	

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Academic Communities of Engagement (ACE) Framework

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Communities | Blended Learning | Online Learning | Online | Engagement | Student Engagement | Support | Blended

The Academic Communities of Engagement (ACE) framework was originally created to identify the critical factors that limit or facilitate students' ability to engage in online and blended learning environments (Borup et al., 2020). Specifically, the ACE framework builds on previous educational psychology research that has three interconnected dimensions of engagement: affective, behavioral, and cognitive (the ABC dimensions of engagement). Within a blended or online learning environment, students can independently engage in learning activities without the support of others. However, much of the existing research has assumed the in-person learning environment and has not considered the affordances and constraints of online and blended environments that can facilitate or inhibit a learner's ability to engage in learning activities. For instance, the nature of asynchronous online courses can leave learners feeling isolated and require that they exercise more self-regulation abilities compared to their in-person counterparts. These challenges are reflected in online learning's relatively high attrition rates (Freidhoff, 2021). When online learners' ability to independently engage affectively, behaviorally, and/or cognitively is insufficient, they require support from others to be successful. The ACE framework defines the ABC dimensions of engagement and explains how environments, communities, and learner characteristics can limit or facilitate academic engagement.

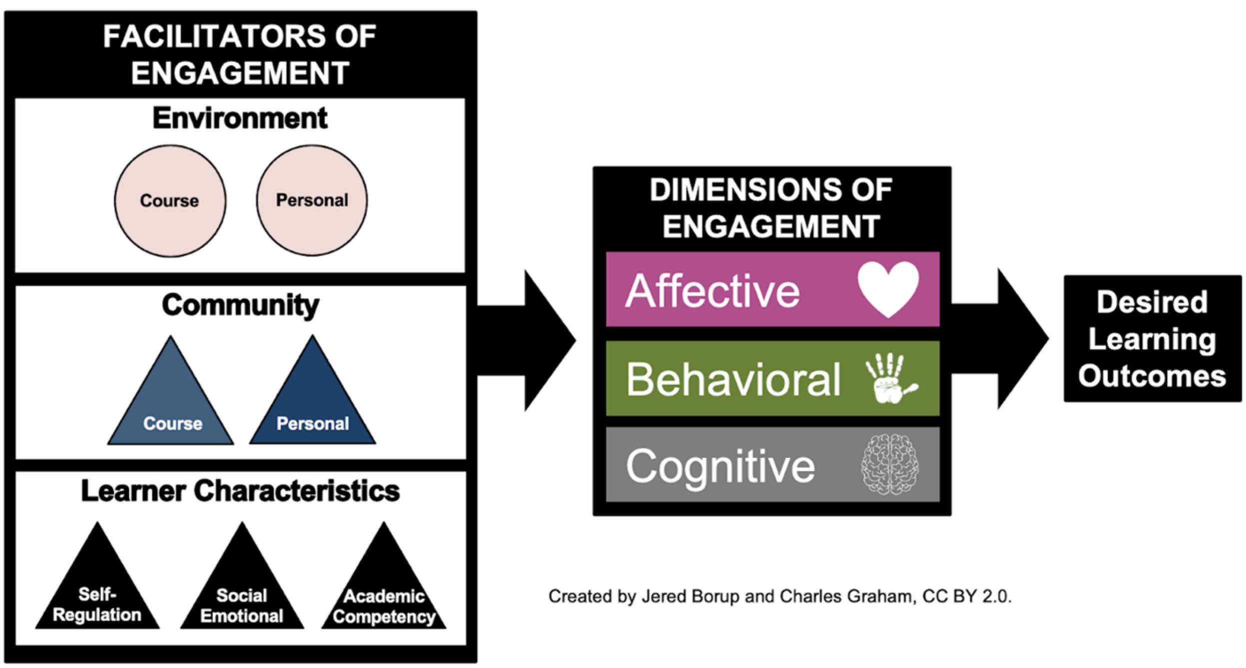
Despite its importance to learning outcomes, learner engagement has been generally ill-defined. In fact, many researchers within the field of instructional design and technology have used the term without providing any definition at all (Henrie et al., 2015; Martin & Borup, 2022). Those who have attempted to define learner engagement have agreed that it is multidimensional. However, researchers commonly disagree on which dimensions to include and how to define them (Christenson et al., 2012). While disagreements will likely always exist (Fredricks, 2011), some researchers have coalesced around three dimensions of learner engagement. Building on this research, the authors of the ACE framework operationalized the dimensions as follows (Borup et al., 2020):

- Affective engagement: “The emotional energy associated with involvement in course learning activities” (p. 813). Example indicators of affective engagement include situational and personal interests, enjoyment, confidence, and happiness.
- Behavioral engagement: “The physical behaviors (energy) associated with the completing course learning activity requirements” (p. 813). Example indicators of behavioral engagement include attendance, completing/submitting work, time on task, and following procedures/directions.
- Cognitive engagement: “The mental energy exerted towards productive involvement with course learning activities” (p. 813). Example indicators of cognitive engagement include attention, concentration, and use of cognitive/metacognitive strategies.

The ABC dimensions of engagement are influenced by “facilitators” that support or hinder engagement (see Figure 1). Students’ abilities to academically engage in online and blended learning activities can vary widely and are dependent on their background and characteristics such as self-regulation abilities, socioemotional abilities, academic competency, and previous online and blended learning experiences. Dimensions of engagement are also influenced by the learner’s personal and course environments and communities (see Figure 1). While there is overlap between environments and communities, the distinction made by the ACE framework is that the environment is the physical location (the where) and materials/activities (the what) and the communities are formed by support actors (the who).

Figure 1

ACE framework image depicting the relationship between facilitators of academic engagement, dimensions of academic engagement, and desired learning outcomes.



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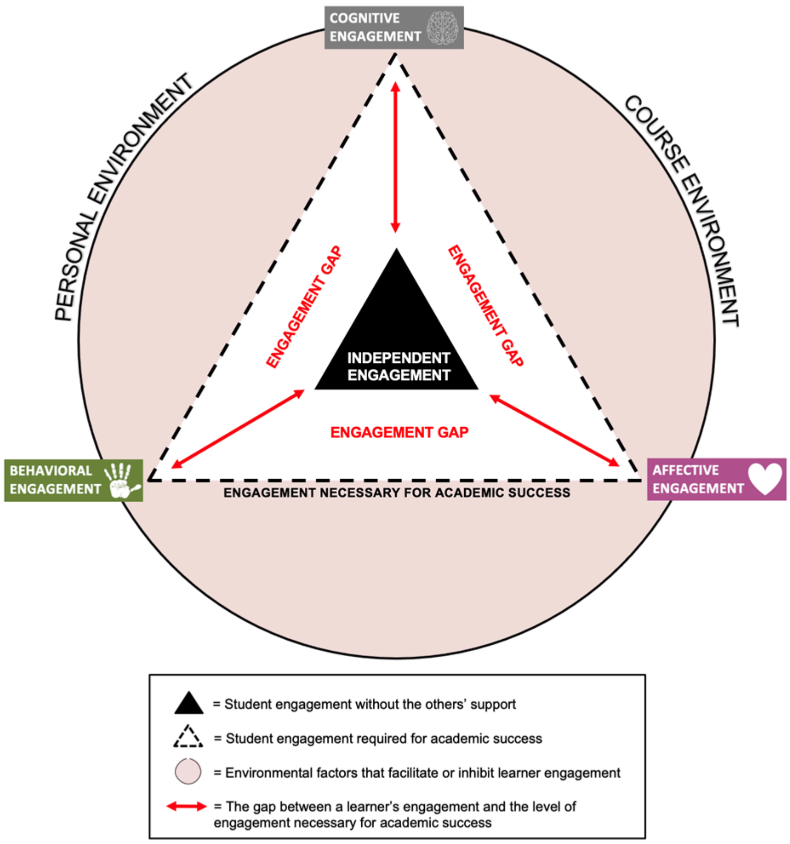
Supporting and Increasing Learner Engagement

Learner engagement is malleable, shaped by changes to the learner’s personal and course environments. Even in well-designed and organized environments, there likely exists a gap between a learner’s independent engagement (or the ability to engage in learning activities without support) and the level of engagement necessary for academic success (see Figure 2). As a result, support offered by actors within the learner’s communities is an important facilitator of learner engagement.

Figure 2

ACE framework image depicting the gap between a student's ability to engage independently and the level of engagement needed for academic success.



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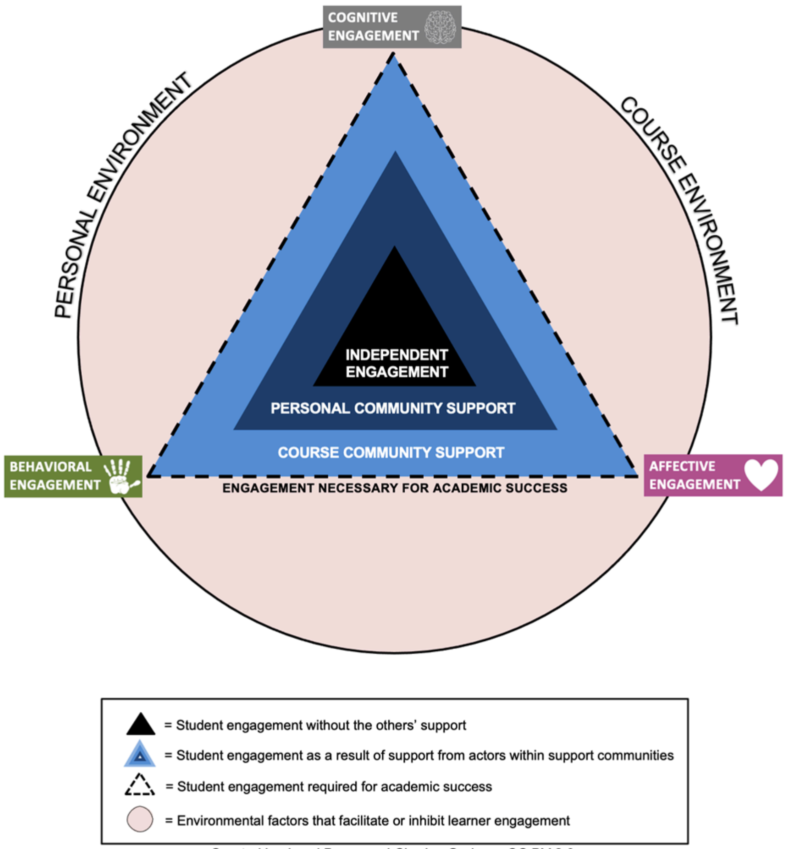
Similar to how sociocultural learning theories describe support for knowledge construction, the primary claim of the ACE framework is that a student's individual ability to independently engage affectively, behaviorally, and cognitively can increase when supported by others. The ACE framework originally grouped support actors within the two communities (see Figure 3):

1. The personal community of support includes support actors such as family and friends who have formed long-lasting relationships with the learner outside of the course.
2. The course community of support includes support actors such as instructors and other students that formed relationships with the learner because of their enrollment in a course or program. These relationships tend to be temporary and not meaningfully extend beyond the duration of the course.

Figure 3

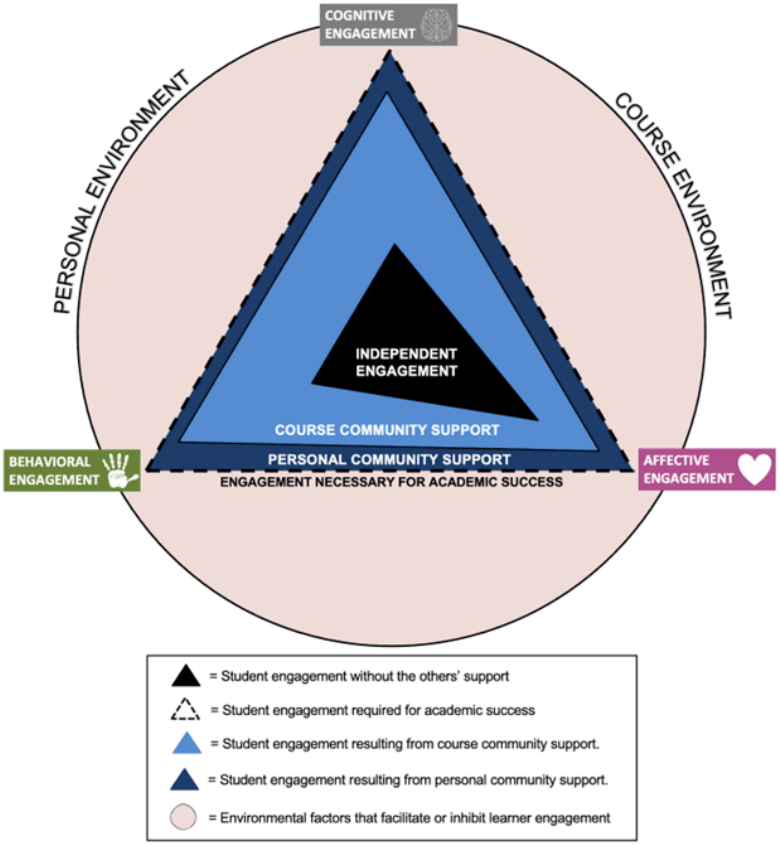
The original ACE framework described two primary engagement support communities at the personal level and course level.



While independent engagement is represented by an equilateral triangle, in reality a student's ability to engage can vary across the different dimensions. Similarly, the support students receive can be asymmetrical. For instance, in Figure 4, a student has high affective engagement but low behavioral and cognitive engagement. They received a high level of support from their course community and much less support from their personal community. The order that the communities are represented in the figure are largely arbitrary and can be changed if the researcher chooses. For instance, in the following figure, we swapped the location of the support communities with the inner triangle representing the course community support and the outer triangle representing the personal community support.

Figure 4

The ACE framework with high course community support



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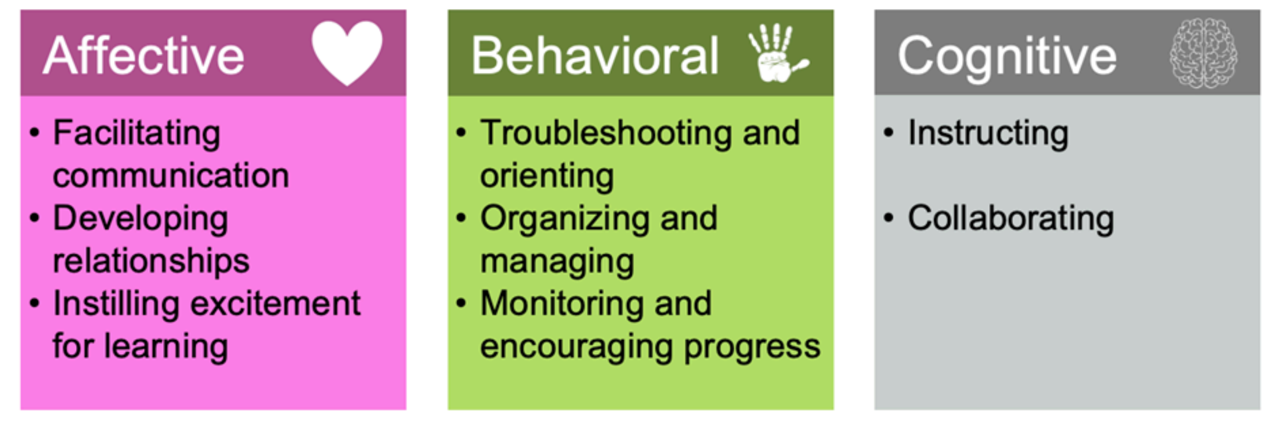
Following a review of the literature and the completion of a series of case studies in various online and blended contexts, the ACE framework authors offered some possible support elements for learner engagement and aligned them with the three dimensions of engagement (see Figure 5). Specifically, the authors of the ACE framework proposed the following:

- Affective engagement would likely increase with support elements of facilitating communication, developing relationships, and instilling excitement for learning.
- Behavioral engagement would likely increase with support elements of troubleshooting, orienting, organizing, managing, monitoring, and encouraging progress.
- Cognitive engagement would likely increase with the support elements of instructing and collaborating.

Figure 5

Support elements for the ABC dimensions of engagement as proposed by the original ACE framework.



The Future of the ACE Framework

Since its publication in 2020, researchers have adapted the ACE framework to a variety of settings. In the appendix, we share three adaptations that provide important insights into:

- The dynamics between independent engagement, personal community, and course community.
- The value of both the local and global course communities.
- The importance of adding the school/institutional community of support.

As a relatively new framework, additional case studies will continue to help refine and/or expand aspects of the ACE framework. Measures of the framework should also be developed and validated. This type of research is best done collaboratively with stakeholders and will be especially important if we are to identify strategies to increase learner engagement.

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Appendix: ACE Framework Adaptations

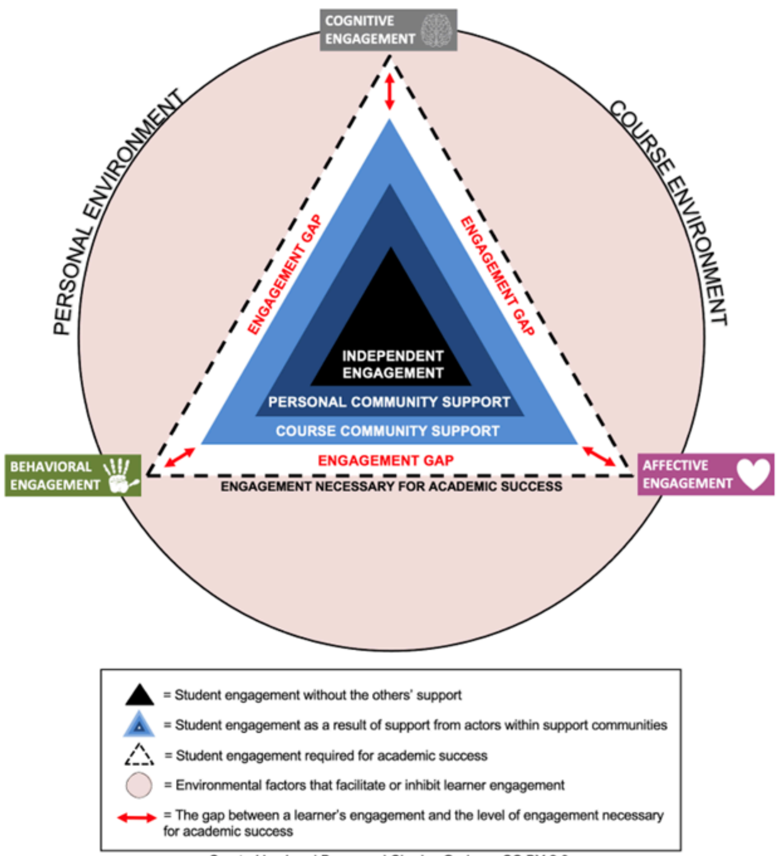
When first published, the authors of the ACE framework called for future research to confirm, refine, and/or expand on the framework. In the following sections, we highlight three cases of the ACE framework that have made important adaptations.

The Dynamics Between Independent Engagement, Personal Community, and Course Community

In their research at a full-time cyber charter school, Hanny et al. (2023) conducted and analyzed parent interviews to better understand parents' efforts to support their children's ABC engagement. They found that parents commonly identified a gap between their child's engagement with current level of support and the amount of engagement that was necessary for academic success (see Figure 6).

Figure 6

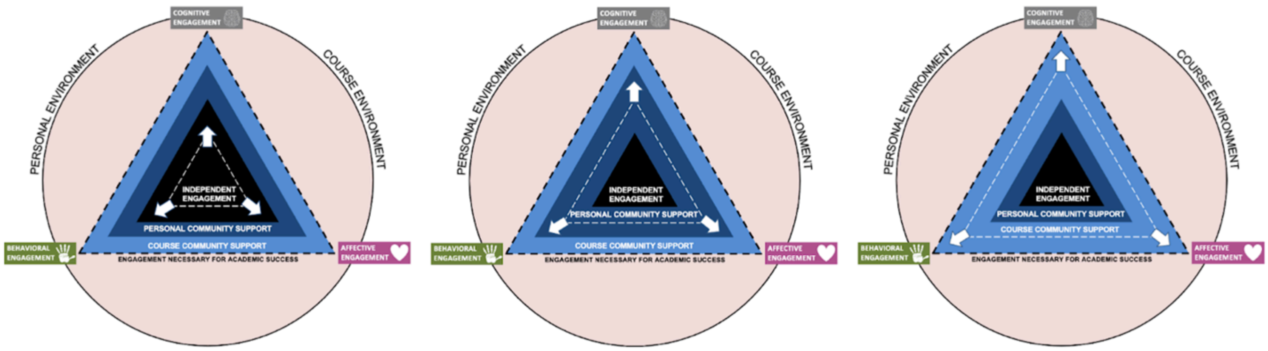
The ACE framework with an engagement gap between a learner's engagement following support and the engagement necessary for academic success.



Parents addressed this engagement gap in three ways. First, parents worked to increase their child's ability to independently engage in learning activities, often by helping them to develop better self-regulation and socioemotional skills. Second, parents worked to increase their own knowledge and skills so that they could offer their child more effective support. Third, parents advocated for their child to increase the levels of support offered by the support actors within the course community (see Figure 7).

Figure 7

Three ways that parents work to close the engagement gap for their students, (1) (left) by increasing their child's ability to independently engage, (2) (center) by increasing their own ability to support engagement, and (3) (right) by advocating for greater support from those in the course community.



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Local and Global Course Communities

Several studies have applied the ACE framework to contexts with multiple, distinct environments and communities within the same course. For instance, when Shin and her colleagues (Shin et al., 2022) offered a Massive Open Online Courses (MOOC) to teachers of English throughout the world, they learned that some of the MOOC participants were also attending in-person MOOC camp sessions facilitated by local experts. In their research, they used the ACE framework to better understand how in-person MOOC camps in Brazil, Vietnam, and Peru impacted learners' ABC dimensions of engagement. Their analysis of interviews with MOOC camp participants and facilitators found that the local MOOC camps offered important support that increased engagement in the MOOC (offered only in English). The camps helped participants to better persist through the MOOC activities and transfer their learning to their teaching. This local course community provided linguistic support for teachers whose levels of English language proficiency could not support comprehension of the MOOC content. In addition, the camps offered content support by experts who could situate the global MOOC content within the local culture and context. As a result, Shin et al. (2022) adapted the ACE framework for culturally and linguistically learners (ACE-CLD) to include three communities and environments: the personal community/environment, the in-person local course community/environment, and the global online community/environment (see Figure 8 and 9).

Figure 8

Adapted figure to include the global and local course environments and communities as facilitators of engagement.

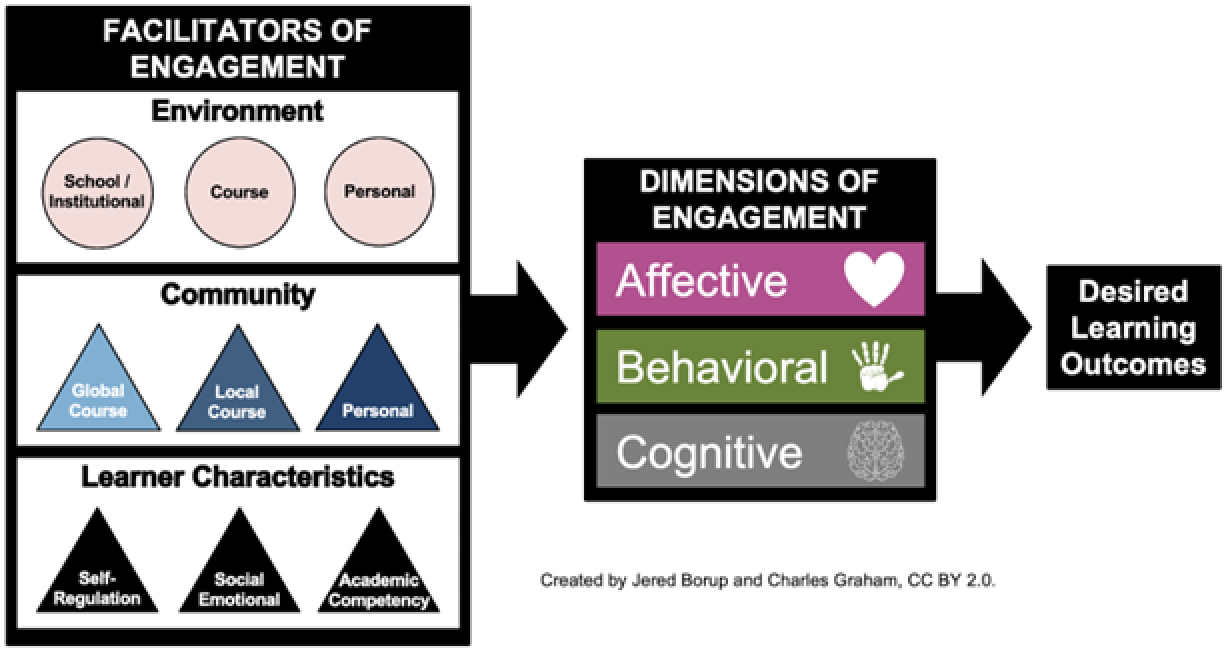

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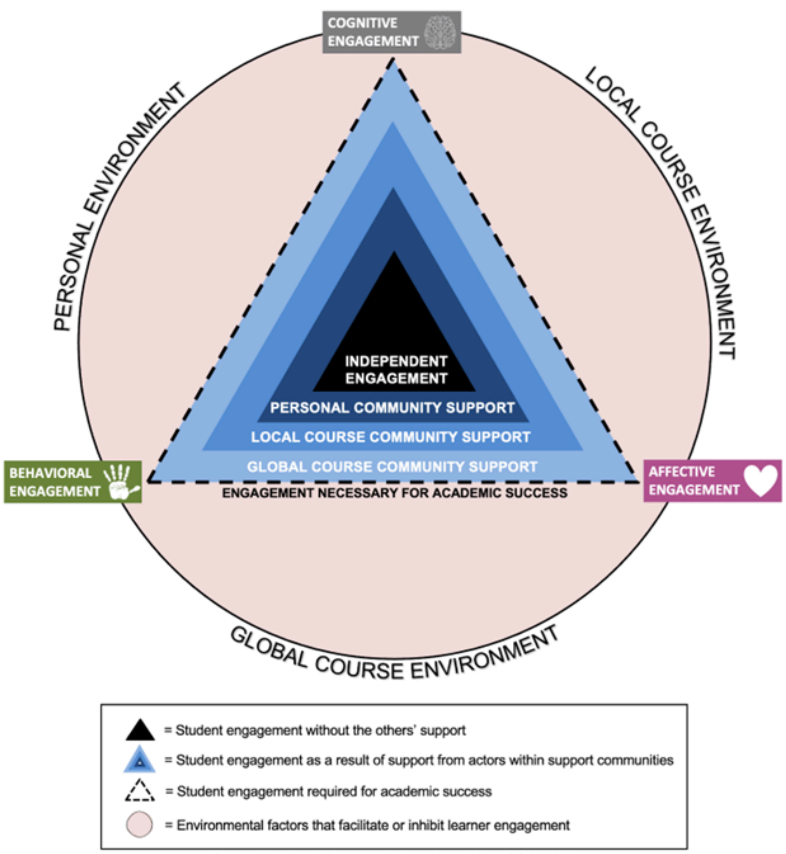
Figure 9

The adapted ACE figure with local and global course communities of support



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A similar distinction has been made between local and online course communities and environments. For instance, Spring et al. (2023) examined a blended program where university students enrolled in online courses but also attended weekly local, in-person sessions to discuss their learning with peers. Unlike the MOOC camps described by Shin et al.

(2022), these discussions were facilitated by volunteers who were not experts in the different course content areas but knowledgeable at fostering a supportive learning community. As a result, the facilitators were best equipped to support affective and behavioral engagement, and the online teacher supported cognitive engagement. Similarly, Borup and his colleagues conducted a series of case studies examining a learning model where high school students enrolled in one or two online courses and completed the courses under the supervision of an on-site facilitator in a classroom environment. In these cases, the in-person community and environment offered the learner support that their online community and environment did not or could not provide.

School/Institutional Community of Support

The original ACE framework did not include the school/institutional community of support. However, current applications of the ACE framework at the institutional level have found there are environmental and community facilitators/barriers to engagement that can be addressed at the institutional level (Spricigo et al., 2023; Tuiloma et al., 2022). While it is possible to combine the course and school communities, there are advantages and precedent to separating them. For instance, Rovai and colleagues developed measures for learners' sense of community at the course and school levels (Rovai, 2002; Rovai et al., 2004). Similarly, Skinner and Pitzer (2012) distinguished between engagement in the classroom and with the school. Others have also distinguished between support offered to online learners at the institution level and the course level (Thrope, 2002; Trespalacios et al., 2023). This type of distinction, can provide a broader and more nuanced understanding of a learner's engagement and various support actors and the supports they provide. This is especially important when learners are enrolled in multiple courses at a single school/institution and less important when learners are only enrolled in a single course and do not engage with the school/institution.

Figure 10

Adapted figure to include school/institutional course environment and community as facilitators of engagement.

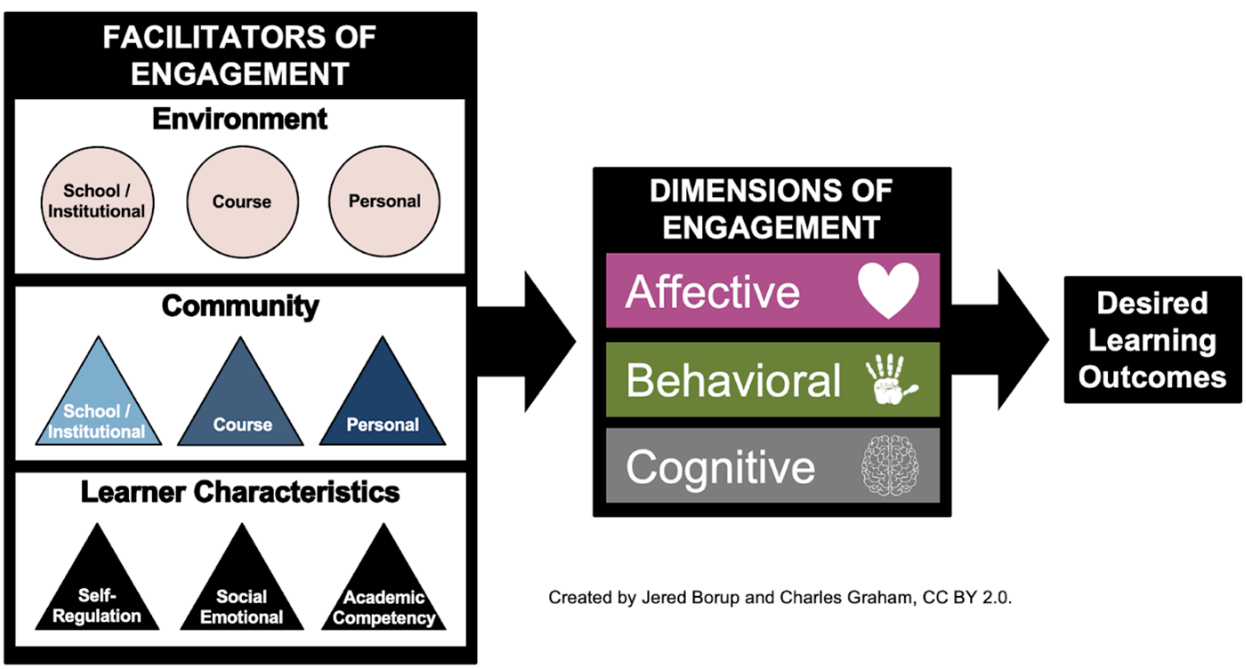
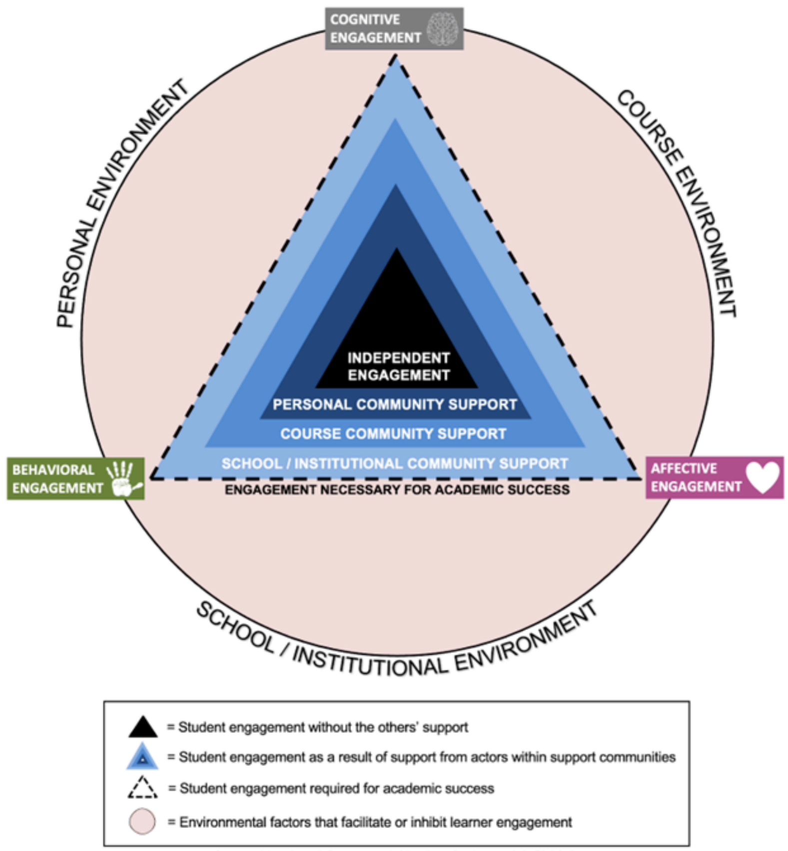


Figure 11

The adapted ACE figure with school/institutional community of support.



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Augmented Reality

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Augmented Reality · Constructivist Learning · Learning Experience · Inquiry-Based Learning · Interactive Simulation · Situated Learning · Virtual Classroom

Augmented Reality (AR) is the integration of digital information, such as images, videos, or 3D models, into the real-world environment, providing an enhanced perception of reality (Yuen, 2011). By overlaying digital information onto the real world, AR enhances the learning experience and provides students with interactive and immersive educational content (Bower et al., 2014). This article explores the concept of AR and its significance in motivating learners, simplifying complex concepts, and creating a dynamic and inclusive learning environment. Additionally, theories that support the integration of AR in educational technology are discussed, followed by myths related to AR and a glimpse into the future of AR in EdTech.

Augmented reality (AR) has a rich history dating back to the 1960s, with its origins in computer graphics and virtual reality research. In 1968, Ivan Sutherland developed the first head-mounted display, laying the groundwork for AR devices. In 1992, Tom Caudell coined the term “augmented reality” to describe a digital display system used in aircraft assembly. However, it was not until the late 20th century that AR gained momentum. The development of smartphones, improvement in processing and rendering, improved cameras, and other advanced computing capabilities in the 2000s enabled widespread AR adoption. Notable milestones include the launch of ARToolKit in 1999 and the release of Pokémon Go in 2016, which popularized AR among consumers. Since then, AR has been steadily advancing and finding its way into various industries, including education (Aggarwal & Singhal, 2019; Caudell & Mizell, 1992). Today, AR is typically experienced through devices like smartphones, tablets, or wearable devices that use cameras, haptics, and sensors to detect the user’s surroundings and display relevant digital information (Hosch, 2023).

Benefits in Education

By bridging common gaps between concepts and the physical world, AR can enable learners to explore complex concepts in a hands-on manner, increasing their motivation to learn (Billinghurst & Duenser, 2012). AR can also offer dynamic and interactive learning experiences that actively involve students in the educational process. Through gamification elements and interactive simulations, AR allows passive learners to become active participants, resulting in higher engagement levels (Ainajdi, 2022). Catering to diverse learning needs, AR can also support differentiated learning by offering customizable content and adaptive learning experiences (Kaufmann & Schmalstieg, 2003), including providing new strategies for teaching students with special needs, such as autism (Berenguer, 2020).

Augmented Reality (AR) has also shown potential in enhancing different pedagogical approaches (Shelton, 2020), including the following:

- **Constructivist Pedagogy.** AR can be used to encourage deep engagement with tasks, concepts, and resources through information overlays (Kerawalla et al., 2006).
- **Situated Learning.** AR can help integrate educational experiences within real-world environments, bridging the gap between classrooms and reality (Chen & Tsai, 2012; Dede, 2009).
- **Game-based Learning.** AR can be used for immersive digital narratives, providing authentic resources, feedback systems, and practice in transferring skills to real-life applications (Dunleavy et al., 2009; Klopfer & Squire, 2008).
- **Inquiry-based Learning and Problem-based Learning.** AR can offer contextually relevant information and virtual models for analysis and exploration within the context of solving problems in the external world (Johnson et al., 2010).

Myths and Disambiguation

Augmented Reality (AR) is often wrongly associated with Virtual Reality (VR). However, AR stands as distinct from VR by overlaying virtual content onto the real world, seamlessly blending physical and digital worlds together, in an attempt to enhance the real world, while VR replaces the real world with immersion into an artificial environment (Parekh et al., 2020). Educators must grasp this fundamental difference to make informed decisions when integrating AR into the learning process, as each approach provides unique benefits and challenges (Nur Fitria, 2023).

In addition to understanding the distinction between AR and VR, it's also essential to grasp the differences between Extended Reality (XR) and Mixed Reality (MR). XR serves as an umbrella term encompassing various immersive technologies, including AR, VR, and MR (Alnagrat et al., 2022). While AR overlays digital elements on the real world, MR goes a step further by merging digital and physical environments interactively. MR introduces a spectrum ranging from the real world with minimal digital elements at one end to the virtual world with minor real-world components on the other end (Rauschnabel et al., 2022). Recognizing these distinctions is crucial as each of these technologies has unique affordances and applications, particularly in the field of education.

Another prevalent misconception is that AR is limited to gaming. Although it gained popularity in gaming initially, AR's potential extends to education, healthcare, retail, everyday tasks, and more (Parekh et al., 2020). Many AR applications do not incorporate any game mechanics but rather provide user-friendly ways to allow learners or users more broadly to quickly access information and to make sense of or to more deeply understand the world around them (Boardman et al., 2019).

Future Progress

The future of AR may involve exploring methods for implementing touchless hand interactions in real time, leveraging machine learning agents, and integrating remote learning components into AR applications designed for educational purposes. In parallel, the recurrent mentions of artificial intelligence, virtual reality, and augmented reality in comparison to other modalities persist as processing and graphical rendering capabilities steadily become more compact and cost-effective through the utilization of headsets, smartphones, and haptic devices. This underlines the continued likelihood of sustained attention directed towards these technologies (Kimmons & Rosenberg, 2022).

AR experiences will become more seamless and immersive with expectations including improved AR hardware, such as lightweight and affordable smart glasses, making AR more accessible to learners. Additionally, advancements in artificial intelligence and machine learning will enhance AR's ability to personalize educational content and make sense of real-world objects (e.g., faces, locations).

Moreover, collaborative AR experiences will enable individuals from different locations to interact and learn remotely, fostering increased global collaboration and cultural exchange. As AR applications expand, we may witness the further development of virtual classrooms, where learners can more easily gather in shared virtual spaces and engage in collaborative learning activities.

In conclusion, Augmented Reality (AR) has the potential to significantly influence education by providing more immersive, interactive, and connected learning experiences. It can motivate learners, simplify complex concepts, cater to diverse learning needs, and create dynamic learning environments. By supporting constructivist, situated, games-based, and inquiry-based pedagogies (Shelton, 2020), AR holds promise for enhancing student engagement and understanding. However, it is crucial for educators and policymakers to address challenges such as cost, content quality, privacy, ethics, and accessibility to ensure that AR contributes to a more inclusive and effective educational landscape.

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Blended Teaching

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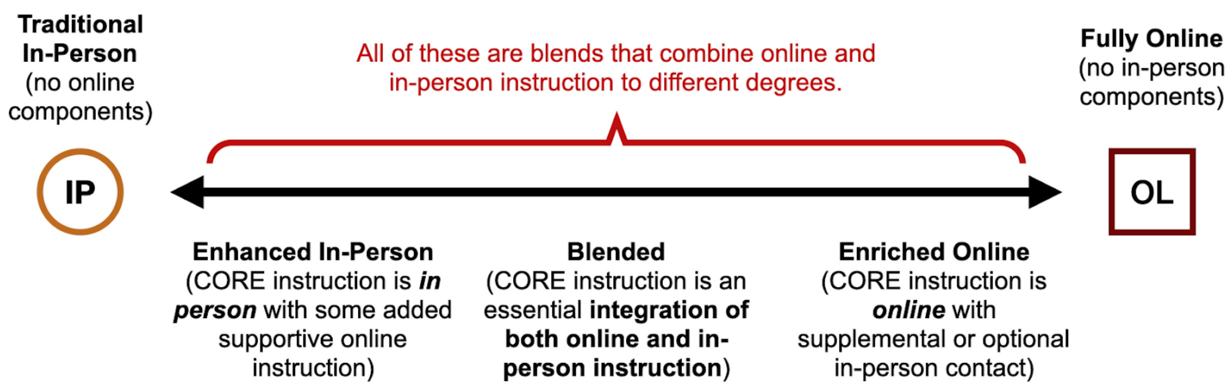
Blended Learning | Online Learning | Online | Online Teaching | Blended Teaching

Blended teaching is the strategic combination of instruction in two different modalities: online and in-person (Graham, 2021). This article addresses the question of why instructors choose to teach in a blended modality. It also addresses seven common challenges to student engagement that intentional blended strategies can help to overcome. A few practical examples of strategic blends are provided. Finally, two research-based competency frameworks are shared to help blended instructors increase their awareness and self-evaluation of core pedagogical skills for effective blended teaching.

Effective blended teaching is almost always intentional and strategic. There are a wide variety of models and teaching strategies that can be designed into a blend. Figure 1 depicts a spectrum of possibilities from the modality perspective.

Figure 1

Spectrum of blended possibilities based on combining in-person and online modality



There are a number of blended models that fit within the spectrum described in Figure 1. Some of these models include rotation, flex, and flipped (Staker & Horn, 2012); hyflex (Beatty, 2019); inside out and outside in (Kohls et al., 2018); supplemental, emporium, replacement, and buffet (Twigg, 2003); and time-based blends (Norberg et al., 2011). Incorporating these models in traditional schools and universities demands new forms of school leadership (Scheninger, 2019) and a critical examination of strategic innovation, school structure, and cross-institutional partnerships (Thompson et al., 2019).

Why Blend?

There are many reasons why teachers and institutions choose blended approaches. The three most common reasons are shown in Table 1. It is important to note that teachers often work to achieve multiple purposes with a blend even though one purpose may have priority over the others. Furthermore, reasons for blending can have a strong influence on the blended approach that is chosen.

Table 1

Common reasons to adopt blended teaching and learning

Reason	Brief Explanation
Improved Student Learning	Whereas different learners maintain personal preferences for how they prefer to receive information (Pashler et al., 2008) and for how they actually learn (Willingham et al., 2015), teaching through multiple modalities can lead to improved student learning.
Increased Access and Flexibility	True blended approaches can facilitate purposeful anytime/anywhere learning experiences for students and anytime/anywhere teaching circumstances for instructors, removing the fixed limitations of time and place for education to occur (Joosten et al., 2021).
Increased Efficiency	Some curricula are more quickly and more easily taught when digital tools are used to enhance teaching and learning. Similarly, other concepts and contents benefit most from face to face instructional interaction. Blending can improve efficiency when teachers and students have access to both online and in-person options (Chigeza & Halbert, 2014).

Strategic Blending

Having a clear purpose for blending can help make blended course or lesson design more intentional and strategic. Blending with purpose allows teachers to align pedagogical objectives and activities with appropriate approaches and technologies, thus keeping improved student learning at the forefront (Picciano, 2009). In addition, teachers may adopt blended approaches to increase opportunities for social emotional learning and deep learning as described by the 6C's: character, citizenship, collaboration, communication, creativity, and critical thinking (Fullan et al., 2018). Table 2 outlines seven common pedagogical challenges to student engagement (7P's) that blended teaching strategies can help educators to overcome. Additionally, frameworks such as PICRAT or 4E's (enable, engage, elevate, extend) can help teachers to strategically reflect on the relationship between their pedagogical purposes and the technologies used to support those purposes (Kimmons et al., 2022; Kolb, 2017; Borup et al., 2022).

Table 2

Seven pedagogical challenges to student engagement that blended approaches can help with (Stein & Graham, 2020; Graham et al., 2019)

Challenge	Blended Approaches Can Address Challenge
Participation	Intentionally combining in-person and online interactions can ensure that all students participate.
Pacing	While in-person instruction often revolves around synchronous whole class activities, online instruction can be individualized to meet unique pacing needs.
Personalization	This occurs when the learner is an active participant in making choices around the goals, time, place, pace, or path of learning experiences, (Graham et al., 2019; Bray & McClaskey, 2015). While personalization is possible in an entirely in-person learning environment, the flexibility and digital tools (like adaptive software) available online, can make it a more practical option for teachers in a blended teaching context.
Place	Whereas in-person instruction requires that all learners be physically present in the same location, online portions need not be limited to the same space. Furthermore, students can virtually visit authentic locations for learning that are outside the classroom.
Personal Interaction	Instead of the one-to-many model of interaction inherent to in-person teaching, online learning can facilitate flexible and meaningful one-to-one interactions between teachers and students, especially when instruction is asynchronous and intentionally planned.
Preparation	Blending allows students to look ahead at the curriculum, making deeper and more meaningful preparations for in-person learning experiences. It can also help teachers to know students' level of preparation before class time.
Practice with Feedback	Through algorithmic and pre-programmed elements, online practice activities can facilitate a faster and more robust feedback experience than is otherwise available for analog, in-person learning.

Practical Examples

Consider how the following real-world examples of blended teaching and learning align with the common reasons for blending listed above, along with how they might help to overcome pedagogical challenges.

- Postsecondary - A college professor meets with her class in person on Tuesdays and Thursdays and has additional coursework and learning materials organized online as required elements of the course. Multiple online pathways are provided for students to progress through the curriculum, allowing for student choice as an integral part of the adult learning experience (Merriam & Bierema, 2013). In addition, students may select from a menu of options for demonstrating the knowledge they have acquired.
- Secondary - Instead of lecturing for the first 30 minutes of class, a math teacher shares a condensed video recording of the lecture for students to watch as homework the day before. She then begins class with a brief formative assessment to gauge which of yesterday's concepts deserve highest priority for in-class discussion. Her purposeful planning allows her to embed important concepts into the online content that will prepare students for a richer in-person discussion.
- Elementary - An elementary teacher organizes students into small groups, based upon academic need. She then dedicates a portion of the day's instructional time for "centers," rotating students through online instructional activities strategically aligned with student needs, small group activities, and teacher directed instruction.

Blended Teaching Competencies

Several key issues are faced when designing blended environments: incorporating flexibility, stimulating interaction, facilitating student learning processes, and fostering an affective learning climate (Boelens et al., 2017). Important blended and online teaching competencies have been identified that can help address these and other significant issues (Pulham & Graham, 2018). Table 3 outlines two competency frameworks relevant to blended teaching that are grounded in research and focus primarily on pedagogical skills. The Blended Teaching Readiness Survey (https://bit.ly/blended-teaching-readiness) based on the BT Readiness Framework serves as a helpful tool for teachers to self-assess their understanding and skills for blended teaching.

Table 3

Competency frameworks relevant for blended and online teaching

Blended Teaching Readiness Framework (Graham et al., 2019; Pulham & Graham, 2018)	**Pillars of Online Pedagogy (Archambault et al., 2022)**
• Integrate Online and In-Person Instruction • Use Digital Data to Inform Teaching Practices • Enable Personalized Learning Experiences • Facilitate Online Interaction with Instructors, Students, and Content	• Build Relationships and Community • Incorporate Active Learning • Leverage Learner Agency • Embrace Mastery Learning • Personalize the Learning Process

The ability to teach in a blended modality is becoming increasingly important for instructors in K-12, higher education, and corporate training contexts. Instructors can strategically identify blended approaches and models that can benefit students in their unique contexts. Blended teaching competencies can be learned, measured, and improved upon.

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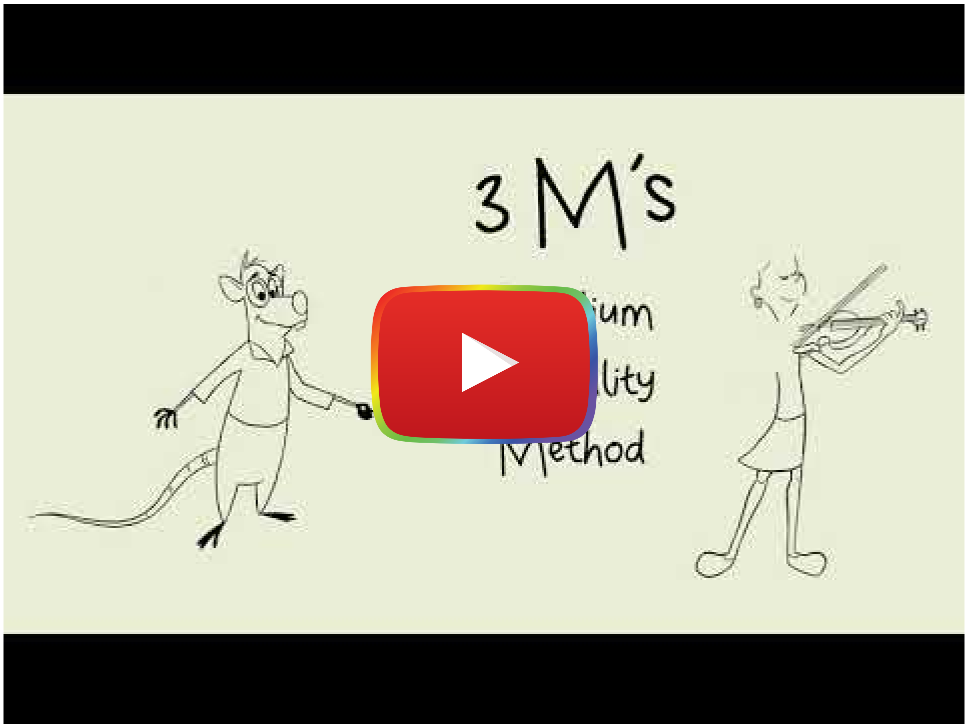
Community Artifacts



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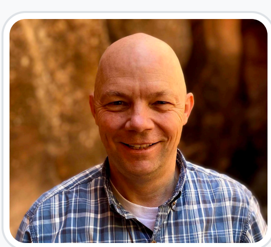

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Cognitive Load Theory

Chad Clark & Royce Kimmons

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Instructional Design | Cognitive Load | Extraneous Cognitive Load | Germane Cognitive Load | Intrinsic Cognitive Load

Cognitive Load Theory (CLT), formulated by John Sweller, describes how working memory processes information and includes three types: intrinsic, extraneous, and germane. Each type of cognitive load plays a crucial role in educational technology and instructional design, and by minimizing extraneous cognitive load and promoting germane cognitive load, educators can enhance learning effectiveness. CLT has become widely recognized as an influential framework in educational research, guiding instructional practices and fostering continuous improvement in designing effective and engaging learning experiences for students.

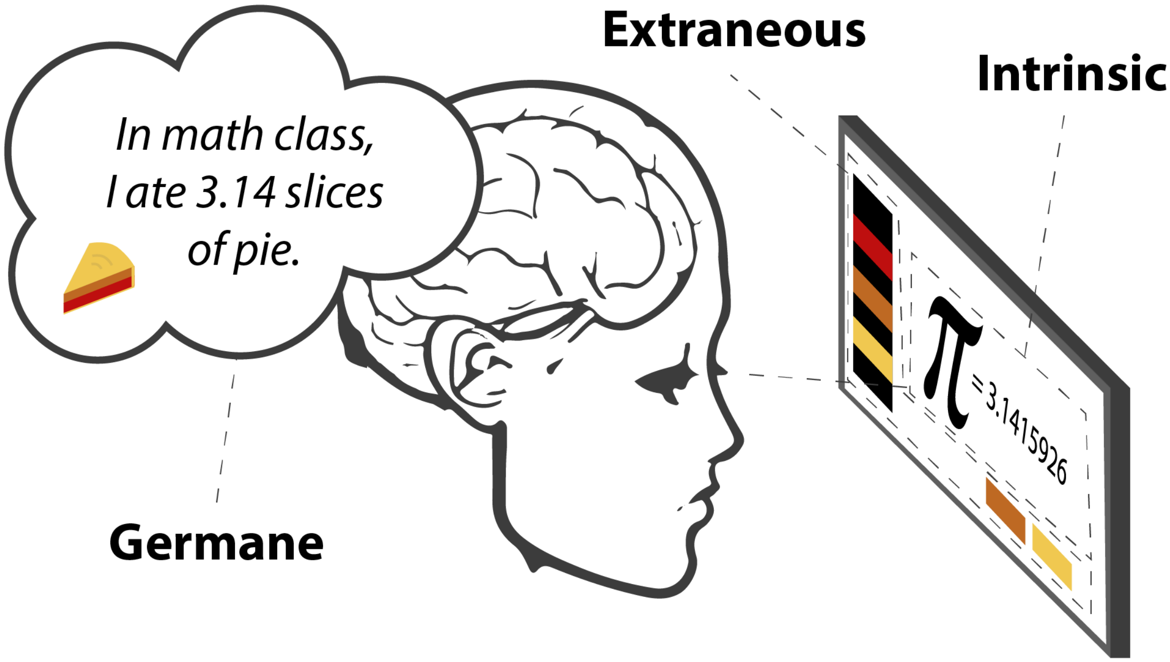
The concept of cognitive load was first presented by Sweller (1988) in relation to the effectiveness of conventional problem-solving methods for acquiring domain-specific knowledge and skills. Sweller (1988) indicated that working memory has a limited capacity and stressed the importance of minimizing extraneous cognitive load to maximize learning. Specifically, Sweller (1988) noted "human short-term memory is severely limited and any problem that requires a large number of items to be stored in short-term memory may contribute to an excessive cognitive load" (p. 265). In the ensuing years, CLT has become a foundation for the design and application of many instructional design principles (Paas, Renkl, & Sweller, 2003) and has also undergirded elaboration of multimedia learning principles (Mayer & Moreno, 2003). Many educational researchers and theorists make the connection between CLT and instructional design (Van Merriënboer, Kirschner, & Kester, 2003) and contextualize CLT within instructional design principles (Chandler & Sweller, 1991).

Three Discrete Types of Cognitive Load

Sweller and others have articulated three types of cognitive load: intrinsic, extraneous, and germane (see Figure 1).

Figure 1

Visualization of the Three Types of Cognitive Load



Intrinsic Cognitive Load

Intrinsic cognitive load refers to the degree of difficulty inherent in a learning event. All concepts are not equal and the tasks that are higher up the visual pyramid of Bloom's Taxonomy of Learning will require more intrinsic cognitive load allocation (e.g., the learning tasks of application and creation tax the intrinsic load levels of the learner more than remembering or understanding do). Likewise, some concepts themselves are much more intrinsically complex and reciprocally require more cognitive load to reach understanding. Sweller (2010) described this as the allocation of working memory necessary for dealing with the "intrinsic complexity of information" (p. 123).

Extraneous Cognitive Load

As originally articulated, the word "extraneous" is never explicitly stated in conjunction with cognitive load but is indirectly referenced as "measures" that are "presumably irrelevant to schema acquisition" because they are not critical to new schema induction (Sweller, 1988, p. 282). Put another way, these are aspects of gaining understanding and ultimately of knowledge construction that are superfluous to such ends. This is especially important with more complex learning tasks as strategies that rely upon "a heavy cognitive load" (p. 277) leave less cognitive capacity free for dealing with intrinsic load.

Elements of the educational experience that do not support the learning task, such as instruction that is poorly organized or includes irrelevant information, constitute extraneous cognitive load. Stated alternatively, extraneous cognitive load distracts from accomplishing the learning objective and is therefore "concerned with the manner in which instruction is designed" (Sweller, 2010, p. 123), including such factors as language difficulty, media use, examples, images, sounds, distractors, etc.

Germane Cognitive Load

Germane cognitive load refers to the effort needed to transfer short-term information to long-term knowledge and understanding via schemas. Sweller (2010) characterizes germane cognitive load in the context of the other types of cognitive load as follows:

> *Unlike intrinsic and extraneous cognitive load, germane cognitive load does not constitute an independent source of cognitive load. It merely refers to the working memory resources available to deal with the*

element interactivity associated with intrinsic cognitive load. (p. 126)

As such, germane cognitive load would involve the learning activities and mental processes that attempt to connect information to long-term knowledge schemas in a constructivist manner, such as using mnemonic devices, activating prior knowledge, etc.

Reconciling the Elements

Pass (1992) summarized CLT as "a multidimensional concept in which two components—mental load and mental effort—can be distinguished. Mental load is imposed by instructional parameters . . . and mental effort refers to the amount of capacity that is allocated to the instructional demands" (p. 429). Therefore, when teaching students, Sweller, van Merriënboer, and Pass (1998) indicated that instructional strategies should be followed to reduce extraneous cognitive load while increasing germane cognitive load. Five years later, van Merriënboer et al. (2003) concluded that CLT continues to offer "useful guidelines for decreasing intrinsic and extraneous cognitive load, so that sufficient processing capacity is left for genuine learning" (p. 5). Succinctly stated, when designing and delivering instruction, to reduce extraneous cognitive load, educators can simplify the presentation of information, engage in instructional practices that promote germane cognitive load, and adapt instruction to fit learners' zone of proximal development or level of expertise.

Conclusion

Cognitive Load Theory is a widely recognized and influential model in the fields of educational research and instructional design and permeates a great many aspects of educational practice and research. CLT has been described as an "internationally well known [sic] and widespread theory, which has been empirically confirmed in numerous studies" (Bannert, 2002, p. 139). Initially credited as originating from John Sweller in the 1980s, CLT has since been examined, expanded upon, and applied in practice by a great many educators to optimize learning outcomes. CLT can provide valuable insights for minimizing extraneous cognitive load while promoting germane cognitive load, and can therefore help educators create more effective and engaging instruction that maximizes learners' potential for genuine understanding and knowledge construction. As CLT continues to inform educational practices, it holds the promise of contributing to the ongoing improvement of instructional design and educational effectiveness for years to come.

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Rebecca N. Nissen & Clark D. Asay

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With the advent of the internet came the ability to easily share information on a global scale. However, this ability to easily share contrasts with the stricter nature of intellectual property laws, particularly copyright. Creative Commons (CC) licenses were created in an effort to ease this tension between the global nature of sharing information through the internet and the stricter nature of copyright laws (Creative Commons, n.d.-f). Lawrence Lessig, a Stanford law professor at the time, helped spearhead the CC movement. Lessig was motivated in part by a desire to "make more creative works freely available on the internet" (Creative Commons, n.d.-f). Lessig had witnessed the growing success of the free and open-source software movement, where software developers had used open licenses to provide downstream users with greater software freedoms. Inspired by that movement, Lessig and the CC community launched the CC licenses in 2002 for creative content (Broussard, 2007; Creative Commons, n.d.-f; Lessig, 2005). For a deeper history of CC licenses, click here.

Design

The CC licenses utilize a "three-layer design" that is composed of (a) the legal code layer, (b) a human readable layer, and (c) a machine-readable layer. The legal code layer is written in a format commonly used by lawyers. The human readable layer, also known as Commons Deed, is easier for laypersons to read and understand while "summarizing and expressing some of the most important terms and conditions" (Creative Commons, n.d.-b). The machine-readable layer is understandable by machines, such as search engines and software systems, using the CC Rights Expression Language (Creative Commons, n.d.-b).

Licenses

The six CC licenses are as follows: CC BY, CC BY-SA, CC BY-ND, CC BY-NC, CC BY-NC-SA, and CC BY-NC-ND (see Table 1). In addition to these six licenses, CC0 is another CC tool that "allows licensors to waive all rights and place a work in the public domain" (Creative Commons, n.d.-b). Unlike CC0, the Public Domain Mark is a "mark" for a work that is "free of known copyright around the world" (Creative Commons, n.d.-d). Below is a simplified a list of requirements for each of the six CC licenses (for a more comprehensive and descriptive list, as well as the license deeds and legal codes, visit the CC license webpage):

Table 1

Creative Commons Licenses

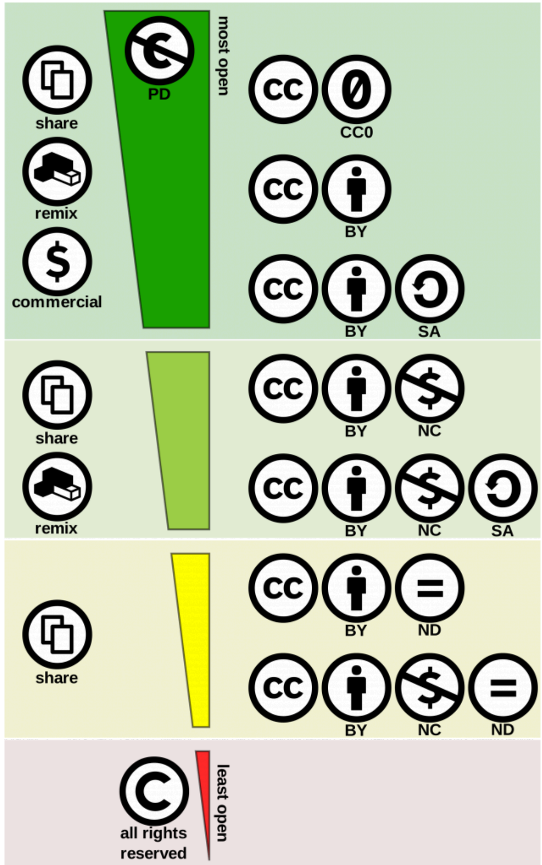
License Title	Abbreviated Elements	Explanation of Abbreviation
CC BY	BY	Credit the creator
CC BY-SA	BY SA	Credit the creator Credit and license the work using this content under the same terms
CC BY-ND	BY ND	Credit the creator Do not change/adapt the work
CC BY-NC	BY NC	Credit the creator Do not use for commercial gain
CC BY-NC-SA	BY NC SA	Credit the creator Do not use for commercial gain Credit and license the work using this content under the same terms
CC BY-NC-ND	BY NC ND	Credit the creator Do not use for commercial gain Do not change/adapt the work

Openness

Although CC licenses are open licenses, they exist on a spectrum. In other words, some licenses are more permissive than others (see Figure 1). Each license is categorized using the free cultural works definition. Free cultural works are works "that can be most readily used, shared, and remixed by others, and go furthest toward creating a commons of freely reusable materials" (Creative Commons, n.d.-e). CC BY and CC BY-SA are considered free cultural works, as well as CC0 and works with the Public Domain Mark (Creative Commons, n.d.-e). Wiley (2009; 2014) defines openness using the 5Rs of openness (Reuse, Revise, Remix, Redistribute, and retain). One might notice that not all of the CC licenses satisfy all five conditions. For example, CC BY-NC-ND, the most restrictive CC license (Creative Commons, n.d.-e), does not allow for a work to be changed or adapted; thus, it does not satisfy the Remix aspect of open content as defined by Wiley.

Figure 1

Creative Commons License Spectrum



"Creative Commons License Spectrum" by Shaddim is licensed under CC BY 4.0

Selecting and Applying Your Own CC License

The two steps to applying a CC license to a creative work are as follows:

1. Select a CC license. CC's License Chooser can help you make the decision (Creative Commons, n.d.-g).
   1. Note that a CC0 license is unchangeable, and you must own/control copyright of that work (Creative Commons, n.d.-h). This license also follows a different application process in that the owner must fill out an application waiver through CC's License Chooser to receive a special html code ("Marking your work with a CC license," 2019). Details can be found here.
2. Indicate clearly which CC license is being used. This can be done in the copyright notice section of the work. CC recommends using a link or writing out the URL to the deed of the license being used (Creative Commons, n.d.-i). Here, you can access and download the trademark and logo for the CC license being applied to the work.

More details on choosing and applying a CC license can be found here.

Attribution

To provide attribution to CC licensed works, both Cullen (2022) and Creative Commons (Creative Commons, n.d.-c) recommend using the "title-author-source-license method," (TASL) or title-creator-source-license as Creative Commons also lists it (Creative Commons, n.d.-c). Here is a fictional example, based on the example Cullen provided in the same work: A researcher wants to use a photo of a wind turbine in a chapter they are writing about energy conservation. The photo, titled "Turbine Against Blue Sky," was taken by a woman named Emma Richardson and is licensed under the CC BY 4.0 license. Attribution would appear as follows:

"Turbine Against Blue Sky" by Emma Richardson is licensed under CC BY 4.0.

In her publication, Cullen (2022) continued to explain that links should be attached to each of the underlined sections to guide users to where the image was originally published, the photographer's profile on the host website, and the license description, respectively. The Creative Commons website states that this format of attribution is "an ideal attribution of a CC-licensed image" (Creative Commons, n.d.-c).

Although each CC license is different, the attribution method should remain the same—unless the creator reasonably states otherwise or if the work was adapted or modified. If the person using the work modifies it, then the modification should be mentioned ("Recommended practices for attribution," 2022). For example, if a graphic designer named Daniel Cobbler wanted to provide attribution for the work "Turbine Against Blue Sky" after they had created a derivative titled "Turbine in Storm" (as can be done because it is a CC BY license), Creative Commons ("Recommended practices for attribution," 2022) recommends using the following format:

This work, "Turbine in Storm", is adapted from "Turbine Against Blue Sky" by Emma Richardson, used under CC BY 4.0 by Daniel Cobbler.

Although this example is of a CC BY license, Creative Commons states that this format and the format shown earlier should be used "whenever [emphasis added] you are using CC licensed works" ("Recommended practices for attribution," 2022). It is important to note that attribution formatting may change depending on the style guidelines being used (e.g., APA, MLA, AP, etc.) as some styles may require additional information.

A basic understanding of CC licenses can give power to both the creator (i.e., copyright holder) and the audience. It gives the creator the power to "express the freedoms they want their creativity to carry" (Lessig, 2005) and audiences the ability to use those works without a need to contact the creator for usage permissions or a constant fear of copyright infringement.

Author's Note

Because practices of attribution change and evolve, Creative Commons maintains a wiki page that they update according to those changes. To read more and compare your current understandings with the standards Creative Commons is following, try reading the following website they link to within their official website (to view the page within which they link to their wiki, see Creative Commons, n.d.-c):

https://wiki.creativecommons.org/wiki/Recommended_practices_for_attribution

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Decision-based Learning

Kenneth J. Plummer & Richard H. Swan

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Instructional Design Conditional Knowledge Schema Building Functional Expertise Pedagogical Method Expert Blind Spot

Decision-based learning (DBL) is a teaching method that organizes instruction around the conditional knowledge that guides experts' decision-making processes. An expert unpacks how they make decisions in the given domain to create an expert decision model, which can be represented visually. Students use the model to guide them through real-world problems or scenarios. Instruction is available at each decision point. Soon, students must perform without the model's help. Appropriate use of DBL helps students function in the domain and lays a necessary foundation for understanding and applying underlying theories of the discipline.

Decision-based learning (DBL) is a teaching method that organizes instruction around the conditional knowledge that guides experts' decision-making processes. Briefly, conditional knowledge is knowing "when or under what conditions" to apply procedures and concepts (Bransford, Brown, Cocking, & Center, 2000). In short, DBL is organized around a functional sequence rather than a logical sequence.

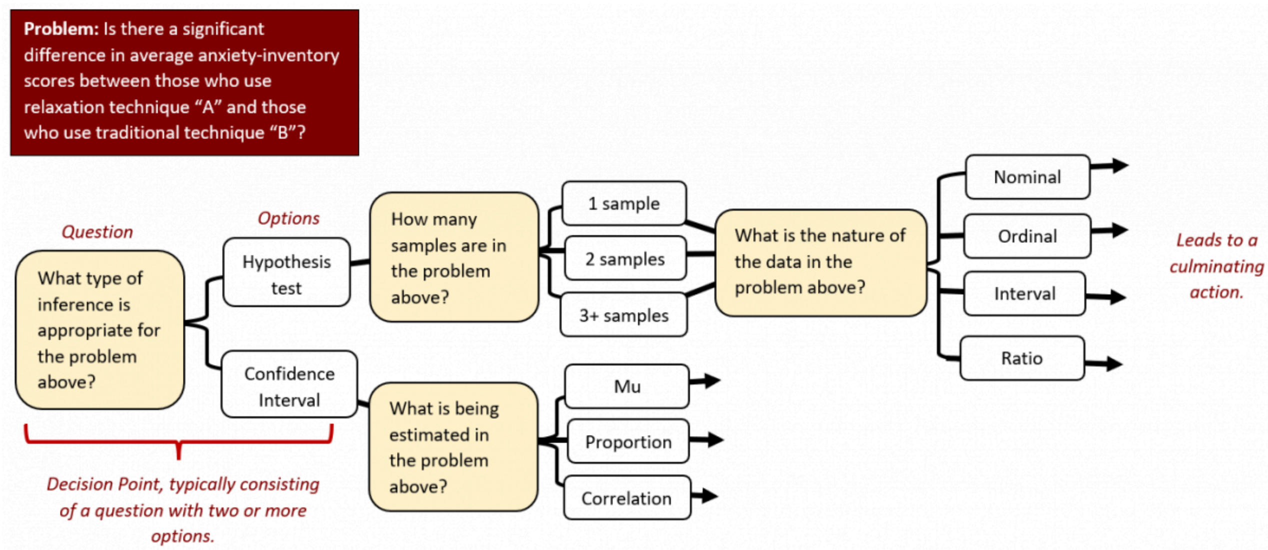
For experts (which includes most instructors), their recognition of conditions has become so automatic as to seem intuitive. This phenomenon has become known as the "expert blind spot" (Cardenas, West, Swan, & Plummer, 2020). Consequently, this essential knowledge remains invisible to students in most forms of instruction. However, conditional knowledge is essential for successfully analyzing situations and selecting an appropriate course of action. Conditional knowledge is also a necessary foundation for well-developed conceptual understanding (Swan, Plummer, & West, 2020).

DBL seeks to reveal this conditional knowledge. Using a form of cognitive task analysis, an expert breaks down decisions they make based on the conditions in a real-world problem/artifact/scenario. This process serves to classify the problem and, therefore, signal a correct/appropriate/optimal action for the given situation.

The decision-making process can be structured as a series of questions (decisions) with possible responses. Decisions lead to a culminating action or resolution. The result is an expert decision model (EDM), which can be represented visually (Plummer, Swan, & Lush, 2017). An EDM may be linear, branching, or looping or may exhibit a combination of these patterns (for example, see Figure 1).

Figure 1

Portion of an Expert Decision Model (EDM) Used in a Basic Statistics Course



An EDM should focus on a single learning outcome (i.e., culminating action) and the object of analysis for that learning outcome (e.g., problem). For example, Plummer, Kebritchi, Leary, and Halverson (2022) describe several culminating actions as follows:

> *At the end of each decision path is a culminating action or decision. For example, in a chemistry course, the culminating action at the end of their decision model was to determine if the correct technique had been located to solve a heat and enthalpy problem (Sansom, Suh, & Plummer, 2019). In a qualitative inquiry course, the culminating action was to determine the credibility of a published qualitative study (Owens & Mills, 2021). Finally, in a mechanical engineering course, the culminating action was to determine the design and performance of a machine element (Nelson, 2021). (p. 5)*

It should be noted that a given learning outcome, and therefore an EDM, includes a range of problem types. These problem types share many characteristics but also have defining characteristics that make them distinct. For example, heat and enthalpy are two high-level problem types which also contain problem types within themselves. The more closely related, the more characteristics they share until there may be only one distinguishing characteristic between a problem type and its nearest sibling(s).

Given a real-world problem or scenario, students navigate a series of stepwise decision points, learning how to reason through a scenario leading to an appropriate culminating action. Instruction occurs at each decision point focusing on how to identify the defining conditions in the given problem for the current decision. Instruction should be limited to what is essential to make that specific decision. We refer to this as just-enough, just-in-time instruction. The concise nature of this instruction helps students focus on and separate the defining condition for that decision from other sibling or cosmetic conditions in the scenario.

Initially, learners may have difficulty distinguishing cosmetic conditions from defining conditions. With sufficient repetition, learners develop the ability to distinguish defining conditions that lead to resolution of the problem. To provide sufficient repetition, a robust bank of multiple problems for each problem type is ideal. One way to quickly create problems is to keep the same cosmetic conditions and alter the defining conditions to account for each problem type.

Finally, DBL includes frequent, interleaved assessment without the aid of the EDM. Initially, instruction is highly scaffolded by the EDM and associated instruction. However, students tend to over-rely on the model unless they are required to perform without scaffolding. Frequent, low-stakes assessments that require equal performance without the model are essential to prompt students to internalize their learning. In this way, students begin to develop a functional schema of the domain.

With practice, DBL helps students begin to conceptualize individual real-world situations as instances of a problem type. In other words, they begin to generate a functional schema allowing them to independently apply their learning in real-world situations. Further, with conditional knowledge as the organizing principle, students have an opportunity to see how conditions have patterns that invoke relevant concepts and procedures. As they delve deeper, this framework also helps students understand the boundaries and application of underlying theories, principles, and concepts of the domain.

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EDTECHNICA

Emergency Remote Teaching

Stephanie L. Moore & Charles B. Hodges

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Online Learning | Pandemic Pedagogy | Emergency Remote Teaching | Emergency Remote Education | Education in Emergencies

Emergency Remote Teaching (ERT) is "a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" (Hodges et al., 2020, para. 13). In contrast to online learning, this term describes instruction that is entirely remote and is not as robust as intentionally planned and well-designed online learning solutions. While ERT relies solely on technology-mediated learning and can include online learning, it is not limited to online learning solutions. For example, it may involve the use of radio, print, television, telephone, mobile devices, and other mediating technologies that can be delivered remotely. ERT is also different from education in emergencies, which often involves longer-term solutions to address emergency or crisis situations such as displaced refugees, although at times the two may be difficult to distinguish. Hodges et al. (2021) emphasize three characteristics of ERT – temporal in nature, immediacy of an emergency, and the remote nature of instruction – all of which are essential in distinguishing ERT from other terms it may be conflated with, such as online learning or education in emergencies. The purpose of this chapter is to position ERT as a unique term requiring a clear definition of the construct in relation to other prior or emergent adjacent constructs such as education in emergencies and pandemic pedagogy.

In 2020, as the COVID-19 pandemic unfolded, educational systems at all levels around the world had to cope with immediate lockdowns to control the spread of the coronavirus. Some estimates list as many as 1.6 billion K-12 students from over 190 countries lost access to in-person school (World Bank Group, 2021). Higher education students were affected too; for example, 84% of U.S. students in higher education had at least some or all of their classes moved to online delivery as a result of COVID-19 (National Center for Education Statistics, 2021). To provide instructional continuity, many school systems and institutions of higher education shifted to online modalities. Many referred to this instruction as online learning; however, there were several reasons why this label of "online learning" was not accurate or even desirable. To provide an alternative label that would help distinguish what was actually taking place from well-established online learning, Hodges et al. (2020) proposed a specific term for the instruction delivered under these circumstances: *emergency remote teaching* (ERT). The authors drew a sharp contrast between online education, which has existed and been studied for over twenty years prior to the pandemic, and ERT. The central argument is that online education is carefully planned instruction where the online modality has been purposefully selected with adequate time for planning, development, and delivery of a robust educational system. Online learning draws on existing theories, models, and standards to deliver learners a permanent alternative or complementary learning option to face-to-face instruction. Hodges et al. (2020) note that ERT is not simply "a bare-bones approach," rather it represents "a way of thinking about delivery modes, methods, and media, specifically as they map to rapidly changing needs and limitations in resources" (para. 14).

Some significant differences between online learning and ERT exist. First, online learning is specific to the modality of online systems and resources as the instructional delivery method. ERT may call upon a range of different modalities. During the pandemic, schools reported the use of print materials mailed to students, programming on local public television stations, telephones, mobile devices, and other means of connecting (Catalini, 2020; RFI, 2020). Second, standard online learning intended as a permanent full-time option takes months to develop in contrast to ERT, which is developed rapidly in response to quickly changing circumstances. Hodges et al. (2021) further elaborated on characteristics of ERT. First, they note that ERT occurs as a *temporary solution to undesirable circumstances*. The temporal nature of the shift greatly influences designs and decision making, as the intent is not to maintain the remote teaching beyond what the circumstance requires. This short-term nature means fewer resources – infrastructure, time, and so on – are invested, leading to a potentially lower quality solution. This lower degree of investment cascades into the decision-making process to influence all manner of decisions in ways that are different from permanent, full-time online learning options. As just one example, many schools dramatically cut supports for learners with ADHD or special education needs during emergency remote teaching (Becker et al., 2020; Rice, 2020), even though those supports can be and are delivered for learners with ADHD as part of permanent online learning options (Moore & Barbour, 2023; Rice, 2020; see also the Greater Commonwealth Virtual School at https://gcvs.org/special-education-technology/). The end product is a very different sort of design, akin to the differences between a tent and a house.

Second, Hodges et al. note the "immediacy of 'emergency'" as another important difference. Emergencies have an immediacy to them that standard long-term planning for permanent infrastructure does not. In an emergency, decision makers must make immediate decisions bounded by the immediate realities of what is available and what is not. Those realities may also change during some emergencies, as available infrastructure is impacted by the emergency itself. For example, earthquakes, tornadoes, hurricanes, and other natural disasters can lead to additional cascading systems failures as power lines and data networks are disrupted. ERT is situated in a context of crisis management where conditions may shift quickly and radically and conditions become increasingly fragile or unstable, necessitating processes to both mitigate potential damage and facilitate recovery (American National Standards Institute, 2009). Some instability may even stem from social unrest or civil conflict. For example, in Afghanistan, when public schools became targets for bombing because of Taliban resistance to girls receiving schooling, schools shifted to the use of radio-based education as opposed to online or mobile learning because the infrastructure for radio was more reliable (INEE, 2011). This differs dramatically from online learning, which assumes a particular type of infrastructure and assumes that infrastructure will be stable and reliable.

Third, Hodges et al. note that "remote" is an important word choice, suggesting instruction that is "removed" from its typical mode. It implies that some sort of communications technology will be required to bridge physical distances between educators and learners. It also stems from understanding the immediacy and emergent nature of the circumstances: rather than limiting options or descriptions of actual solutions to online modality alone, it affords a range of solutions that will arise as educators and decision makers navigate shifting circumstances.

Other terms have been proposed to describe education during the pandemic. One specific example that has broader use is "pandemic pedagogy." The term appears to have emerged from a Facebook group (Pandemic Pedagogy, n.d.) started during the pandemic that served as a hub for educators, students, and others to share insights, practices, successes and challenges, and research on fully remote or online education. The differences between ERT and pandemic pedagogy are unclear. Pandemic pedagogy is often used solely in reference to the COVID-19 pandemic (e.g. Szarejko, 2022), which suggests this term is limited to a specific time and a particular type of emergency. Additionally, in many publications, pandemic pedagogy and ERT are used interchangeably (e.g. Barbour et al., 2020; Tzimiros, et al., 2023), suggesting little daylight between the two terms. While ERT is still used primarily related to the same pandemic, it appears that is largely because it emerged from that context and researchers and practitioners are still processing their experiences during that specific event. However, ERT is appearing in other publications situated beyond the pandemic such as the unfolding war in Ukraine (Andrusiak et al., 2022).

Proposing the terminology, emergency remote teaching, and its definition to describe the phenomenon that became so prevalent in the early days of the COVID-19 pandemic has provided an important distinction for policy makers, scholars, and practitioners. Unfortunately, the terminology has not yet been adopted on a societal scale, which has resulted in inaccurate conclusions being spread in the press and popular media. Statements like "The Results Are In for Remote Learning: It Didn't Work" (Hobbs & Hawkins, 2020) have been common during the later stages of the COVID-19 pandemic, often declaring that "online learning" does not work. Such statements ignore not only the differences in the purpose, design, delivery, etc. of emergency remote teaching, and the decades of research and evaluation showing the efficacy of online learning. Such statements also ignore the myriad of other societal issues taking place during the pandemic. Many individuals, including teachers, professors, and students, and their families were dealing with job loss, food insecurity, deaths of friends and relatives, and the general stress of living through a situation not experienced for over 100 years (Moore et al., 2022). It is nearly impossible to determine what factors made the emergency remote teaching experience better or worse for some than others. The quick move to emergency remote teaching allowed for continuity of instruction where the alternative in many cases was no school at all.

Predating the COVID-19 pandemic, by many years, the term "education in emergencies" has been used to describe education occurring in a variety of circumstances. Sinclair (2007) defines education in emergencies as referring to "education for populations affected by unforeseen situations such as armed conflict or natural disasters" (p. 52). The work on education in emergencies has been conducted by groups like the Inter-Agency Network for Education in Emergencies (INEE) and international groups such as UNICEF and UNESCO. The construct of "education in emergencies" is not centered around modalities but instead on major disruptions to education systems caused by both civil (armed conflict, war, displacement of individuals, etc.) and natural causes (earthquakes, floods, hurricanes, etc.). Working together for over twenty years, these entities have developed a robust suite of research and resources that focus on topics from refugee education to life skills for peace education to case studies on the use of different educational technologies (see INEE.org for more). A central feature of education in emergencies is a rights orientation: education is a human right, and provision of education in emergencies provides a sense of normalcy, supports healing, restores hope, provides life skills that may mitigate future conflict, protects nations' investments in education, and protects marginalized groups. This orientation provides a sharp contrast to goals of instructional continuity often reflected in ERT and pandemic pedagogy. ERT may more rightfully be situated under the umbrella of education in emergencies, especially as a way to move scholarship and practice in this space past the confines of the COVID-19 pandemic. For more on education in emergencies, see the Burde et al. (2017) review of theory and research and Pigozzi (1999) working paper series published by the United Nations Children's Fund.

Where next for Emergency Remote Teaching?

Clearly, this is a term that has resonated with the research community, as evidenced by the number of citations of the Hodges et al. (2020) article in particular. Given the open questions around its relationship to "education in emergencies" in particular, this is a clear need to clarify the differences and the relationship(s) further. Additionally, future work should focus on articulating a theoretical framework for ERT that can support further research and the development of implementation frameworks to allow for a more smooth transition to ERT when it is needed in the future

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Help-seeking

Fan Yang & Jill E. Stefaniak

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Online Help-seeking | Categorization of Help-Seeking | Learner Support | Barrier to Seeking Help

Help-seeking occurs when learners realize a gap in their learning, and they seek assistance to bridge the existing gap. Traditionally, they engage in conversations with instructors or peers for constructive advice in both face-to-face settings and online learning environments. The advent of technologies has greatly diversified learners' help-seeking options. Studies on help-seeking focus predominantly on the correlational relationship between learners' demographics like gender, major, characteristics, motivational beliefs, mastery or performance goals, and their help-seeking behavior without enough attention to learners' online help-seeking pattern (Cheng et al., 2013, Tanaka, 2002). Research on help-seeking strategies can support students in a variety of formal and informal learning environments and their psychological decision-making.

Help-seeking is a concept that has undergone four distinct phases of research focus (Chowdhury & Halder, 2019). Initially, during the 1950s and 1960s, help-seeking was perceived by researchers as a behavior indicative of weakness and dependence. Influenced by prevailing values of competitiveness and self-reliance, Nelson-Le Gall (1985) concluded that, during that era, help-seeking was associated with immaturity, passivity, and even incompetence (Beller, 1955; Murphy, 1962). However, the groundbreaking work of Nelson-Le Gall in the 1980s served to strengthen the understanding of help-seeking as an adaptive approach to addressing learning challenges (Puustinen, 1998). Nelson-Le Gall (1981) advocated a reevaluation of help-seeking and introduced a dichotomy between executive (nonadaptive) help-seeking and instrumental (adaptive) help-seeking. Executive help-seeking occurs when learners' intention is to get the desired help to solve the problems without further interest in understanding the problems. Instrumental help-seeking, however, means the requested help is limited to the amount and type of assistance that enables learners to solve the problems independently. That means executive help-seekers focus on direct answers, while instrumental help-seekers focus on ways to solve problems. The third phase of research incorporated help-seeking into models of self-regulated learning, while the most recent phase focuses on advancements in technology-based tools. Kitsantas and Chow (2007) studied the influence of learning environments on learners' help-seeking behavior, demonstrating statistically that learners felt less threatened and exhibited higher instances of help-seeking behavior in online learning settings.

Models of Help-seeking

Help-seeking has been regarded as an activity related to learners' cognitive and social development. Nelson-Le Gall (1981) proposed five steps in the help-seeking model. Learners first become aware of the need for help and then they decide to seek help. After identifying the potential help(s), they employ specific strategies to elicit the help they need. Finally, learners evaluate the help-seeking episode which may affect their future help-seeking experiences. Karebenick & Dembo (2011) proposed an expansion to Nelson-Le Gall's (1981) model, arguing that help-seeking starts from learners' awareness of help after the psychological decision-making process. For example, they identify that a problem exists, and they decide that help is needed (Karabenick & Dembo, 2011). After reflecting on past help-seeking experiences and realizing the necessity of seeking help, they may finally decide to seek help. Then comes more decision-making, i.e., the purpose and goal of seeking help, the person to ask for help. After that, the learner comes to the official step of soliciting help and obtaining the requested help. Finally, learners will process the requested help, preparing for subsequent help-seeking experiences. What these two models have in common is that they both start with learners' awareness of help-seeking and end with learners' evaluation of the help-seeking experience. For example, learners may evaluate whether the help they get is useful or not in addition to the degree of difficulty of seeking the help they need, thus modifying the ways they seek help in the future. Just as the authors (2021) indicated, learners are always experiencing trade-offs between accessibility, convenience, reliability, and a variety of other factors. What differs from each other is that the model by Karabenick and Dembo (2011) is more detailed, and it emphasizes learners' decision-making processes in the iterative process of help-seeking. Former steps affect subsequent actions and if problems arise, the help-seeking process may come to an end.

Categorizations of Help-seeking

The categorizations of help-seeking have been broader than ever. According to Nelson-Le Gall (1981, 1985), learners displayed two forms of help-seeking. Executive (also called expedient) help-seeking occurs when a learner's intention is only to have the problem solved, while instrumental (or adaptive) help-seekers seek a limited amount and type of help to solve the problem or attain a goal independently. Karabenick & Knapp (1991) did a survey to test learners' help-seeking tendencies, and they further categorized those behaviors into five categories, including formal and informal help-seeking, instrumental activities, lowering performance aspirations, and altering goals. Formal help-seeking means learners seek help from formal sources including instructors, and professional personnel, while informal help-seeking means the help comes from sources learners are typically closer to. Instrumental activities mean things learners do to help them perform better, i.e., try harder, study more, etc. Lowering performance aspirations means learners choose to lower their aspirations and do easier things next time, like taking a lighter load or selecting easier courses. Altering goals means a complete deviation from their original goals, like transferring to another school or changing their major or minor.

With the spread of new technologies, other categorizations related to information searching have been added apart from the traditional formal and informal help-seeking as a brand-new form (Cheng et al., 2013). Makara and Karabenick (2013) proposed a well-received framework to categorize learners' help-seeking sources. The first dimension regarded help-seeking as either formal or informal, just like what researchers did in the past. The second dimension of personal and impersonal help-seeking was decided by the relationship of help givers and receivers. The third dimension focused on the involvement of technologies. Mediated help-seeking means help comes from some form of technology, while face-to-face help-seeking means physical meetings between help-seekers and helpgivers. Their last dimension was unique to technological advances too. Dynamic help-seeking means the help source adapts or changes over time in accordance with learners' needs, while static help-seeking means not.

Barriers to Help-seeking

Studies on barriers to learners' help-seeking behavior focus mainly on three factors, including the learners themselves, the course instructor, and the environment. Firstly, studies have revealed that learners with a greater desire for autonomy or independence over their studies are less likely to seek help (Deci & Ryan, 1987; Butler, 1998). They view themselves as autonomous learners and they prefer to rely more on themselves instead of from external sources. What's more, other students avoid seeking help because they want to maintain a positive social image and their self-worth (Ryan et al., 1997). Seeking help from other sources is regarded as a humiliating or even shameful act for these learners. Another line of research suggested a negative link between shyness, academic help-seeking, and learners' learning adjustments (Chen et al., 2018; Giblin & Stefaniak, 2021), which explained why shy learners are more likely to employ passive learning behavior (executive help-seeking or avoidance of help-seeking).

From a course instructor's perspective, the ability to establish positive relationships with learners and to create a welcoming environment where communication is prevailing is really important. Learners are more likely to seek help in a friendly environment where they are not being judged and criticized as being incompetent, whereas in an unsocial learning environment that emphasizes performance-avoidance goals, learners' help-seeking behavior is greatly affected (Karabenick, 2004). Students in classrooms where mastery goals are emphasized typically exhibit more positive help-seeking behavior.

Supporting Students' Help-Seeking

Instructors play a pivotal role in supporting students' help-seeking behavior. Encouraging students to seek help when needed can enhance their understanding, boost confidence, and promote a positive learning atmosphere. Instructors should not assume that students inherently know how to seek help and should actively share resources and cultivate an environment that encourages communication to address challenges related to new content and assignments. To achieve this goal, they may familiarize learners with diverse help-seeking sources, increase learners' self-efficacy in both face-to-face and online settings, and promote learners' awareness of relatedness, autonomy, and competence in learning (Yang & Stefaniak, 2023; Newman, 2002).

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Information Literacy

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Information Literacy | Research | Misinformation | Information Systems | Source Evaluation

Recent information studies literature defines information literacy as the set of integrated abilities and dispositions encompassing the understanding of how information systems function, the reflective discovery of information, and the use of information in sharing and creating new knowledge so as to participate wisely in a variety of settings. An information literate person will display a critical understanding of how information systems function and will wisely and intentionally participate in those systems as they consume, create, and share information to strengthen and serve professional, religious, family, and civic communities. Various library organizations have developed theories on information literacy, but everyone has a responsibility to learn and teach information literacy skills.

What is Information Literacy?

Information literacy is the set of integrated abilities and dispositions encompassing the understanding of how information systems function, the reflective discovery of information, and the use of information in sharing and creating new knowledge so as to participate wisely in a variety of settings. An information literate person will display a critical understanding of how information systems function and will wisely and intentionally participate in those systems as they consume, create, and share information to strengthen and serve professional, religious, family, and civic communities.

Information Literacy is not a new concept, and its importance is ever-growing in today's information landscape. Information literacy was first introduced by Zurkowski (1974) in a workforce context. Soon, though, the idea was adopted by academia and policy-making organizations. In 1989, the American Library Association (ALA) declared that "to be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information." Although the terminology "information literacy" may not be familiar to all, the concepts are embedded in many disciplines. According to ALA (2000), "[i]nformation literacy forms the basis for lifelong learning. It is common to all disciplines, to all learning environments, and to all levels of education" (p. 2). Visual literacy, data literacy, science literacy, and media literacy are just a few examples of related concepts that fall under the umbrella of information literacy.

The Association of College & Research Libraries' (ACRL) Information Literacy Competency Standards for Higher Education were released in 2000. These standards state that an the information literate student

- Determines the nature and extent of the information needed.
- Accesses needed information effectively and efficiently.
- Evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.
- Uses information effectively to accomplish a specific purpose.
- Understands many of the ethical, legal and socio-economic issues surrounding information and information technology (Association of College & Research Libraries, 2000).

These standards approached information literacy as a set of skills, which are easy to assess. Other theories of information literacy, though, approach it as not only a set of skills but a way of thinking and a social practice (Addison & Meyers, 2013; Sample, 2020).

UNESCO's Prague Declaration: Towards an Information Literate Society (2003), described information literacy as "a prerequisite for participating effectively in the Information Society and part of the basic human right of lifelong learning." Information literacy as a social practice includes access to information (including government information) as a human/civil right (Appedu & Hensley, 2022; Flornes, 2017; Henninger, 2017; Sturges & Gastinger, 2010); information as both accessible and discoverable (Henninger, 2017); and to be taught Information Literacies is a Human Right (Appedu & Hensley, 2022; Henninger, 2017; Sturges & Gastinger, 2010).

A competing theory to information literacy is the concept of metaliteracy introduced by Mackey and Jacobson (2011) in their article "Reframing Information Literacy as Metaliteracy." According to the Metaliteracy website, it "is a pedagogical model that empowers learners to be reflective and informed producers of information both individually and in collaboration with others."

In 2015, however, ACRL released a Framework for Information Literacy in Higher Education, which describes threshold concepts, knowledge practices, and dispositions associated with information literacy. The Framework is based on a Delphi Study related to threshold concepts and incorporates some of the concepts of metaliteracy. In fact, Jacobsen was a member of the task force to develop the Framework.

The 6 Frames of the New Framework

Information has value.

- Intellectual property laws and publishing practices affect how people access and use information. Though much information is provided freely, people need to navigate and make informed choices about citations, copyright, and other legal and socioeconomic practices that affect the information they need.

Authority is constructed and contextual.

- Authority is recognized and evaluated differently by various communities, and its level of importance is determined by the information need. People need to be aware of the biases that can influence how authority is perceived and be open to new perspectives.

Searching as strategic exploration.

- Searching for information is an iterative process that requires mental flexibility and evaluation of a range of sources. It begins with a question that directs the search for relevant information and is influenced by cognitive, affective, and social factors.

Research as inquiry.

- Inquiry is a process that involves asking questions and solving problems within or between disciplines that are unresolved. Collaboration and debate are often involved, and the process can extend beyond academia to address personal, professional, or societal needs.

Information creation as a process.

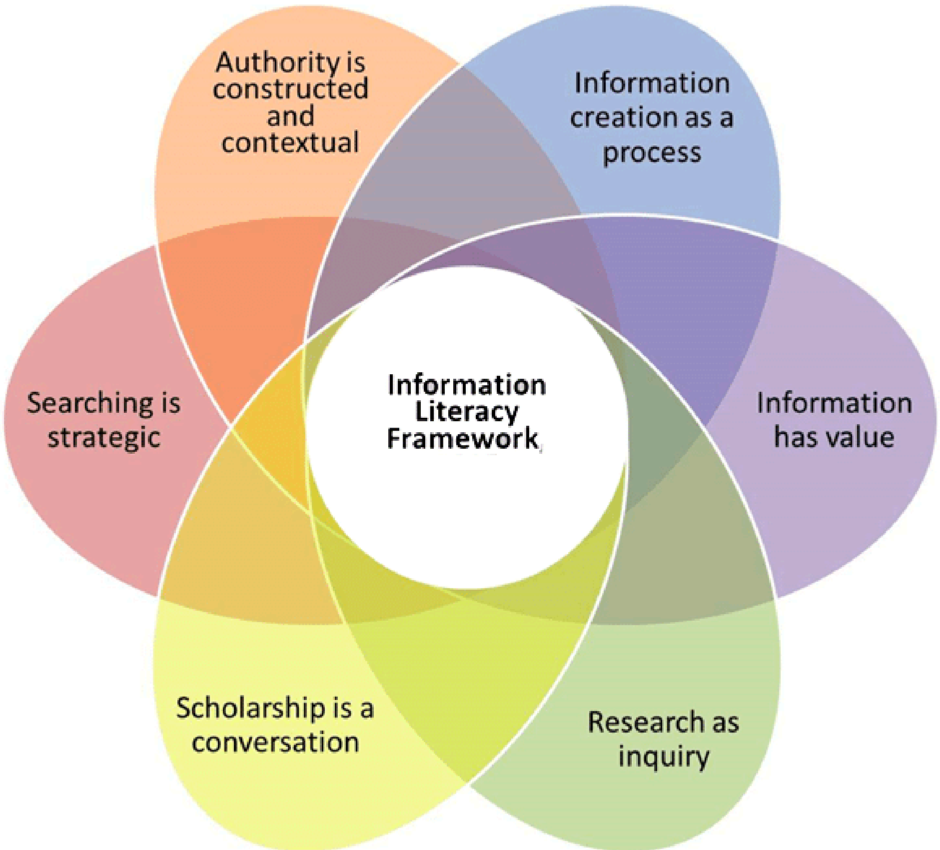
- Information is created through a process that could include researching, editing, and reviewing, which process results in various formats and modes of delivery. People need to recognize how the information they access was created so they can evaluate how well it meets their information need.

Scholarship as conversation.

- Communities of scholars and professionals engage in a discursive practice of research that involves sustained discussion and negotiation of meaning over extended periods of time. Seeking out diverse perspectives is crucial to gaining a deeper understanding of a topic, and attribution to relevant previous research is an essential aspect of participation in the conversation.

Figure 1

Academic Libraries and Technology



Burress, T., Clark, M., Hernandez, S., & Myhill, N. (2015, June 25-30). Wikipedia: Teaching Metaliteracy in the Digital Landscape [Poster session]. ALA Annual Conference & Exhibition, San Francisco, CA, United States. [Li nk]

Many instructors still use the older Information Literacy Competency Standards for Higher Education adopted in 2000. However, ACRL sets the standard for information literacy instruction in higher education, and educators working in K-12 can design their instruction on similar lines to provide learners with consistent concepts related to the [Framework for Information Literacy for Higher Education].

Why is it important?

People are immersed in a constantly changing information landscape: AI, "fake news," a "post-truth" world. They often struggle to discern fact from fiction and feel unsure how to navigate the overload of information they face. Information literacy is a discipline dedicated to educating people on the importance of wisely exploring, using, sharing, and creating information. The end goal is to help people become lifelong learners and ethical global citizens.

Who is responsible for teaching information literacy?

Information literacy is not simply the domain of information literacy professionals, such as librarians. Information literacy instruction is the responsibility of educators, librarians, and citizens alike and should be found in libraries, schools, universities, museums, the media, publishers, theaters, and the cinema, among others. In short, everyone has a responsibility to learn and teach information literacy.

What does information literacy instruction look like?

Information literacy instruction can come in many forms, but the curriculum should focus on how to find, evaluate, and use information. The ACRL Framework should guide the instruction content, which could include the SIFT method of evaluating sources. This method, developed by digital literacy expert Mike Caulfield, involves four steps: **Stop, Investigate the source, Find better coverage, and Trace the information back to a primary source.** To help learners find better coverage, you can teach them how to **read laterally** by reading what other websites say about a source to verify information, identify potential biases, and determine an author's purpose. To help learners trace the information to a primary source, you can teach them how to go upstream by checking the references in a source. On a website, it would mean clicking on embedded links, reading those sources, and clicking on their embedded links until you find a primary source.

Figure 2

The Four Steps: SIFT

Caulfield, M. (2019). Sift: The Four Moves [Online image]. Hapgood. Link

The SIFT method is more effective than the outdated CRAAP test (currency, relevancy, authority, accuracy, and purpose) that used to be taught as the primary way to evaluate sources. SIFT encourages looking beyond the source to verify and contextualize information.

Key terms to use and define in information literacy instruction

- Misinformation: information that is unintentionally incorrect or out of context
- Disinformation: information that is purposely incorrect or out of context with the intent to deceive
- Primary source: the origin of a piece of information, usually a person's experience or a research study
- Secondary source: text or media that interprets or otherwise refers to another source for information
- Inquiry: investigating something without knowing the answer beforehand
- Iterative searching: repeating actions with tweaks each time to achieve a better result
- Bias: a preference for someone or something, sometimes considered to be unfair

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Related Literacies

Other literacies are also important for navigating the modern world. These literacies include but are not limited to the following.

- Media literacy: the ability to analyze, evaluate, and critically interpret various forms of media content.
- News literacy: the ability to analyze and evaluate news content.
- Visual literacy: the ability to interpret and communicate through visual channels, like charts, graphs, infographics, and videos.
- Data literacy: the ability to navigate the complexities of data presentations by examining data sets, detecting trends, and concluding insights of the data.
- Digital literacy: the ability to evaluate and utilize digital technologies and information systems.
- Science literacy: the ability to understand and evaluate scientific information.
- Civic literacy: the ability and desire to participate in an informed and civil way in one's community and society as a whole.
- AI literacy: This area of research is changing rapidly and discusses the importance for teaching students about how AI works, such as where AI tools get their information, ethical issues surrounding its use, and how to use it effectively.

For more information

- https://www.ala.org/acrl/standards/ilframework

The Framework for Information Literacy for Higher Education contains professional standards for identifying the threshold concepts, knowledge practices, and dispositions of information literate individuals in higher education.

- https://projectinfolit.org/

Project Information Literacy (PIL), a nonprofit research institute, conducts ongoing national studies on information use throughout higher education.

- https://infolit.byu.edu

Brigham Young University's Information Literacy website contains content on learning more about information literacy, as well as resources for teaching and assessing information literacy in the classroom.

- https://ncte.org/statement/nctes-definition-literacy-digital-age/

The National Council of Teachers of English (NCTE) defines literacy in a digital age, with implications for teaching and assessment. This definition focuses on interconnection and adapting to a variety of contexts.

- https://www.sconul.ac.uk/sites/default/files/documents/coremodel.pdf

The SCONUL Seven Pillars of Information Literacy contains the core information literacy standards developed by the Society of College, National and University Libraries in the United Kingdom.

- https://www.cilip.org.uk/news/421972/What-is-information-literacy.htm

CILIP, the UK's library and information association, released an official definition of information literacy in 2018.

- https://adbu.fr/wp-content/uploads/2013/02/Infolit-2nd-edition.pdf

The Australian and New Zealand Information Literacy Framework (ANZIL) was adapted from ALA's standards to fit the cultural and educational needs of Australian and New Zealand librarians, educators, and learners.

- https://umd.instructure.com/courses/1354089

The University of Maryland has put together a guide on understanding AI and Information Literacy.

For teaching support

- https://sandbox.acrl.org/resources
- Sponsored by the American Library Association and the Association of College and Research Libraries, the ACRL Sandbox is a repository of information-literacy materials, lesson plans, and assessment tools.
- https://cor.stanford.edu/

The Civic Online Reasoning curriculum developed by the Stanford History Education Group provides educators with single lesson plans or a full curriculum for teaching information and civic literacy.

- Crash Course - Navigating Digital Information

In partnership with MediaWise, the Poynter Institute, and the Stanford History Education Group, John Green's Crash Course series teaches learners how to navigate the internet using information literacy techniques.

ED
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Makerspaces

Cecil R. Short, Jacob Hall, & Kalianne L. Neumann

DOI:10.59668/371.12182

Technology Integration | Pedagogy | Authentic Learning | Learner Agency | Constructionism | Experiential Learning

Makerspaces are experiential learning environments that facilitate creative activities, problem solving, collaborative learning, and in-depth exploration of disciplinary concepts. These spaces generally support active, hands-on, highly engaging learning experiences that promote learner agency, self-regulation, and product-oriented learning. Makerspaces commonly include technology such as 3D printers, cutting machines, laser printers, heat presses, dyers, and computers with various design software. Makerspaces also include less technological resources such as general arts and crafts supplies. In educational settings, makerspaces are commonly housed in library or lab settings, mobile carts, or within individual classrooms; however, makerspaces can also be found in communities' informal learning spaces like libraries and workshops.

Although makerspaces are an emerging movement, "making activities" (e.g., tinkering, crafting) date back to humanity's beginnings, and educational foundations for makerspaces began over a century ago (Blikstein, 2018; Gerstein, 2019). Experiential learning, child development through playing and building with authentic materials, student empowerment as changemakers in a malleable world, and using tools to construct and externalize knowledge within tangible artifacts are key pedagogical underpinnings of makerspaces (Blikstein, 2018; Gerstein, 2019b; Sanders et al., 2019). Fleming (2015) captured how these ideas connect to the essence of a makerspace: "If you build it, they will come; and if you let them build it, they will learn" (p. 16).

The maker movements' recent foundations are often associated with its contemporary advocates, a convergence of ideas, and opportune conditions (Ochs et al., 2019; Turner, 2018). As many countries envisioned workforces fueled by innovation, there was increased support for environments that could prepare learners to become creative problem-solvers (Hsu et al., 2017). Additionally, makerspace interest has been spurred by the integration of science, technology, engineering, and math (STEM); the growth of do-it-yourself communities; the incorporation of 21st-century skills; and the increased availability of digital fabrication technologies, tools to use when making, and research on makerspaces (Blikstein, 2018; Gerstein, 2019b). Figure 1 represents what some makerspaces might look like.

Figure 1

Fayetteville Free Library Makerspace by Leah Kraus and Mike Cimino, used under CC-BY License / image obtained from slide presentation.

Instructional Uses of Makerspaces

Makerspaces provide both formal and informal learning opportunities. They foster exploratory learning, disciplinary content knowledge, and multi- or transdisciplinary content knowledge. Makerspaces are touted as places that facilitate innovation, creativity, engineering design, probleming-solving, computing, and collaboration (Sharma, 2021). For example, Gurjar (2021) described a preschool makerspace in Italy that supported children's expression and creativity; Hughes et al. (2017) integrated Arduino and Chibitronics to teach computational thinking and mathematical ideas through creating and programming digital tangibles; and Davis et al. (2021) observed the intersection of literacy and media production in play-based makerspaces. As seen in Video 1, makerspaces can foster self-regulation, problem solving, and growth-mindsets for learners

Video 1

Learning Problem Solving and Growth Mindest in a Makerspace from Edutopia.

Watch on YouTube

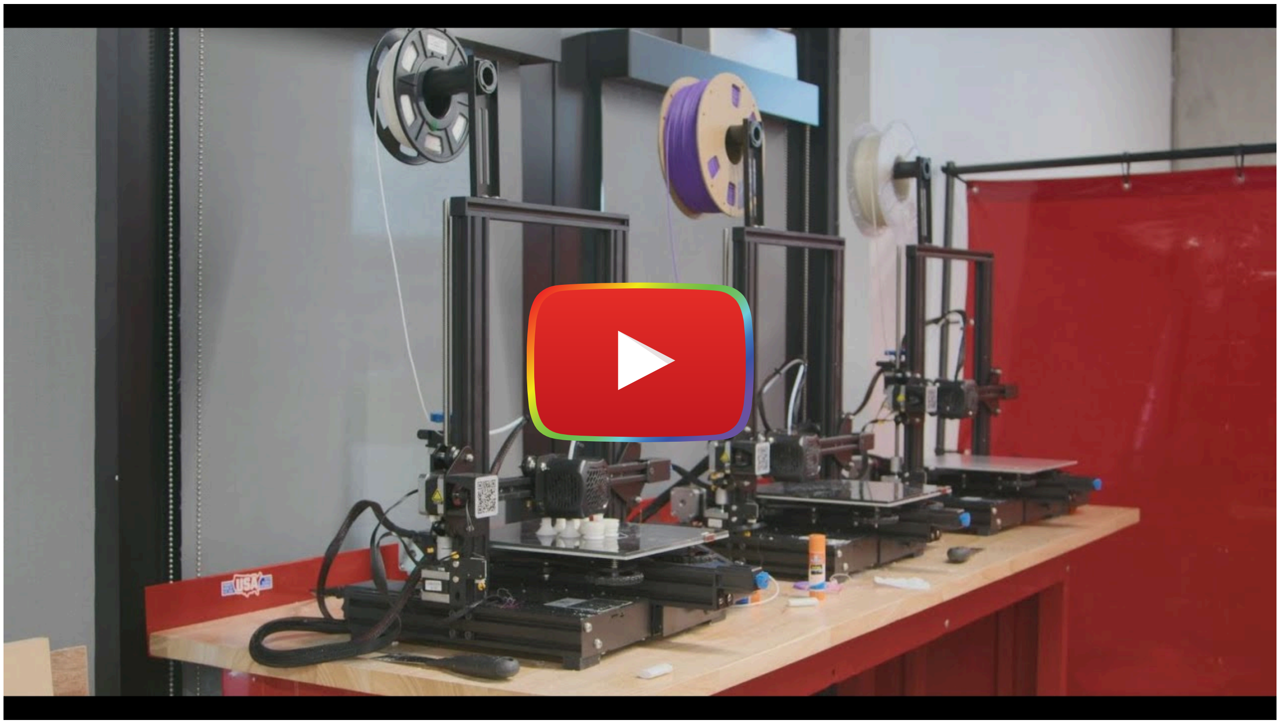
Post-secondary makerspaces focus on various content knowledge and skills (Breaux, 2017). Some have even been used to prepare teachers for integrating makerspaces into their instruction, increasing the desire for additional makerspaces (e.g., Dousay, 2017; Heredia & Tan, 2021). Neumann et al. (2021) described using the Maker's Workshop framework with preservice teachers to support their ability to guide, plan, and implement maker lessons, and helping these students align maker lessons/activities to required educational standards and curricular goals.

Makerspaces are often located in school and community libraries. Library makerspaces are intended to build upon consumption of knowledge opportunities with opportunities to collaborate, tinker, and create (Fleming, 2015). Given the diverse needs of learners who traverse library makerspaces, it is critical to design makerspaces with accessibility in mind, carefully attending to the physical layout and availability of resources (Ochs et al., 2019; Steele et al., 2018). In many communities, librarians and media specialists serve as champions of change who encourage participation in the maker movement, lowering barriers to making in their communities (see examples in Community Artifacts below).

In other cases, makerspaces may be stand-alone areas built into educational environments. For example, the STEM Action Center in Utah has its own Innovation Hub, a makerspace with 2,000 square feet dedicated to project-based, career-focused, hands-on learning (see Video 2).

Video 2

What is a Makerspace from STEM Utah.



Watch on YouTube

Makerspaces in Research

Most of the empirical research on makerspaces has been conducted in the United States within the field of education (Mersand, 2021; Sharma, 2021). The makerspace movement, however, has expanded globally. Recent international research has examined the design of inclusive makerspaces, establishment of maker ecosystems, and what varying cultures affirm as making, innovation, and expertise (Forbes et al., 2020; Giusti & Bombieri, 2020; Gurjar, 2021; Hira & Hynes, 2018; Jain, 2019; Lindtner, 2015; Matthee & Turpin, 2019; Tabarés & Boni, 2023; Valente & Blikstein, 2019).

Although much makerspace research is published in education journals, Sheridan et al.'s (2014) seminal comparative case-study on learning in makerspaces described how diverse spaces (a standalone community workspace, a church basement, and a children's museum) can be used as making/learning environments. Much of the research on makerspaces that followed focused on specific makerspace variables such as the various facilitators, roles, tools, and conditions that makeup makerspaces (Mersand, 2021).

Since the early 2010s, informal learning contexts (e.g., after school programs, libraries, workshops) have been the primary setting of research on learning in makerspaces (Halverson & Peppler, 2018; Mersand, 2021; Sharma, 2021). This trend is likely due to the tension created by standards-based curriculum in formal contexts (Rouse & Rouse, 2022; Sanders et al., 2019). Recently more scholars have shifted their focus to formal learning contexts (i.e., classrooms) to better understand how students learn in makerspaces (Rouse & Rouse, 2022).

Whether set in formal or informal learning contexts, the learning outcomes reported in makerspace research are most often affective outcomes, such as attitudes, beliefs, increased engagement, and development of maker identities (e.g., Chu et al., 2015; Davis & Mason, 2016; Kafai et al., 2014; Mersand, 2021). While some scholars report on outcomes associated with skills or content knowledge (e.g., Bull et al., 2017), such cognitive and psychomotor outcomes are not commonly the primary focus of makerspace research (Mersand, 2021; Rouse & Rouse, 2022).

Related Terms

Experiential Learning, Learner Agency, Problem-based Learning, Project-based Learning, Self-efficacy, Self-regulation, Third Places

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Community Artifacts

Fayetteville Free Library - This library-based makerspace offers an overview of makerspaces and some training resources for using various maker technologies.

The Maker Lab at Chicago Public Library - This is an excellent example of using makerspaces in a third place.

HackPGH - An exemplar of a makerspace as a community-based workshop

Maker Resources for K-12 Educators - A vast array of resources to support the many elements of successful makerspaces (e.g., designing, facilitating, sustaining, developing educators)

Nation of Makers - An American nonprofit that supports maker organizations.

Makerspaces: Remaking Your Play and STEAM Early Learning Areas by Michelle Kay Compton and Robin Chappele Thompson (2021) - A makerspace book for early childhood educators

Microcredentials

Stackable, Combinable, or Transferable Qualifications

Aras Bozkurt & Mark Brown

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Higher Education | Microcredentials | Nano-Degrees | Specialization | Vocational and Further Education

Microcredentials (or micro-credentials) are the records of the learning outcomes that a learner has acquired following a small volume of learning, which is assessed against transparent and clearly defined criteria (European Commission, 2022). While there is no global consensus on the definition of a microcredential, the above definition adopted by all EU Member States goes beyond the bottom-up movement of issuing open badges. It distinguishes microcredentials as (digital) proofs of meeting defined learning outcomes that are assessed, quality-assured, and verified by a trusted body. Moreover, microcredentials are expected to provide metadata transparently showing the learner's identity, awarding body, date of issue, study hours needed to achieve the learning outcomes (including credit value and level if applicable), type of assessment, and form of participation. While other terms are often used interchangeably to refer to microcredentials (e.g., digital badges, digital credentials, online certificates, alternative credentials, nano-degrees, micromasters, master tracks, and specializations), they do not always meet the above requirements. Importantly, the definition in this paper, which draws on contemporary international developments in the area, positions microcredentials as a core feature of the 21st-century credentialing ecosystem where they can be stackable or combinable with other verified qualifications or used on their own as evidence of learning.

By the beginning of 2020, a greater consensus has emerged on the definition of a microcredential. Indeed, major bodies such as the OECD, UNESCO, and the European Commission even agree on including a hyphen to lessen the confusion in terminology. More significantly, all EU Member States have adopted a common definition similar to the shared global definition proposed by UNESCO (2022). Several countries have already developed National Microcredential Frameworks (See Brown et al., 2021), with Australia being the latest to do so (Department of Education, Skills and Employment, 2022). This paper shares some of these developments and explains several of the driving forces behind microcredential growth.

What is driving microcredentials?

Several different but interconnected drivers fuel the current microcredentialing movement. Firstly, promoting lifelong learning is key to ensuring everyone has the knowledge, skills, and competencies they need to thrive in an ever-changing digital society. Accordingly, there is an increasing appreciation of the need for more flexible learning and career pathways. Secondly, a related driver is the rapidly changing nature of work and the need to upskill people to enhance their employability and fill growing skills gaps in response to labor market trends and the needs of industry and employers. The COVID-19 recovery has amplified the impact of digital transformation (Bozkurt & Sharma, 2022) and the importance of providing fit-for-purpose training and formal education pathways. In this context, microcredentials emerge as flexible and more inclusive learning opportunities to meet society's current and future challenges. As the European Commission (2022, p. 2) states in its recent Council Recommendation:

"They make possible the targeted, flexible acquisition of knowledge, skills, and competencies to meet new and emerging needs in society and the labor market and make it possible for individuals to fill the skill gaps they need to succeed in a fast-changing environment, while not replacing traditional qualifications."

This last point recognizes that higher education institutions perform an important role in society. However, traditional degree programs reflect "a long-form learning model" (HolonIQ, 2021, para. 3) that no longer 'frontloads' learners with knowledge, skills, and competencies for the remainder of their lives. As several major employers have moved to focus on employing people with work-ready skills rather than degrees (Akhtar, 2020; Kukulska-Hulme et al., 2022), microcredentials have begun to challenge the traditional credentialing ecosystem. In contrast to traditional qualifications, microcredentials recognize a wider range of learning or expertise in specific areas (Maina et al., 2022). Microcredentials can be bundled or unbundled, making it possible to create more personalized or unique training and educational pathways for both professional and personal development (Pelletier et al., 2021).

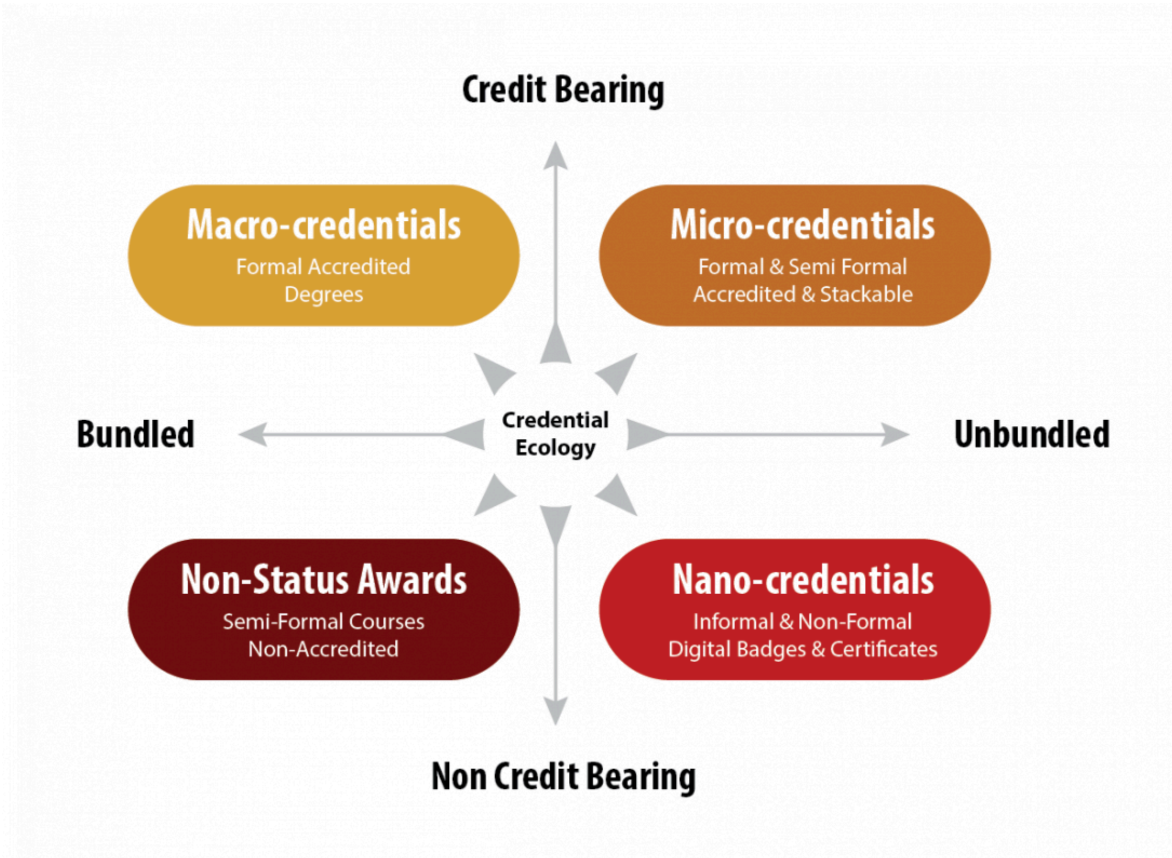
In this respect, microcredentials provide new possibilities for life-long, life-wide, and life-deep learning. It is also significant that microcredentials have the potential to liberate learners in terms of providing entry points to those who want to verify and accredit their qualifications and expertise without entering the long-term traditional higher education system. Additionally, in many cases, employers do not need or have the time for their employees to complete long-form qualifications as they seek just-in-time on-the-job training and continuous professional development. Thus, microcredentials further help to meet this kind of specific recognition of learning in workplace settings. In this regard, the traditional 'brick and mortar' higher education model does not meet such needs (Brown et al., 2021). This is where microcredentials can help "to overcome the gap between the learning outcomes of initial formal qualifications and emerging skills needs" required by the industry (Shapiro, 2020, p. 2).

Where do microcredentials fit?

There is growing momentum to integrate microcredentials more fully into the current credential ecosystem as both standalone and stackable qualifications. However, this is not as easy as it sounds, as the bottom-up open badging movement remains largely outside the scope of contemporary microcredential definitions. Moreover, Wolz et al. (2021), McGreal and Olcott (2022), and West and Cheng (2022) highlight that a common global definition is still a work in progress. Despite these challenges, our traditional conception of qualifications is changing, which needs to be reflected in how we understand the new and emerging credential ecosystem. Although overly simplistic, Brown et al. (2021) illustrate this ecosystem consisting of four distinctive quadrants representing credit-bearing and non-credit-bearing awards along with traditional bundled macro-credentials (i.e., degree programs) and those being rebundled through the microcredentialing movement (see Figure 1). In this more contemporary map of the credential landscape, microcredentials occupy the space of being unbundled, stackable and credit-bearing small volumes of learning. In contrast, nano-credentials refer to all manner of unbundled learning opportunities, such as open badges, that do not meet the definition of a microcredential as reported in this paper.

Figure 1

The new credential ecology (Brown et al., 2021)



Where next for microcredentials?

This paper has shown that microcredentials have transformative potential, providing pathways for personalized professional growth and career development. They can be a key mechanism for recognizing prior learning and informal learning experiences linked easily to eportfolios. However, there still are some serious challenges to overcome. For instance, greater interoperability is required across digital credential platforms and technologies. Also, there is a need to modify existing regulations so that microcredentials can be recognized at local, national, and international levels. There is also a need for trusted quality assurance mechanisms and accrediting bodies. Additionally, there is a need to focus more on the demand-side rather than the supply side of microcredentials. More importantly, microcredentials research needs more empirical evidence of the (private) benefits to learners and the (public) benefits to employers, governments, and societies.

Related Terms

Digital Literacies, Learner Agency, Lifelong Learning

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Microlearning

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Just-in-time Learning | Microcontent | Instructional Unit | Small Unit | Short Courses

Microlearning is a strategy of delivering short, stand-alone instruction with one or two knowledge or skill-based objectives as part of or within formal, non-formal and informal learning environments through any modality. There are varying definitions of the term microlearning in the literature. Paul (2016), for example, refers to microlearning as a form of e-learning delivered in small chunks, focused on delivering skill-based and just-in-time learning, which is competency-based and immediacy-focused (see Figure 1). Others define the term from a problem-centred, and connectivist view that engages students to "solve a problem, direct their own learning, apply their knowledge or connect with others" (Major & Calandrino, 2018, p. 2). From a connectivist view (De Gagne et al., 2019), microlearning prioritizes the development of learners' capacity to connect and associate multiple ideas and resources from different microlearning objects. As a result, learners can connect with diverse sources of information and their peers, leading to a deeper understanding of the subject matter.

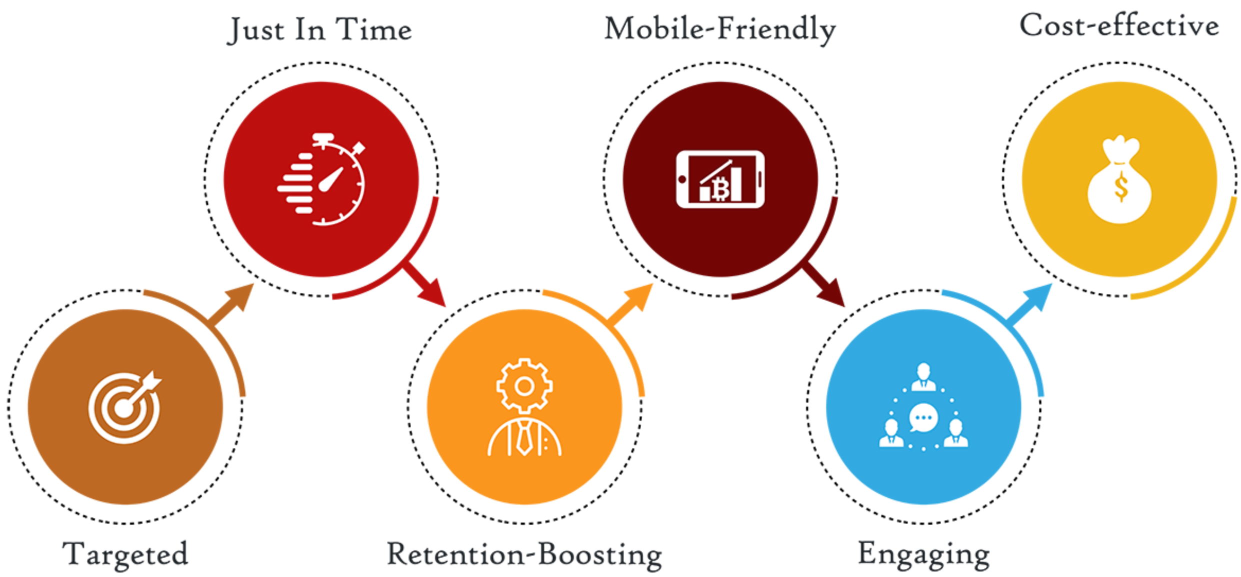
Have you ever tried to carry a cup of coffee in one hand while using your phone with the other hand, and also trying to unlock your front door at the same time? You're juggling so many tasks that your brain starts to feel overwhelmed, and you end up spilling the coffee all over yourself! That's an example of extraneous cognitive load—you're trying to process too much information at once, and it becomes difficult to complete any of the tasks successfully.

The purpose of microlearning is to reduce extraneous cognitive load, which is dependent on the "way the instruction is designed, organized and presented" (Moore et al., 2004, p. 989). Cognitive learning theory buttresses this purpose. It is like trying to run a marathon while carrying a heavy backpack full of rocks—the extra weight slows you down and makes the task much harder than it needs to be! Thus, to make effective instruction, one must limit the number of objectives and quantity of information in any learning resource. For effective coverage of microlearning objectives without compromising extraneous cognitive load involves keeping instruction short. Still, the duration of the time is debatable, as (Tipton, 2018) stated "as long as necessary and as short as possible."

Leveraging technology, microlearning can be delivered online through e-learning or mobile learning, providing opportunities for self-directed learners to pursue lifelong learning quickly. Although popularized in the early 2000s, the earliest use of the term microlearning was in 1963 (Correa, 1963). However, different names were often used for microlearning, such as short courses, just-in-time learning, microcontent, etc. (Hug & Friesen, 2007).

Figure 1

Characteristics of Microlearning



Skyline Graphics. (2023). Six benefits of Microlearning with icons and description placeholder in an Infographic template [Infographic]. Adobe Stock.

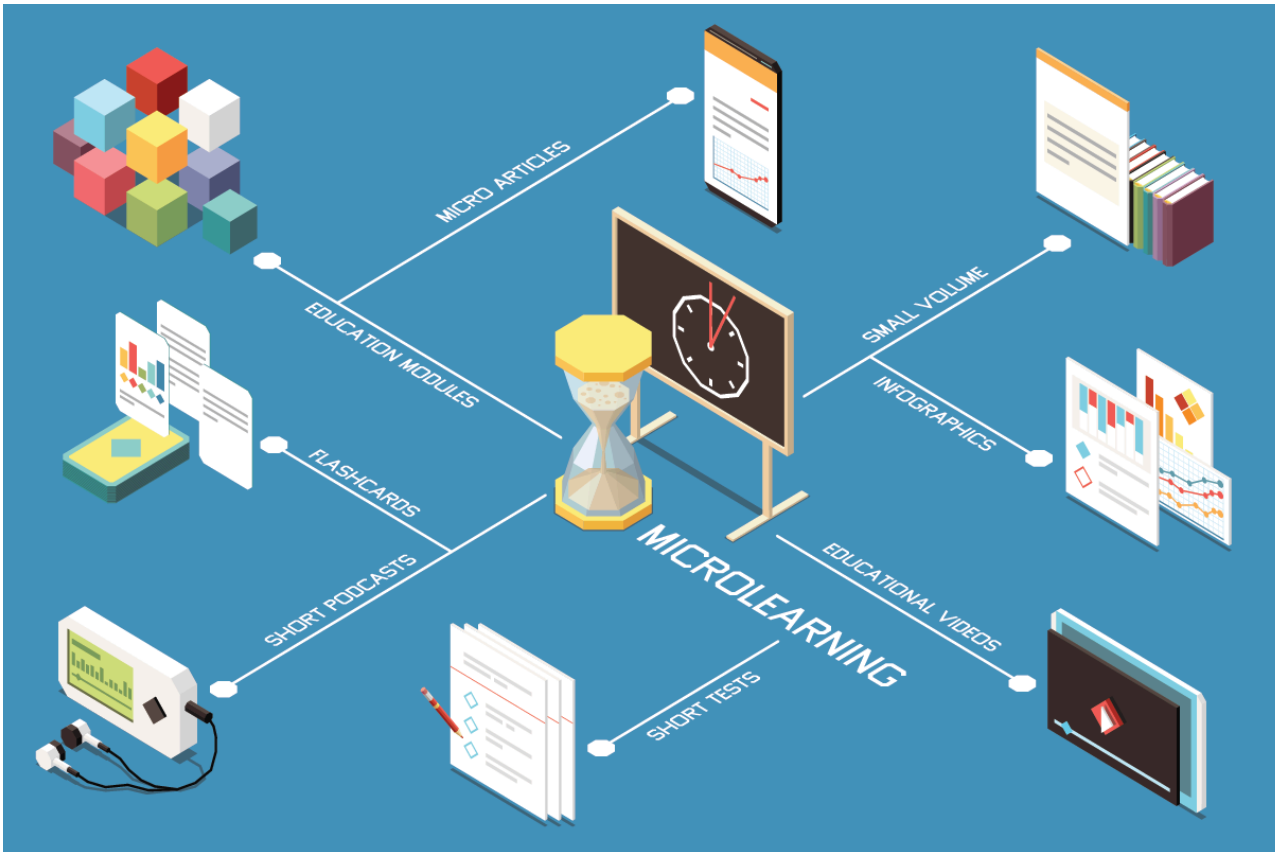
Microlearning is a versatile learning approach that can be integrated into any educational setting. For instance, higher education can be utilized as a supplementary resource to the traditional curriculum, allowing students to personalize their learning experience and receive prompt guidance and feedback (Kohler et al., 2021). Similarly, Kohler et al. (2021) suggested that microlearning can deliver cross-curricular, co-curricular and open-curricular opportunities in higher educational settings. In professional settings, microlearning can be used to deliver continuous professional development (CPD), e.g., through professional associations and regulatory boards for teachers and project managers.

The stand-alone aspect of the definition suggests that microlearning is not simply chunking content, as chunking breaks information into smaller pieces, and each piece is necessary to understand the whole picture. Rather, with microlearning, each learning resource is created and can be used independently of other resources.

Microlearning can be used in traditional in-person contexts to deliver short courses or other learning solutions. Video is a popular medium for delivering microlearning, but other media can be used, such as flashcards, games, infographics, and checklists (see Figure 2). And, since media use for instruction is commonplace in most learning environments, microlearning objects should conform to research-based multimedia design principles (Clark & Mayer, 2016; Mayer, 2021).

Figure 2

Examples of Microlearning Formats



Macrovector. (n.d.). Microlearning Isometric Flowchart [Illustration]. Adobe Stock.

The content delivered through microlearning can either be content-knowledge-focused or competency-skills based. Thus, microlearning objects can be used either in traditional academic settings, informal learning scenarios such as social media, and workplace learning. In corporate settings, learning is repeated for reinforcement at intervals because training retention decreases with time from the event, as time increases according to the concept of the forgetting curve (Ebbinghaus, 1885; Murre & Dros, 2015).

Some myths have been assumed as elements of Microlearning. For example, several authors have argued on the ideal length of training time (Torgerson & Iannone, 2019) to qualify as micro and assumed it is time-dependent (Tipton, 2018). Tipton (2018) suggested the content should be as short as possible and long as necessary. Other myths are that it has to be video-based (infographics and images can also be used), require technology (job aides, checklists), one-size fits all (based on learner needs and context analysis).

The future of microlearning is likely to be driven by advances in technology, such as the increasing use of artificial intelligence (AI) and machine learning (ML) to personalize learning experiences. With the help of AI and ML, microlearning can be tailored to the specific needs of individual learners, providing them with the most relevant and effective learning content.

Another trend that is likely to shape the future of microlearning is the use of gamification techniques. By adding game elements to microlearning modules, learners can be engaged and motivated to complete the learning activities.

Mobile devices are another key factor driving the growth of microlearning. As more people use their smartphones and tablets to access learning content on-the-go, microlearning will become an increasingly important part of the overall learning experience.

Related Terms

Micro-learning, informal learning, lifelong learning, micro-credentials or badges, mobile learning, nonformal learning, online learning, personal learning environment, social media, knowledge bytes or bite-sized learning

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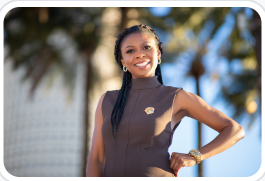

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Anu is an Instructional Designer (MS. Instructional Design & Tech) currently working in the healthcare sector. Her career background is in education and training. Her inspiration for course design is to keep the learner at the center. This inspiration led her to author a research where she shared her design decisions - Two culturally situated instructional design cases for beginner English language learning in Haiti. During her downtime, she enjoys taking walks, watching documentaries, and try out hot spicy food across cultures.

Online Mentoring

Camey L. Andersen & Steven K. Thomas

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Online | Mentor | Collaborative Learning | Mentoring | Online Mentoring

Online mentoring is "a computer mediated, mutually beneficial relationship between a mentor and a protege which provides learning, advising, encouraging, promoting, and modeling that is often boundaryless, egalitarian, and qualitatively different than traditional face-to-face mentoring" (Bierema & Merriam, 2002, p. 219). While online mentoring has been available since the advent of internet access, it is evolving to become a transformative educational and professional development strategy. By creating collaborative learning experiences between mentees and mentors, online mentoring advances a learning vision where mentorship transcends cultural, geographical, and physical barriers, enhances inclusivity, and fosters holistic development within an increasingly interconnected global community. The democratization of mentorship also encourages belonging and engagement and provides new opportunities for self-directed learning (DeWaard & Chavhan, 2020; Olivier & Trivedi, 2021).

Online mentoring elevates the classic art of mentoring (Shandley, 1989; Jacobi, 1991; Ehrich et al., 2004) into the modern world of technology and innovation. While foundational mentoring principles still apply to online mentoring, definitions are also evolving. In early online mentoring research, traditional mentoring models were adjusted to be successfully implemented online (Hamilton & Scandura, 2003; Whiting & de Jansz, 2004), but foundational research focused specifically upon online mentoring was missing (Sanyal & Rigby, 2017). More contemporary definitions offer a simplified explanation that online mentoring provides a "process in which electronic media are used as the main channel of communication between the mentor and mentee" (Argento-Linares et al., 2017, p. 401).

Online mentoring has increasingly become more valuable as advancements in technology have facilitated and streamlined accessibility and connectivity (Collier, 2022; Tetzlaff et al., 2022). Recent challenges of remote work and mandated online education have also provided new opportunities and the necessity for creating trust between employees or students and instructors, building support for the sponsoring organization, and improving inclusion through online mentoring (Tu & Li, 2021). Currently, online mentoring is evolving to surpass previous paradigms, acquiring heightened prominence in the form of transformative educational and professional development strategies (Mullen, 2021). This evolution is characterized by the merging of technology with pedagogical methodologies resulting in a dynamic platform that leverages digital connectivity to foster mentor-mentee relationships (Tinoco-Giraldo et al., 2020). In this context, online mentoring encompasses a mentor's guidance, knowledge dissemination, and personal development for the mentee through virtual channels. It also draws on online mentors' intentional use of strategies including personal competence, availability, career planning and networking, communication, feedback, and emotional connection (Byrnes et al., 2019, p. 239). This reframing process for online mentoring capitalizes on the digital landscape's potential for immersive and collaborative learning experiences.

Advantages

In comparison to classical mentoring, online mentoring benefits from potentials of being "boundaryless" and more "egalitarian" (Bierema & Merriam, 2002, p. 419). First, physical and logistical constraints to mentoring can be removed as mentors and mentees meet in a wider variety of locations and at a wider variety of times than might be available in a traditional office setting, such as outside, in moving vehicles, and with backdrops to hide locations or during early morning, late evening, and between other meetings.

Online mentoring also transcends geographical and cultural constraints (Bierema & Merriam, 2002; Pollard & Kumar, 2021) by providing opportunities for long-distance and international mentoring, ensuring access for students and employees worldwide that would not be possible in person with mentees and mentors in separate offices, locations, and countries. It may also help remove psychological barriers between mentees and mentors due to professional position, stature, or age, and may help improve mentoring relationships where there are potential biases of race, culture, gender, first-generation status, etc. that may cause feelings of estrangement or lack of inclusivity among professionals and students (Termini et al., 2021). Online mentoring can help level the conversational landscape for the mentee, allowing them to ask questions with more confidence and facilitating deeper engagement and active listening (Andersen & West, 2021). Working toward this goal of greater equality in mentorship fosters a sense of belonging and enhances an institution's commitment to inclusivity.

Moreover, online mentoring can encourage self-guided learning as mentees actively use online resources and flexible interactions to explore topics they are curious about. This approach promotes independence, critical thinking, and the skill to research on one's own—all in line with modern learner-focused methods. Furthermore, online mentoring breaks down barriers and nurtures self-directed learning, making it a powerful tool for modern education (Olivier & Trivedi, 2021). Online mentoring's focus on autonomy can enrich not only academic or workplace success for the mentee but also personal development, shaping a dynamic and vibrant learning environment.

Constraints

There continue to be challenges to overcome in online mentoring requiring careful consideration and strategic management. Connectivity and access to reliable data remain persistent hurdles. If a mentor and mentee cannot have an uninterrupted mentoring conversation, such as via video conference or messaging due to insufficient data coverage, even the best attempts at mentoring will fail. In many countries, access to high-speed internet is an ongoing difficulty. Even with remote work and online higher education becoming more mainstream, there may also still be obstacles to virtual communication perception between mentee and mentor. Visual and auditory cues that facilitate effective interpersonal interactions in face-to-face settings may not be as readily discernible, leading to miscommunication. The efficacy of online mentoring is contingent on the technological fluency and comfort of both mentors and mentees and requires vigilant attention by both to ensure up-to-date technology skills and coherent dialogue. Individuals who are apprehensive or ill at ease with online communication platforms may struggle to derive optimal benefits from online mentoring.

Online mentoring may also require more direction from mentors regarding online dialogue and etiquette, especially for students who are accustomed to informality in personal online communication (O'Dowd et al., 2020). Mentors may also need to connect with their mentees through multiple modalities to be most effective, which requires time and planning and is essential for cultivating robust and meaningful online mentoring relationships (Sanyal & Rigby, 2017). Cybersecurity is also an issue with online mentoring, as the possibility that interactions may not be secure might influence comfort and openness (Jan & Mahboob, 2022). In response to these challenges, mentors must assume an essential role in guiding and shaping effective online mentoring interactions. As the realm of online mentoring continues to evolve and expand, the development of comprehensive strategies to address these challenges will be integral to realizing its full potential as an impactful learning modality.

The Future of Online Mentoring

Online mentoring seems positioned to become more critical to higher education and business as technology improves and as professionals, students, and society become more engaged in online learning opportunities. This trajectory underscores the growing significance of using online mentoring to foster a diversified spectrum of skills and cultural insights through global mentoring. In this growing trend of global mentoring, mentors and mentees can move beyond cultural boundaries in pursuit of enriched learning experiences and the cultivation of intercultural competence (Domer et al., 2021; Rodriguez et al., 2021). Mentors and mentees may reach out for mentoring across cultures to improve learning and connection. Benefits include finding global solutions to common challenges, developing a more diverse perspective, building global community and collaboration, especially where participants share common fields, and working together on international projects and programs (Rosser et al., 2020). Mentors and mentees must show resolve for working around barriers such as time differences, language and communication constraints, and cultural differences to achieve "intentionally global" mentoring opportunities. (Rosser et al., 2020, p. 8). More opportunities for global mentoring in business, education, and medicine are promising to enhance academic and professional proficiencies while also fostering a heightened cultural acumen that resonates with the evolving international landscape.

Artificial intelligence methods may also impact online mentoring. While a chatbot may not be able to replace the role of a skilled mentor, AI could help improve online mentoring relationships by managing administrative details such as (a) scheduling and providing resources to mentees, thus minimizing the time commitment for mentors, (b) providing learner analytics to improve how the mentor guides the mentee, and (c) helping to match mentors and mentees together (Murray et al., 2022). AI-assisted online mentoring may also offer increased access to mentoring and provide more effective mentoring to large populations and diverse, underrepresented groups (Neumann et al., 2021; Ocado et al., 2023).

As the landscape of online education continues to evolve, a collaborative relationship with online mentoring may strengthen its impact as a transformative educational modality. Connections between technological innovation, pedagogical adaptation, and cross-cultural interaction show the potential for creating a generation of students and professionals adept in both their chosen fields and global perspectives. The nexus of online mentoring thus stands ready to shape the trajectory of education, business, and other disciplines, ushering in a new era of dynamic, interconnected, and culturally astute learning and educational experiences.

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Steven Thomas, a native of Jackson, Mississippi, possesses extensive expertise as a seasoned industry leader in mentoring, success coaching, enrollment counseling, student wellness, and working with global at-risk populations, complemented by a diverse professional background spanning education, sports, and executive leadership. He has acquired academic credentials from Brigham Young University-Idaho, Belhaven University, Jackson State University, and the Massachusetts Institute of Technology (MIT). Steven has garnered notable achievements, including coaching and securing consecutive State Championship basketball titles, attaining recognition as a five-time bodybuilding champion, and achieving eight-time National Qualifier status as an athlete. In acknowledgment of his contributions to education, he was honored with the Global Forum for Education and Learning's 2020-2021 Top 100 Leaders in Education award. As an entrepreneur, Steven is the founder of NXT LVL Empire, LLC, and Steven Thomas Global, where he serves as a mentor and coach to a diverse clientele spanning across the globe. Recognized for his eloquence and motivational prowess, Steven is highly regarded as a public and motivational speaker. Presently, he holds the position of Director of Enrollment Counseling, Mentoring, and Student Wellness at BYU-Pathway Worldwide, serving 70,000+ students from 188 countries. Through his multifaceted professional roles, Steven is committed to empowering individuals globally, facilitating the realization of their fullest potential.

Open Educational Practices

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Open Pedagogy | OER | Open Education | Open Educational Practices | OEP

Open educational practices (OEP) is an umbrella term that includes the creation, use, and reuse of open educational resources (OER); pedagogical practices encouraging peer learning, collaborative knowledge creation, sharing, and empowerment of learners; and systemic and structural initiatives to support and embed openness. The underlying values of OEP match those of open education more broadly, i.e. enabling educational access, ensuring inclusivity, and furthering equity. Examples of OEP include using OER, renewable/non-disposable assignments (where students publish work openly), collaborative annotation, Wikipedia editing, open courses, and engaging in open learning/teaching communities, among many others. Some people use the terms 'OEP' and 'open pedagogy' interchangeably, while others consider OEP to be a broader concept, inclusive of open pedagogy, as the latter focuses primarily on teaching practices (see Open Pedagogy). OEP can be enacted at the level of individual artifacts, modules or programs (via OER, open pedagogy, open textbooks, open learning design) as well as systemically across institutional structures (via open education policies, open publishing practices, reward/recognition structures). Recent OEP research focuses on the importance of critical and social justice approaches, reflecting wider trends in digital and higher education. Such approaches acknowledge the importance of context and power relations and encourage diverse, inclusive, and equitable approaches to openness.

Openness has a long history as a core value in higher education. The use of the qualifier “open” reflects an intentional approach to ensure educational access, inclusivity and equity for all learners. The term “open educational practices” or OEP has been in use since 2007 when it first emerged in the context of research projects exploring how OER could make a difference in teaching and learning (Andrade et al., 2011; Ehlers, 2011; Geser, 2007). The concept of OEP was useful in shifting the focus from resources to practices and processes, thus highlighting the value of learners and teachers engaging in knowledge creation and sharing as collaborative pedagogical praxis (Beetham et al., 2012; Karunanayaka & Naidu, 2020; Koseoglu & Bozkurt, 2018). As noted by Hodgkinson-Williams (2010): “The move to incorporate ‘practice’ in the definition signifies the acknowledgement that content disembedded from its context is difficult to adapt without some understanding of the pedagogical and epistemological assumptions underlying the creation of the resource” (p. 6)

Although the concept of OEP initially arose from projects exploring the use of OER, OEP is increasingly a “multidimensional construct” (Brandenberger, 2022). Today, based on empirical studies across diverse contexts, it is recognized that not all forms of OEP necessarily involve the creation, use and/or reuse of OER (Beetham, et al., 2012; Cronin, 2017; Czerniewicz, et al., 2017; Nascimbeni & Burgos, 2016). “Expansive conceptualisations” of OEP recognise that OEP may include open content, but also allow for multiple entry points to and avenues of openness, e.g. using open tools and spaces for engagement, collaboration, publishing and/or professional development (Cronin & MacLaren, 2018; Paskevicius & Irvine, 2021). Indeed, as there is no single evident way in which practices can be ‘open’, the use of the term OEP can instead signal the intention to both highlight and interrogate the nature of any educational opening in context (Havemann, 2020).

An increasing focus in OEP research and practice is the recognition that openness itself does not ensure equity. Openness is not a panacea. Awareness, intention, and effort are required to ensure that OEP are respectful of differences, truly inclusive, and equitable (Croft & Brown, 2020; Hollich, 2022; Veletsianos, 2021). As noted by the editors of Open at the Margins (Bali et al., 2020a): “we are cautious about rhetoric concerning equity, diversity, and inclusion, asserting that these only have meaning when concomitant processes are genuinely embraced to avoid further marginalizing the marginalized” (para. 6). A number of frameworks, models, and analyses have been developed to support educators in conceptualizing, designing, and implementing OEP using a social justice perspective. Most draw on established social justice theories (e.g. Fraser, 2005; Gidley et al., 2010). These include Arinto, Hodgkinson-Williams and Trotter’s (2017) model of OER engagement and associated levels of social inclusion; Lambert’s (2018) framework of social justice principles applied to open education; Hodgkinson-Williams and Trotter’s (2018) social justice framework for understanding OER/OEP in the Global South; and Bali et al.’s (2020) framing of OEP from a social justice perspective.

Developing and implementing open education policies is an important aspect of OEP at a structural level. The UNESCO (2019) OER Recommendation called on governments and educational institutions to create supportive open education policies to foster OEP, e.g. to support open licensing of publicly funded educational materials, to enable the use and adaptation of OER, to create communities of practice, and to incentivize "open teaching practices" (Huang et al., 2020). Whereas at governmental levels policymaking suggests legislation and funding, at an institutional or organizational level, policy can exist in official, documented forms, but also in forms which are more informal and dynamic (and therefore, more vulnerable to the winds of change), e.g. through project funding, existence of support roles, or accepted norms of practice. Building on the UNESCO Recommendation and other research, recent work has focused on the need to develop enabling open education policies, with a focus on co-creation (Atenas et al., 2022).

The Covid-19 pandemic and subsequent campus closures (beginning March 2020) exacerbated and further revealed issues of inequality, particularly digital inequality. Influential organisations called on the global education community to share educational resources as OER in order to “support educators, students and decision-makers” (ALT, 2020) and to help build “more inclusive, sustainable and resilient knowledge societies” (UNESCO, 2020) during a time of crisis. Reports on the use of OER during the pandemic are mixed, with some reports of increased use (CoL, 2022) and others indicating a lack of evidence of formal adoption (Lederman, 2021). There was, however, an observed rise in the use of informal OEP in the form of educators sharing questions and ideas with one another (Havemann & Roberts, 2021).

In summary, the core principle of open education is ‘education as a common good’, i.e. quality education for all. The use of OEP, in all its forms, can promote shifts in mindsets and actions towards openness, thus contributing towards quality education for all, including the systemic changes required to support this.

Related Terms

Open Pedagogy

Open Educational Resources

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Claire McAvinia

Open Educational Resources

TJ Bliss & Sara H. Tuiloma

DOI:10.59668/371.8286

Open | Open Educational Resources | OER | Open Education | Copyright | Public Domain | Creative Commons | 5R Activities | Open Learning

Open educational resources (OER) are copyrightable works useful for educational purposes that exist in the public domain or under a copyright license that provides free and perpetual permission to retain, revise, remix, reuse, and redistribute (collectively known as the "5R Activities"). The term "Open Educational Resources" was originally coined at a 2002 Forum on Open Courseware organized by the United Nations Educational, Cultural and Scientific Organization (UNESCO; UNESCO, 2002). OER comprise the foundational component of the broader concept of Open Education and may include full courses, course materials, modules, textbooks, videos, tests, and any other copyrightable physical or digital tools or materials used to support access to knowledge (Hewlett Foundation, 2022). Creative Commons provides the most commonly used legal schema for granting an open license to a copyrightable educational resource (Creative Commons, 2020a, 2020b; Kimmons, 2018). Instructional techniques that utilize or rely on OER are generally classified as Open Educational Pedagogy, Open Educational Practices, or OER-Enabled Pedagogy (Wiley, 2013, 2015, 2017).

The concept of open educational resources only exists and has relevancy in the legal context of copyright law. Where copyright law does not exist, there is no need for a concept like OER. As such, OER is fundamentally a legal construct, built on the idea of legal rights or permissions and requirements granted by creators to intended users.

The most commonly accepted set of permissions are the 5R Activities, developed and defined by David Wiley. These include permission to retain, revise, remix, reuse, and redistribute copyrightable works (Wiley, n.d.). Wiley describes each of these permissions with examples:

- Retain - make, own, and control a copy of the resource (e.g., download and keep your own copy)
- Revise - edit, adapt, and modify a copy of the resource (e.g., translate into another language)
- Remix - combine an original or revised copy of the resource with other existing material to create something new (e.g., make a mashup)
- Reuse - use an original, revised, or remixed copy of the resource publicly (e.g., on a website, in a presentation, in a class)
- Redistribute - share copies of an original, revised, or remixed copy of the resource with others (e.g., post a copy online or give one to a friend)

In addition to permissions, creators of OER often reserve some rights and requirements on the use of their works that are less than the "all rights reserved" restrictions of full copyright but more than the "no rights reserved" status of works in the public domain. The most widely used international schema for reserving these rights and notifying users of their existence is a standard set of six copyright licenses developed and maintained by Creative Commons (Creative Commons, 2020a; Kimmons, 2018; cf. Table 1). To release a work under one of these licenses, authors simply need to append the desired symbol and link to their work.

Table 1

The Six Creative Commons Copyright Licenses

Name	Short Name	Symbol and Link	Description
Creative Commons Attribution	CC BY		This license allows reusers to distribute, remix, adapt, and build upon the material in any medium or format, so long as attribution is given to the creator. The license allows for commercial use.
Creative Commons Attribution-ShareAlike	CC BY-SA		This license allows reusers to distribute, remix, adapt, and build upon the material in any medium or format, so long as attribution is given to the creator. The license allows for commercial use. If a reuser remixes, adapts, or builds upon the material, they must license the modified material under identical terms.
Creative Commons Attribution-NonCommercial	CC BY-NC		This license allows reusers to distribute, remix, adapt, and build upon the material in any medium or format for noncommercial purposes only, and only so long as attribution is given to the creator.
Creative Commons Attribution-NonCommercial-ShareAlike	CC BY-NC-SA		This license allows reusers to distribute, remix, adapt, and build upon the material in any medium or format for noncommercial purposes only, and only so long as

Name	Short Name	Symbol and Link	Description
			attribution is given to the creator. If a reuser remixes, adapts, or builds upon the material, they must license the modified material under identical terms.
Creative Commons Attribution-NoDerivatives	CC BY-ND		This license allows reusers to copy and distribute the material in any medium or format in unadapted form only, and only so long as attribution is given to the creator. The license allows for commercial use.
Creative Commons Attribution-NonCommercial-NoDerivatives	CC BY-NC-ND		This license allows reusers to copy and distribute the material in any medium or format in unadapted form only, for noncommercial purposes only, and only so long as attribution is given to the creator.

Four of the six Creative Commons licenses are used in the legal creation of OER: CC-BY, CC-BY-SA, CC-BY-NC, and CC-BY-NC-SA because these licenses allow for all of the 5R Activities. The last two licenses, CC-BY-ND and CC-BY-NC-ND, do not allow users to remix or revise a work, and thus violate these core elements of the definition of OER.

OER is the subject of much academic research, with widely varying goals and approaches. A large corpus of research is built on a framework first described by (Bliss et al, 2013; Open Education Group, n.d.) known as the COUP Framework, which explores the impact of OER through the lenses of Cost, Outcomes, Uses, and Perceptions. Several meta-analyses of OER research have been published as well, exploring the overall impact of OER across various metrics and in various contexts (Colvard et al., 2020; Grewe & Davis, 2017; Hendricks et al., 2017; Hilton, 2016; Ikahihifo et al., 2017; Jhangiani & Jhangiani, 2017; Martin et al., 2017).

Policy related to OER has been implemented throughout the world at many different levels of governance, including institutional, municipal, regional, national and international (Idaho State Board of Education, 2021; SPARC, n.d.). Such policies typically incentivize the adoption and use of OER by educators. In 2019, UNESCO adopted a Recommendation on OER that requires all member states to “monitor policies and mechanisms related to OER using a combination of quantitative and qualitative approaches” (UNESCO, 2019).

Related Terms

- Open Pedagogy

OER-Enabled Pedagogy, Open Education, Open Educational Practices, Open Licensing, Open Pedagogy, Open Textbooks

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Watch on YouTube

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TJ Bliss is a change-maker in higher education. He focuses on making change with people by building strong relationships of trust, and has proven track records in education leadership, philanthropy, fundraising, and nonprofit management. TJ is the Chief Academic Officer for the State Board of Education in Idaho, where is an advocate for affordable and accessible higher education using open education and other strategies. Previously, TJ was the Chief Advancement Officer for the Wiki Education Foundation and Program Officer overseeing OER funding at the William and Flora Hewlett Foundation. TJ has a Ph.D. in Educational Inquiry, Measurement and Evaluation from Brigham Young University, and an M.Sc. in Biology from the University of Nebraska.

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Open Pedagogy

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Open Pedagogy | Open Education | OER-enabled pedagogy | Open Educational Practices

Open pedagogy is a set of teaching practices built on the foundation of the open education community's shared values, including but not limited to student agency, sharing, diversity and inclusion, peer learning, renewable assignments, co-creation/collaboration, and active/experiential learning. Though there is a lack of consensus around the definition of open pedagogy, it most often refers to student involvement in the development of course content in the form of renewable assignments or the creation or adaptation of open educational resources (OER). The practice of open pedagogy may result in or overlap with OER-enabled pedagogy and open educational practices.

As noted by Witt (2020) in "Towards a Working Definition of Open Pedagogy," the definition of open pedagogy has undergone a process of definition, redefinition, and adaptation through time. In fact, some researchers (Witt, 2020; Year of Open, 2018) have labeled open pedagogy as "undefinable." As initially defined by Wiley (2013), open pedagogy occurs when students and faculty take advantage of the "5 Rs" of openly licensed content (retain, reuse, revise, remix, and redistribute) to expand learning opportunities in the classroom. Other scholars specifically define open pedagogy as an approach to teaching in which students join the academic conversation of a topic by creating course materials that they can choose to share with an open license. This may involve creating assignments that are "renewable," (Wiley & Hilton, 2018) meaning they have utility beyond the classroom. Others have connected open pedagogy to theoretical teaching approaches, such as experiential learning, peer learning, and student-centered learning. For some instructors, open pedagogy also has a close relationship to diversity, equity, and inclusion. Examples of these and other open pedagogical practices can be found in the Open Pedagogy Notebook and Project Roadmap listed in additional resources. The variety in definitions is further complicated by similar terms used in the open education community. Wiley and Hilton later defined "OER-enabled pedagogy" as teaching using open educational resources (OER), which is very similar to the original definition of open pedagogy, further muddying the waters.

Because there is significant variation in the use of the term “open pedagogy,” and because the term is sometimes used interchangeably with similar ones, such as “OER-enabled pedagogy” and “open educational practices,” here we provide a very broad and flexible definition: Open pedagogy is a set of teaching practices built on the foundation of the open education community’s shared values, which are varied. These values may include engaging with the global community, sharing openly licensed content, using student-centered approaches, asserting student agency, and increasing diverse and inclusive curriculum and content. These values help us to understand what open pedagogy means and how it can be used in education.

At its heart, open pedagogy is the process of involving students in the creation, adaptation, and/or dissemination of openly licensed content. While some consider the mere use of OER in curriculum to be open pedagogy, OER-enabled pedagogy may be a better description of that. Whether using or creating openly licensed materials, these resources allow students to engage with a global community. A common description of open pedagogy assignments that involve student creation is that they are “renewable” rather than “disposable,” (Wiley & Hilton, 2018) due to the ability of students to build customizable resources and contribute to a larger conversation. Course assignments that involve the adaptation or creation of openly licensed resources can lead to improved diversity, inclusion, and accessibility in course materials by providing opportunities for diverse student voices to be heard.

Open pedagogy assignments can create an environment for student-centered learning by allowing individual learners to shape their own learning experiences. Additionally, experiential learning, or learning through active and relevant classroom experiences, occurs when students are involved in open pedagogical activities, such as building an open textbook. Student agency is a core value of open pedagogy. Student privacy, vulnerability, equity, inclusion, and agency must be thoroughly considered when designing course curriculum with open pedagogical projects. Legally and ethically speaking, students should not and cannot be coerced or mandated into identifying themselves in openly licensed materials or required to openly license their assignments for course credit or a grade. Instructors must also be aware of potential power differentials with students. For example, if a student is uncomfortable openly licensing their work, they may fear a negative impact on their grade. Adhering to the value of student agency requires obtaining full permission from students before openly publishing any of their work. The use, intent, and future implications of the project, as well as how the licensing will work, should be made clear in the learning objectives. Some students may experience social anxiety that could dissuade them from fully committing to a project, so it is essential for each student to not only understand what is being asked of them, but what will happen with a project after it is finished. Open pedagogy can still take place as an instructional practice even if all students in a course ultimately choose not to openly license their work.

Additionally, the sharing and licensing of traditional knowledge related to Indigenous communities should be honored. Students working on projects related to cultural or Indigenity topics should respect the autonomy and authority of said peoples and defer to their resources by seeing what has already been shared and cited. While indigenous cultures may be willing to and often do share their traditions and knowledge, care should be taken not to remix, co-opt, or colonize sacred or cultural materials. Guidance can be found in BCcampus’ Indigenization guides, listed in additional resources.

Related Terms

- Open Educational Resources

Open education; OER-enabled pedagogy; Open-enabled practices; Diversity, equity, and inclusion; Experiential learning; Student agency; Openly licensed

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Open Recognition

Richard E. West

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Open | Badges | Assessment | Evaluation | Learning | Informal Learning | Microcredentials | microlearning | Open Badges | Open Recognition | Verifiable credentials | prior learning assessment recognition

Open recognition is the use of open technologies and practices to recognize all learning, including learning not formally recognized by traditional degrees and certificates. It encompasses similar concepts such as microcredentials, open/digital badges, blockcerts, verifiable credentials, and comprehensive learner records. The goal of open recognition is to recognize all learning, whether in formal educational settings or in non-formal or informal learning practices, and to create technologies for collecting, sharing, and displaying these learning recognitions. In this article I discuss the important role that credentials and learning recognition plays in society, and then contrast an open recognition approach with more traditional approaches to recognizing and credentialing learning. I discuss various new technologies to emerge to promote microlearning and credentialing, but argue for open recognition as a more expansive view, enabling us to recognize all learning from formal, non-formal, and informal settings.

Open recognition is the use of open technologies and practices to recognize all learning, including learning not formally recognized by traditional degrees and certificates. It encompasses similar concepts such as microcredentials, open/digital badges, blockcerts, verifiable credentials, and comprehensive learner records. In addition, it is strongly connected to movement to recognize prior learning through Prior Learning Assessment Recognition (PLAR). The goal of open recognition is to recognize all learning, whether in formal educational settings or in non-formal or informal learning practices, and whether previously learned or currently in the process of learning. To accomplish this recognition of all learning, there are new and emerging technologies for collecting, sharing, and displaying these learning recognitions, including open badges and microcredentials.

The Important Role of Recognition in Educational Systems

Humans are continually learning. Every second, our senses take in 11 million bits of information (NPR, 2020). We naturally, and often unconsciously, use that information to reshape mental schemas, emotional frames, and behavioral patterns. We are constantly learning and growing, irrespective of and largely uncontrolled by any external system or instructional "design."

Despite always learning, our learning often must be recognized in order to be useful in our lives. It is recognized by an employer when they see us qualified for a particular job or promotion, or by a school admissions board when they judge that we have learned enough to qualify for higher education. There are also important informal recognitions of learning, such as when a peer recognizes our ability in a particular area and asks for our assistance, or when we recognize our own abilities and shortfalls, and make decisions about what to focus on learning next. These informal recognitions motivate and inspire learners in interesting ways. Much of the field of instructional design relies on recognition of learning as part of analyzing learner needs, gaps in knowledge, objectives that should be learned, and the sequencing of learning that might be most helpful.

Thus, while most efforts to reform or improve education focus on educational content or the important relational communities that support learning (see West, 2023), it is equally important to consider the recognition that is part of any educational system. Similarly, in attempting to make education more open, we need to consider open recognition equally to open content and open pedagogies. In this article, I briefly discuss the different ways we formally recognize learning, and propose a framework for understanding open recognition alternatives.

Traditional Recognition of Learning

Traditionally, the emphasis in learning recognition has been top-down. In this approach, an institution is trusted to appropriately recognize whether and what a student has learned, and certify this learning. This recognition of learning appears in the form of grades, progress reports, competency dashboards, certificates, and degrees. These markers are "proxies for ability and potential" (Gallagher, 2016, p. 38) that signal to other entities in society (e.g. employers) about what the student has learned. These end entities trust these proxies because of the trust they have in the institution recognizing the learning.

This formal, top-down recognition of learning is important as both "the foundation of the business model for most higher education institutions" (Gallagher, 2016, p. 3) as well as a key pillar of an industrialized society in need of specific skill sets. However, this form of learning recognition is also limited for several reasons:

1. Lack of Equity — A top-down system breeds inequity as the power within society, as it relates to education, is controlled by few hands—in this case, usually universities. As all institutions can exhibit bias, this has the potential to exacerbate a lack of equity within society.
2. Lack of Access — When recognition of learning is controlled by a small segment within society, then access to the benefits of learning recognition is limited. Even though humans are constantly learning, only those who can get their learning recognized by the correct institution will be able to benefit from their learning. As an example, it is possible to learn a skill such as computer programming outside of a university, but for a long time this knowledge was not recognized as equally valuable. Because of the power of technology companies in society, that view, in this particular domain, is changing as more technology companies recognize alternatives to higher education degrees (Caminiti, 2022).
3. Lack of Openness — Openness, as related to educational content, has been defined as the ability to reuse, retain, revise, remix, and redistribute (Wiley, 2015). Learning recognition can similarly be considered open only when a learner can retain their own learning data/credentials, reuse them for their own purposes, revise and remix them to better represent their own abilities, and redistribute them. This openness requires new technologies that take control of the recognition of learning away from institutions and instead share it equally with formal/informal learning institutions, as well as learners and communities.

Open Recognition: A New Standard

In 2012, the Mozilla Foundation released the Open Badges standard as a new potential technology to recognize learning wherever it happens. Since then, other technologies have also been created to similarly afford open recognition, including blockcerts, verifiable credentials, and comprehensive learner records. These technologies provide a similar potential, and are in many ways technically interoperable. All make it possible for anyone to recognize the learning of another, or even for a learner to recognize their own learning and codify it in a marker or credential that describes their ability.

While these technologies share many similarities in how they handle learner data, the practices surrounding how these technologies are used are very different. For example, badges can be used to simply digitize grades, certificates, and degrees, while still being issued by the same institutions for the same learner performances as before. They can be used to represent large portions of learning, such as a certificate earned over several months or years, or very small portions of learning, such as participation in a single activity. They can be tied to skills and competency frameworks, or be informally awarded as a form of “micro-reference” or endorsement that simply states that one person noticed the performance of another.

Due to the wide variety of practices surrounding the implementation of these open credentialing technologies, a division has arisen in various communities of research and practices. In these cases, nomenclature becomes important: communities using these technologies for official, top-down credentials awarded by large institutions (e.g. universities, employers, and national organizations) typically refer to these as open microcredentials or certificates. Meanwhile, communities using these technologies for informal/non-formal learning, community-based recognition, or self-claiming recognition call these awards open badges or open recognition. The term open recognition appears to have emerged in the Bologna Open Recognition Declaration (2016) and later referenced in a document produced by the Joint Research Centre of the European Commission.

Later, Open Recognition was described as “a movement born from the practice of Open Badges, exploring and promoting practices, tools and policies enhancing and broadening the opportunities for everybody, individuals and communities to be recognised and contribute to the recognition of others.” (Mirva, 2020, see also http://www.openrecognition.org/bord/). While a fairly recent movement, it hearkens back to how learning was recognized within non-formalized learning communities. As Belshaw and Hilliger (2023) explained, Open Recognition is similar to “peer-to-peer validation and communal acknowledgement of skills and achievements, similar to how guilds or apprenticeships operated in the past” (para. 14).

A Unifying Open Recognition Standard

Proponents of open recognition see the movement as inclusive of open microcredentialing, certificates, and other top-down practices (see Figure 1). Simply, Open Recognition is the recognition of all learning, by any learner, acquired anywhere, at any time. This includes formal learning in school or through an employer-based system, non-formal (but intentional) learning such as MOOCs and other internet courses or community classes/lessons, or informal learning that arises unintentionally through daily activities (Council of Europe, 2023).

Figure 1.

Open recognition includes, but also extends, concepts like open badges and open credentials.

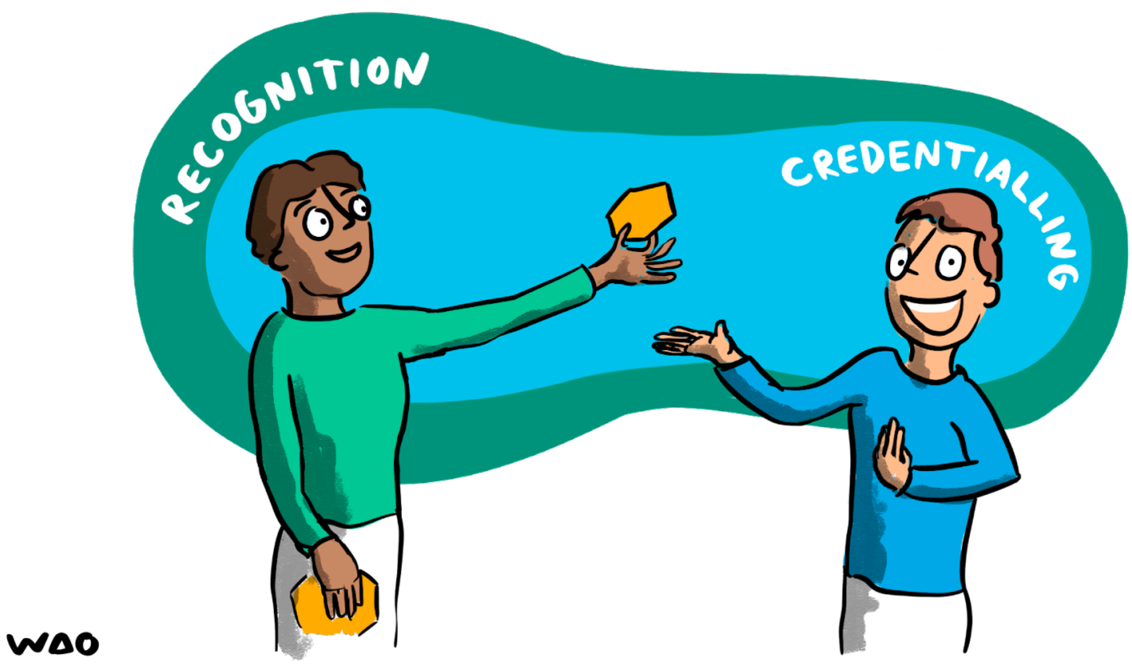


Image CC BY-ND Bryan Mathers. Link

Thus, while there is overlap between the practice of microcredentials and open badges, they are also often used to mean different kinds of educational practices. However, they are all part of an Open Recognition framework that provides a method and technology for recognizing all types of learning. Figure 2 by the We Are Open community, based on ideas from Serge Ravet, visually depicts how these various types of learning recognition are related to each other on a spectrum from formal learning to informal learning, and from a focus on traditional/institution-based recognition to non-traditiona/community-based recognition.

Figure 2

A depiction of how various types of credentials and badges are related to each other and represent options for formal, informal, and non-formal learning recognition.

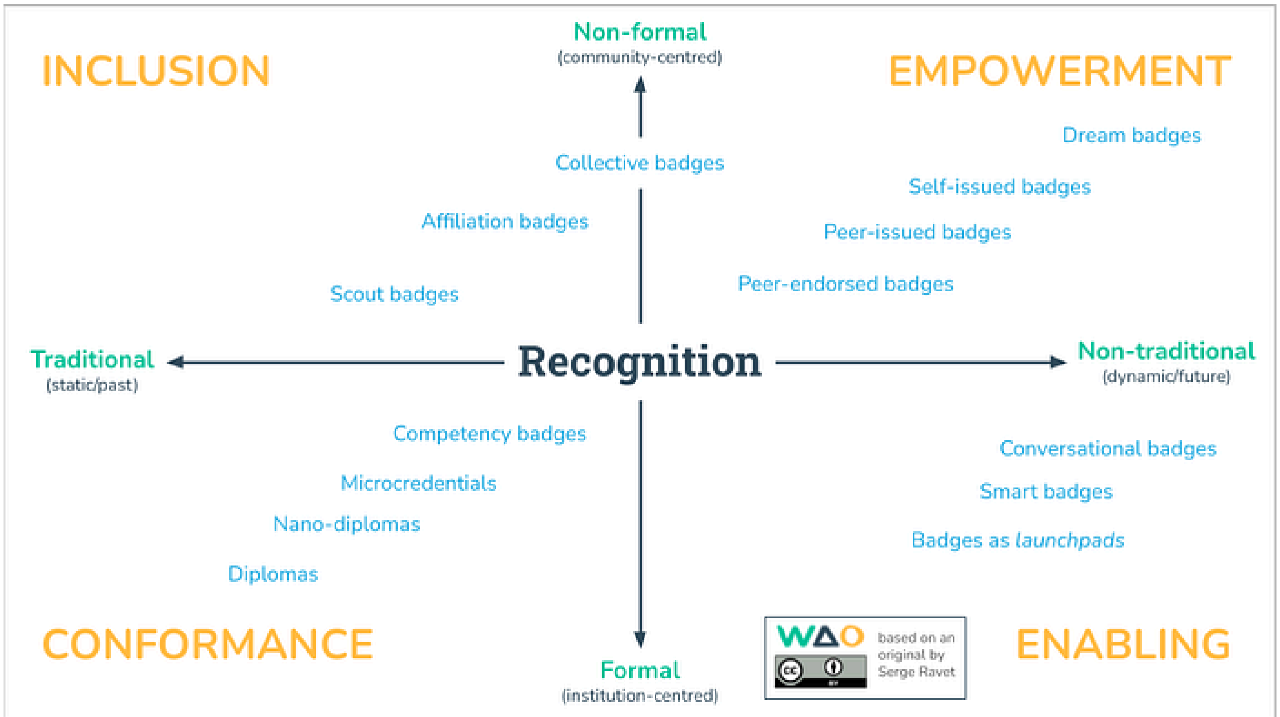
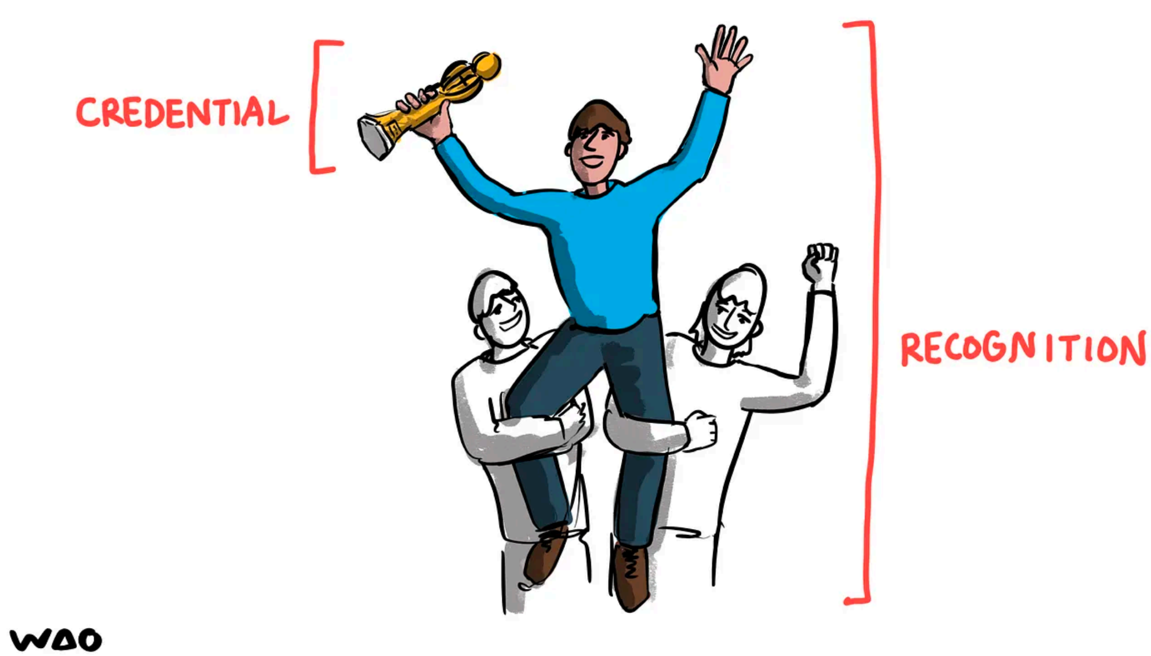


Image CC-BY We Are Open Co-Op (https://weareopen.coop/).

Or perhaps more simply put, open credentials may represent the award given at the end of an educational journey that is valued by outside entities, but open recognition also represents the very real recognition of performance that arises within communities and relationships (see Figure 3).

Figure 3

Credential and Recognition



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Potential Pitfalls of Open Recognition

The goal of open recognition is to bring more equity to learning and human development by allowing for all growth and accomplishments to be recognized and valued. This has the potential to improve upon traditional systems of education, where the power to recognize learning and growth is held by a relatively small number of institutions, such as universities. However, there are also potential pitfalls with open recognition practices. For example, without clear descriptions of the learning, evidence for the accomplishments, and standards for judging the evidence, the credential or recognition may not be valued by others. There is danger that individuals may seek alternatives to formal education, only to discover that the credentials they earn do not aid them in achieving their professional/economic goals. The creation of more ways to recognize human growtn and learning may potentially bring confusion to the credential marketplace.

Indeed, these are important issues, but the potential of open recognition to provide greater opportunity and equity, if wisely implemented with transparency and evidence, could create new pathways for learning that benefit individuals, institutions ill-equipped to support all learners, and societies eager for greater equity and economic prosperity.

Conclusion

Open recognition provides an exciting pairing of technologies and practices “that could potentially disrupt the educational status quo” (Belshaw & Hilliger, 2023, para. 8) in a future where “universities and other institutions still play a role, but they are no longer the sole arbiters of who is ‘skilled’ and who is not. They are nodes in a broad ecosystem of learning and recognition that includes employers, co-ops, communities, and self-directed learners” (Belshaw & Hilliger, 2023, para. 2).

For instructional designers, policymakers, and instructors, it is important to acknowledge the nuanced differences in how we can recognize learning in order to make wise decisions about what type of recognition or credential we believe to be most important in a given setting. Whether awarding microcredentials in a formal educational setting, or open badges in an informal, community-based experience, all learning deserves to be recognized for the value it brings to individuals, families, and communities.

For more information about open recognition practices, and how to implement these practices as a learner or institution, please see the Open Recognition Tookit at https://badge.wiki/wiki/Open_Recognition_Toolkit.

Related Terms

Open Badges, microcredentials, digital badges, blockcerts, verifiable credentials, comprehensive learner records, recognition of prior learning (PLAR).

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Community Artifacts

For more information on open recognition, see this list of articles: https://badge.wiki/wiki/Open_recognition

And consider joining the Open Recognition is for Everyone community at Participate.com

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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.

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Personalized Learning

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Pedagogy | Learner Agency | Self-efficacy | Personalized Learning

Personalized learning is an instructional strategy that tailors instruction to learners' unique backgrounds, interests, abilities, or needs, and commonly includes the prescription that learners have some voice and choice (i.e., agency) in such tailoring. Personalized learning is not a new strategy, though it has seen a rise in popularity in research and practice since the turn of the 21st century. Personalized learning has also seen a variety of descriptions and implementations since the turn of the 21st century. Various definitions of personalized learning have required the pedagogy to include some semblance of mastery-based learning, strong connections between learners or others included in the instruction, engaging instruction, and/or individual learning plans for each learner. There has also been a demand to describe personalized learning by including a more detailed awareness of what learning is being personalized, how it is being personalized, who controls the personalization, and what data informs the personalization.

Despite gaining increased attention in the mid-2000s (Shemshack and Spector, 2020), personalized learning is not a new pedagogical approach. The idea of tailoring instruction to an individual is likely as old as education itself through processes such as apprenticeships, which are often highly personalized. Prior to advancements in instructional technology, however, personalized learning required great efforts by instructors to create and curate resources that learners could use to direct their learning within a learning environment. For example, P-12 teachers looking to provide personalized instruction throughout most of the 20th century would need curriculum and resources for various grade levels or subject areas stored within their classrooms so learners could access materials that were below, at, or above grade level based on their needs and abilities. Access to even more materials would be needed for teachers and learners to tailor instruction to learners' interests. These constraints became much less severe when digital media, the internet, and learning management systems provided tools for digitally creating and curating a range of course resources and materials within a technology-enhanced learning environment (Video 1).

Video 1: What Is Personalized Learning? – Educause

Watch on YouTube

The availability of technologies that can facilitate personalized learning is one reason that the 2010 U.S. National Educational Technology Plan called for an increased effort to implement personalized learning. That plan defined personalized learning as instruction "paced to learning needs, tailored to learning preferences, and tailored to [learners'] specific interests," adding that "personalization encompasses differentiation and individualization" (p. 12). This definition lacked a specific focus on the learner's role in personalized learning, generalizing the use of the term to describe any tailoring of instruction.

The 2017 U.S. National Education Technology Plan provided a revised definition of personalized learning. This definition added that personalized learning included "learning activities [that] are meaningful and relevant to learners, driven by their interests, and often self-initiated" (p. 9), highlighting the role the learner plays in personalizing instruction. Some states have required new K-12 teachers to show proficiency in personalized learning (Arnesen et al., 2019), echoing an ongoing call for a dynamic, personalized learning approach able to provide a unique and effective learning experience for each learner and support each learner in reaching their full potential (Lee et al., 2018).

A 2020 literature review from Shemshack and Spector explored definitions of personalized learning in published research. They found that personalized learning "looks different according to the needs and goals of the individual" (p. 17). This finding is not surprising. As a pedagogical strategy, personalized learning contains several sub-layers (Gibbons, 2013) or core attributes (Graham et al., 2013). Gibbons (2013) stated that pedagogical strategies are often defined differently by individuals who implement them based on singular individual's focus for the implementation. For examples of these core attributes within personalized learning, consider how various stakeholders in Video 2 define personalized learning based on the core attributes of the pedagogy that matter to them. They separately state that personalized learning includes (a) a customized curriculum, (b) learning that excites, (c) learning that puts the student first, (d) learning that promotes agency, (e) learning that is tailored to the individual, (f) learning that provides key interventions based on students' needs, and (g) learning based on how students learn.

Video 2: How Do You Define Personalized Learning? – Educause

Watch on YouTube

Schools, universities, and corporate settings have the technological ability to personalize learning according to the unique needs of learners. Technology provides many options to learners and educators for novel approaches to personalized learning. Yet, the pedagogical knowledge needed to understand the importance of personalized learning and to increase learners' self-efficacy, empowering them to initiate their own learning and assume responsibility for it, has yet to develop.

In pursuit of such pedagogical knowledge, Horn and Staker (2014) provided a framework for thinking about the dimensions of personalized learning in practice. They suggested personalization of instruction can happen by tailoring the time, place, pace, and/or path of learning. Graham et al. (2019) added a fifth dimension to this framework – goals. Shemshack et al. (2021) suggested that a unified evolving personalized learning approach would consider four main components: learner profiles, learners' previous knowledge, personalized learning paths, and flexible self-paced learning environments generated according to dynamic learning analytics (Chatti & Muslim, 2019). Learning environments that include these various dimensions and components may empower learners to assume responsibility for their own learning and increase their learning self-efficacy.

Figure 1

5 Dimensions of Personalized Learning from Graham, et al. (2019)

Research building on deconstructions of personalized learning explained that while various definitions of personalized learning describe the tailoring of instruction based on learners' backgrounds, needs, abilities, or interests, descriptions of personalized learning should include (a) what is being personalized – learning objectives, assessments, or learning activities; (b) how it is being personalized – goals, time, place, pace, and/or path; (c) who or what is providing personalization – an instructor, learner, or adaptive learning system; and (d) what the personalization is based on – performance data, activity data, or learner profile data (Short, 2022). Other research has suggested that more work is needed to understand the outcomes of personalized learning initiatives and the hopes of technology to live up to its transformational potential to provide tailored, individualized learning (Bulger, 2016; Watters, 2023; Zhang et al., 2020).

Related Terms

Blended Learning, Competency-Based Education, Differentiation or Differentiated Learning, Individualization or Individualized Learning, Learner Agency, Learning Management Systems, Open Pedagogy, Problem-based Learning, Project-Based Learning, Adaptive Learning, Technology Enhanced Learning, Smart Learning Environments

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Community Artifacts

https://www.thepltoolbox.com/ - A resource from Dallas Independent School District about schools in their district that provide wall-to-wall personalized learning.

https://edtechbooks.org/k12blended_series - A series of Open Educational Resources focused on K-12 blended teaching. Each book of the series has a chapter that focuses on personalized learning.

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Phenomenology

Angelica Pazurek & Suzan Koseoglu

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Research Methods | Experience | Qualitative Methods | Phenomenology | Philosophy

Phenomenology is the contemplative study of human experience. It refers to a philosophical framework as well as a methodology that can inform educational practice and research. It seeks to reveal and understand how phenomena may be experienced as they are actually lived in the everyday world, or what some phenomenologists refer to as the lifeworld. Phenomenological philosophy suggests that everything in the lifeworld is inextricably connected in a social context, and so phenomenology aims to be more attentive to such meaningful connections—or intentional relations—within lived experiences and to illuminate them as a means to deeply understand the experience of the phenomenon under focus. Phenomenology can support all aspects of education by increasing sensitivity toward the many processes and practices it involves. When used as a naturalistic research methodology with qualitative methods of data collection and analysis, it can provide authentic insight for educators to use educational technologies in ethical and socially responsible ways.

In light of increased advocacy for ethical, socially just, and empowering practices in education (see Selwyn et al., 2020), there has been a growing interest in understanding the experience of teaching and learning with technology. The ways that contemporary technologies are being used today, for learning and beyond, positions them as more than simply objects or tools (Ihde, 1993). Technology can radically alter how teaching and learning are experienced. Thus, there continues to be a need in the field of educational technology to understand the contextual nature of learning with technology as well as the relationships that are shaped and the connections that are made possible in unique learning contexts (Cilesiz, 2021). An in-depth exploration of these issues can be guided and informed by phenomenology, which involves the open and contemplative study of lived experience or direct human experience of a phenomenon of interest in the lifeworld.

Phenomenology can be leveraged in the field of educational technology as a philosophical and theoretical orientation to inform practice or as an action-sensitive methodological approach to research (van Manen, 1990). Phenomenological philosophy is marked by openness, or an open and unbounded sense of wonder and curiosity, that is oriented toward what it is like to experience a particular phenomenon and how it feels affectively and somatically through embodiment and human consciousness (Benner, 1994; Merleau-Ponty, 2012). According to many philosophers, any phenomenological inquiry or practice requires the technique of *phenomenological reduction*, or the reflexive act of suspending preconceived judgments about the phenomenon in order to more openly understand it (Moran & Mooney, 2002).

In addition to phenomenological reduction, another core tenet of phenomenological philosophy is the theory of intentionality, originally proposed by Edmund Husserl, who is purported to be the founder of phenomenology around the turn of the 20th century (Sokolowski, 2000). Intentionality, in a phenomenological sense, refers to directing attention toward relationships, or the meaningful connections, among all things that exist in the lifeworld (Vagle, 2014). That is, phenomenology assumes that everything in the world, and in our lived experiences in the world, is interconnected, interdependent, and inextricably linked. Phenomenological philosopher Maurice Merleau-Ponty offered the helpful metaphor of *threads of intentionality* that connect all things in the fabric of everyday life experiences (Merleau-Ponty, 2012). These threads hold significant meaning, but they are tightly woven, making them difficult to notice and recognize. Karin Dahlberg and colleagues assert that phenomenology assists in slackening these meaning threads, allowing for a more attentive, aware, and contemplative examination to tease out the intentional meanings within lived experiences (Dahlberg et al., 2008).

Practically speaking, these theoretical and philosophical tenets that ground phenomenology can help guide pedagogy and learning design in educational technology contexts. Educational technology practitioners enacting a phenomenological approach are particularly attentive to the experience of learning with technology, and they contemplate what is necessary to support learning and teaching by remaining highly reflexive about the educational experience. In the context of a digital learning environment, such practices of attentiveness and contemplation can, for example, increase educators' sensitivity toward the particular needs of learners and challenges that may arise throughout their experience. This attunement and insight can also help guide the informed reasoning and decision-making that is uniquely required for supporting teaching and learning with technology.

From a research standpoint, phenomenological methodologies must be informed by and draw upon phenomenological philosophy to ensure rigor, quality, and integrity. For example, when using this form of scholarly inquiry, researchers are advised to integrate core phenomenological philosophical assumptions in the research design and then discuss how they also frame the study (Cilesiz, 2021, p. 151). Many historical and contemporary phenomenologists assert that an orientation toward Husserl's theory of intentionality is what makes phenomenology phenomenology and not something else (Merleau-Ponty, 2012; Vagle, 2014; van Manen, 1990). While other qualitative research methodologies, like case study and ethnography, share some similar interpretive characteristics, phenomenology uniquely focuses on the experience of a particular phenomenon as the central unit of analysis. Intentionality is then used as a theoretical and analytical lens to explore and illuminate the meaningful connections associated with the phenomenon as it is lived or as it manifests in lived experience. Phenomenologists also ensure openness and unboundedness throughout their research design, in contrast with case study, which is bounded.

Because of this central commitment to openness, phenomenological research resists a rigid structure as well as prescriptive strategies, steps, and methods (Ahmed, 2006; Giorgi, 1997; Vagle, 2014; van Manen, 1990). In line with openness, phenomenological methods of qualitative data collection and analysis are iterative, emergent, and reflexive. Data collection in phenomenological research has traditionally included interviews and written lived experience descriptions (van Manen, 1990). However, modern phenomenologists now recommend that any data, such as digital media and learning artifacts generated with educational technologies, can potentially serve as valuable sources of insight into the phenomenon under investigation when analyzed through the lens of intentionality (Dahlberg et al., 2008; Vagle, 2014; van Manen, 1990). This analysis leads to findings that provide a highly textured and nuanced depiction of lived experiences by illuminating meanings and meaningfulness (Benner, 1994; Dahlberg et al., 2008). Such findings are often written as an evocative phenomenological description that incites a sensed, felt understanding of the phenomenon using expressive language that aims to "connect to [readers] in a heartfelt way and be complex enough to awaken not just a logical understanding but the sense of it as it lives" (Todres & Galvin, 2008, p. 570).

Phenomenological research has been pluralized in contemporary literature, with several different approaches emerging and being published today. To aid in understanding some notable distinctions, phenomenological approaches can be roughly organized into three main categories according to their purpose and aims. As shown in Table 1, these categories include transcendental or descriptive, hermeneutic or interpretive, and critical or postmodern. In each category, the terms are often used interchangeably in the literature, while some authors and theorists assert further distinctions for each.

Table 1

Three Main Categories of Phenomenological Approaches

Phenomenological Approach	**Transcendental or Descriptive**	**Hermeneutic or Interpretive**	**Critical or Postmodern**
Hallmarks, Purpose, and Aims	Pursuing the essence (stable core features) of a phenomenon and identifying essential structures among participants' experiences	Interpreting unique meanings of a phenomenon and exploring particularities or nuances within participants' experiences to identify experiential themes or converging patterns of meaning Resists the idea of a singular, stable essence	Critiquing power relationships in the lifeworld, exploring diverse orientations toward phenomena, resisting the stability of meanings and manifestations of experience Includes feminist phenomenology, queer phenomenology, and post-intentional phenomenology
Examples of Historical and Contemporary Theorists or Practitioners	Karin Dahlberg Amadeo Georgi Edmund Husserl	Patricia Benner Martin Heidegger Maurice Merleau-Ponty Max van Manen	Sara Ahmed Alia Al-Saji Mark Vagle

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Prompt Literacy

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Artificial Intelligence | Generative AI | prompt engineering | prompt literacy | human-AI interaction | natural language processing

Prompt literacy enables anyone to communicate with and direct generative AI systems without needing expertise in computer programming. Prompts are commands formulated in natural human language that unlock the capabilities of AI and guide its outputs. With prompt literacy, people can successfully interact with generative AI to achieve defined objectives, while exercising judgment and responsibility. Prompts serve as an accessible interface between users and automated systems, translating human intents into AI-compatible directives. Effectively crafted prompts are key to enabling generative AI to produce meaningful, targeted results. Just as traditional literacy involves mastering the written word, developing prompt literacy requires learning how to clearly formulate instructions for AI in its processing language. Command of this skill allows humans to reap benefits from AI, directing its open-ended potential to useful and ethical ends through targeted prompts.

In the digital era, the emergence of Generative AI (GenAI) systems has revolutionized the way we interact with technology (Chiu, 2023; Moorhouse et al., 2023). GenAI systems or tools are available to the general public as both free and paid services, and include names such as ChatGPT, Claude AI, Google Bard, Pi.ai and Bing AI. At the heart of this interaction lies Prompt Literacy, a skill that empowers individuals to communicate with AI without the complexity of programming languages (Gattupalli et al., 2023; Jacobs & Fisher, 2023;). It's a bridge crafted from everyday language, enabling users to guide AI through tasks with simple, direct commands. This skill has rapidly become a cornerstone of digital fluency, akin to learning to navigate a website or send an email in the early days of the internet.

The evolution of prompt literacy parallels the rise of user-friendly AI interfaces (Abedin et al., 2022). GenAI tools now respond to the layperson’s inquiries, from complex problem-solving to creating art in the form of images (such as Dall-E 3). Prompts are simply nothing but conversations and dialogue between a real human transforming their abstract thought into concrete AI action.

For the general public and STEM educators alike, mastering prompt literacy is not just about efficiency; it's about shaping the future. As GenAI becomes more integrated into our daily lives and learning environments, the ability to harness its potential responsibly and effectively becomes crucial. Prompts are not just about the commands we give, but understanding the language that breathes life into ideas, making technology an extension of human intent.

Crafting Effective Prompts

Crafting effective prompts is akin to providing a skilled artisan with the precise tools and clear instructions to create a masterpiece. The art of prompt crafting lies in the specificity and clarity that guide a GenAI tool to generate desired outcomes. As we delve into this craft, let's explore proven strategies and highlight common pitfalls to avoid.

Strategies for creating effective prompts

Crafting effective prompts serves as the foundation for meaningful interaction with Generative AI. By precisely tailoring our language, we can direct AI towards producing specific, relevant, and accurate outputs, ensuring that the technology reliably amplifies human intent. As we stand on the brink of a new era of human-AI collaboration, the ability to communicate effectively with these advanced systems becomes not just advantageous, but imperative for unlocking their full potential.

- **Be Specific:** Narrow down your "ask" to be as detailed as possible. Specificity helps GenAI produce targeted responses (Deng et al., 2023).
- **Context is Key:** Provide background information and supply as much data as possible, when necessary. Context helps GenAI understand the scope and relevance of the task (Ronanki et al., 2023).
- **Using Simple Language:** Clarity trumps complexity. Using simple, direct language prevents misunderstandings, and thus reduces inaccuracies (Deng et al., 2023; Kim et al., 2023).
- **Setting Boundaries:** Define the limits of the task. Evaluate prompts for the "scope" as it helps prevent the AI from generating overly broad or irrelevant content (Tjuatja et al., 2023; Deng et al., 2023).
- **Iterating and Refining Prompts:** Treat your first prompt as a draft. Refine it based on the AI's responses to improve accuracy (Jacobs & Fisher, 2023; Wang et al., 2023).

Common pitfalls to avoid in prompt construction

When venturing deep into the field of GenAI, the efficacy of communication is not solely determined by what we ask but also by how we ask it. We believe crafting prompts is a delicate balance where common missteps can lead to a cascade of confusion and inaccuracy. This is called "hallucinations" (Hanna & Levic, 2023; Yao et al., 2023). Large corporations are working to minimize such inaccuracies in generated outputs, and it will only lead to improvements in future models. However, recognizing these pitfalls is crucial for anyone looking to harness the power of AI effectively. Here are some common pitfalls and why they matter:

- **Being Too Vague:** A precise prompt is like a map that leads to treasure; being too vague is akin to having a map filled with fog. Vague prompts lack the necessary detail that GenAI requires to produce a specific outcome, often resulting in generic responses that hold little value. For instance, asking "Tell me about dogs" could yield a broad spectrum of canine-related information, whereas "Explain the training techniques for service dogs" prompts the AI to focus on a specific aspect of canine behavior. This public GitHub repository focusing on prompt engineering techniques shows a variety of prompts that are specific, and to the point.
- **Overcomplication:** As mentioned, the elegance of a prompt lies in its simplicity. Overcomplicating a prompt can befuddle an AI, much like how a convoluted question can perplex a human. Complex sentence structures, overly technical jargon, or including too many elements in one prompt can lead to outputs that are difficult to decipher and may stray from the intended purpose.
- **Ambiguity:** Clarity is the cornerstone of effective communication with AI. Ambiguous prompts leave too much room for interpretation, causing the AI to fill in the gaps in unpredictable ways. This can lead to inconsistent and sometimes contradictory results. For example, asking for a "report on Jaguar" could result in information about the animal, the car manufacturer, or even the operating system, depending on how the AI interprets the context.
- **Ignoring AI Capabilities:** Each GenAI system has its strengths and limitations. Ignoring these capabilities can be likened to asking a chef to paint a portrait; while they may have a broad skill set, their expertise lies elsewhere. While there are many general purpose GenAI tools on the internet, it is important to understand what the AI you are using is optimized for—whether it's language translation, creative writing, or data analysis—and to craft prompts that align with these strengths. This ensures that the AI operates within its realm of proficiency, providing outputs that are useful and relevant.

Prompt Engineering Frameworks

Navigating the intricacies of GenAI requires more than a rudimentary understanding of technology; it demands proficiency in prompt literacy, a discipline that shapes the very dialogue between humans and machines. As educators and learners grapple with the nuances of this interaction, structured models for prompt crafting offer a roadmap to clarity and efficacy. The CAST model (Jacobs & Fischer, 2023), the CLEAR model (Lo, 2023), and the TRUST model (Trust, 2023) not only optimize communication with GenAI systems but also imbue the process with ethical considerations, universal design for learning (UDL), and pedagogical integrity. These models serve as blueprints, guiding educators and users alike in formulating prompts that harness the full potential of GenAI systems responsibly.

CAST Model

The CAST model, conceived by education researchers Jacobs and Fisher (2023), stands for Criteria, Audience, Specifications, and Testing. It instructs users to delineate the constraints or rules for GenAI outputs (Criteria), identify the intended recipients of the information (Audience), incorporate detailed descriptors for precision (Specifications), and employ a cycle of user feedback and refinement (Testing). This model is akin to a compass in the hands of explorers, guiding both teachers and students through the GenAI landscape with prompts that are as educational as they are functional.

Figure 1

Evolution of a GenAI prompt using the CAST Model.

FIGURE 1. Transforming a Prompt with the CAST Model

Initial Prompt:
Summarize the main theme of Elie Wiesel's *Night*.

CAST Prompt:
Acting as a docent (A) for a Holocaust Museum, prepare a bulleted list (C) of statements to explain how identity and the resilience of the human spirit (S) were important themes of Elie Wiesel's *Night,* on a 7th grade level (A).

Revised Prompt (after Testing):
Acting as a visitor (A) to a Holocaust Museum, describe examples of types of exhibits (C, T) that show how identity and the resilience of the human spirit (as exemplified in Elie Wiesel's *Night*) are represented in the museum.

Source: Jacobs & Fischer, 2023.

CLEAR Model

The CLEAR framework streamlines prompt engineering into five fundamental components: Concise, Logical, Explicit, Adaptive, and Reflective (Lo, 2023). This model advocates for brevity and directness (Concise), a coherent structure of inquiry (Logical), unambiguous output expectations (Explicit), flexibility in approach (Adaptive), and a commitment to continuous improvement (Reflective). Emphasizing prompt precision and adaptability, the CLEAR model acts as a "scaffold" that elevates the quality of AI-generated content, particularly in academic libraries, ensuring relevance and applicability to the task at hand.

TRUST Model

The TRUST model—focused on Transparency, Real World Applications, Universal Design for Learning, Social Knowledge Construction, and Trial and Error—serves as a pedagogical tool to deter student reliance on AI for academic dishonesty. Developed by Trust (2023), this model encourages educators to clarify assignment purposes (Transparency), connect learning to tangible outcomes (Real World Applications), cater to diverse learning strategies (Universal Design for Learning), foster collaborative understanding (Social Knowledge Construction), and embrace a growth mindset (Trial and Error). The TRUST model is not merely a prompt-crafting guide but a manifesto for designing educational experiences that are robust against the temptations of AI-assisted cheating, promoting integrity and deep learning.

Together, these models form a triad of strategies that empower users to wield GenAI with intentionality and insight, ensuring that this powerful technology serves as a catalyst for learning and innovation, rather than an oracle that obfuscates the learning journey.

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Professional Learning Networks

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Pre-service Teacher | Professional Development | In-service Teachers | Teacher Learning | Self-directed Learning

Professional learning networks (PLNs) are uniquely crafted and dynamic learning ecosystems, consisting of people, spaces, and tools that meet an educator's professional needs, interests, and goals (Trust et al., 2016). They serve as a means through which people grow in aspects of their professions. The people within a PLN are individuals who provide career-based feedback, advice, ideas, emotional support, and/or mentoring (Krutka et al., 2017; Trust et al., 2016). The spaces within a PLN are physical, digital, and hybrid places that support or enable professional knowledge building with and from others, such as conferences, workshops, webinars, Twitter chats, unconferences, Reddit forums, and massive open online courses (Trust & Prestridge, 2021). The tools within a PLN are physical resources (e.g., books, curriculum materials) and digital technologies (e.g., Internet search databases, social bookmarking tools, blogs) that are used to access, curate, construct, and disseminate professional knowledge (Trust et al., 2018). Taken together, the people, spaces, and tools within a PLN can support ongoing professional learning and growth for individuals in any academic or organizational context.

The concept of building a network of people, spaces, and tools that supports career-based learning is not new. More than two decades ago, Tobin (1998) wrote about the importance of building a "personal learning network," to support continual, everyday, on-the-job learning. While the terms *personal* learning network and *professional* learning network are often used interchangeably and share the same acronym (PLN), *personal* learning networks can alternatively refer to systems of support for personal interests and hobbies (Fair, 2021). Therefore, the term *professional learning network* is often preferred when referring to career-based learning.

Beyond debates regarding personal vs. professional, the meaning of PLNs has not been consistently defined in the literature. Some scholars have used the term to describe educator use of a single social media platform (e.g., King, 2017; Trust, 2012), while others have differentiated between online PLNs and in-person PLNs (e.g., Kearney et al., 2019). However, educators are unlikely to limit their learning to a single space or modality (Trust et al., 2016). In the digital age, educators often turn to multiple *spaces* (e.g., Professional Learning Communities, conferences, Facebook, Instagram, TikTok), many different groups of *people* (e.g., colleagues, students, people at conferences and social media), and various *tools* (e.g., Internet search databases, blogs, YouTube) for professional learning (Kearney et al., 2019; Staudt

Willet & Carpenter, 2020). Therefore, a broader conceptualization of PLNs as multifaceted ecosystems of support for ongoing career-based learning aligns well with contemporary hybrid learning experiences.

The learning that happens with PLNs has been described as "informal," "self-directed," and even "serendipitous" (Kop, 2012; Prestridge, 2019). In contrast to traditional professional development, which often consists of formal training on predetermined topics presented by external experts, learning with a PLN can be organic, individualized, self-directed, and interest-driven, and it can happen anytime and from anywhere (Beach, 2017; Tour, 2017). Educators can choose which people, spaces, and tools support their own unique needs, interests, and goals. They can decide when and where they would like to learn, how much time to spend learning, and how they would like to engage (Greenhalgh & Koehler, 2017; Krutka et al., 2017; Trust & Prestridge, 2021). Educators can shift and evolve their PLNs, as well as their PLN actions and engagement, over time based on changing professional needs, interests, goals, professional communities, relationships, confidence, time, technologies, and broader contexts (Carpenter et al., 2021; Trust & Prestridge, 2021).

Because PLNs involve social learning that is situated in practice and distributed across people, spaces, and tools, they offer several benefits. Specifically, PLNs can support educators' affective, cognitive, identity, and social growth (Trust et al. 2016). Affective growth refers to changes in emotions, dispositions, and attitudes. For example, educators might feel more invigorated after participating in a Twitter chat or become more willing to try new teaching practices based on inspiration from a keynote speech. Cognitive growth is the development of professional knowledge and skills that occurs when educators come across new information, ideas, and resources from their PLNs and when they critically reflect on their practice. Identity growth consists of shifts in how educators see themselves and their roles, like when individuals shift from being leaders in their classrooms to also being a leader in their school, university, or professional communities. Social growth includes an increased sense of connectedness with others, reduced feelings of isolation, and exposure to diverse people and communities.

While PLNs can offer multiple benefits, there are also several challenges—many of which are specifically related to the use of social media for cultivating and expanding PLNs. On social media, efforts at learning are not guaranteed to succeed and can even lead to miseducation when sources are of low quality, are inaccurate, or advance oppressive systems (Greenhalgh et al., 2021). Social media platforms can distract educators from focused endeavors (Levy, 2016), contribute to an erosion of boundaries for work that intensifies their labor (Fox & Bird, 2017; Selwyn et al., 2017), and may point teachers toward content of dubious quality, as online teacherpreneurs frequently use platforms such as Instagram and Pinterest to advertise their products in online education resource marketplaces such as TeachersPayTeachers.com (Shelton et al., 2022). The quantity of content and people on social media can also prove overwhelming as educators must critically assess what and whom to trust (Staudt Willet, 2019), and self-promotional, commercial, and spam content can make it difficult for educators to find the content and people that would be most helpful to them (Krutka & Greenhalgh, 2021; Shelton et al., 2022). Educators must also manage the risks associated with social media use, such as context collapse where their PLN social media activities may be taken out of context and scrutinized by unintended audiences (boyd, 2014). With the self-directed nature of PLNs and how social media algorithms work, educators may develop PLNs that lack diversity of perspectives and become echo chambers or sustain exclusionary ideologies (Carpenter et al., 2021). Social media platforms also present ethical dilemmas as educators must consider the tradeoffs associated with patronizing these for-profit services and their problematic business practices and models (Carpenter et al., 2021). With these challenges, educators must learn to critically reflect upon their PLNs, the information that is exchanged, and the way their PLNs influence them. Such reflection can be scaffolded by tools such as the PLN Enrichment Framework (Krutka et al., 2016)—a heuristic that supports a deep, critical interrogation of the people, spaces, and tools within a PLN.

Related Terms

Personal learning network

Informal learning

Personal learning environment

Self-directed learning

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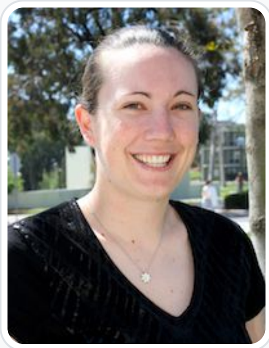

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PICRAT

The PICRAT Technology Integration Model

Royce Kimmons, Darren Edgar Draper, & Joe Backman

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Technology Integration | PICRAT | Teacher Education | Technology Integration Model | Transformation

PICRAT is a technology integration model for teacher education intended to assist teachers in improving their classroom practices. PICRAT (Kimmons et al., 2020; see Figure 1) has two parts representing two guiding questions: PIC and RAT. The PIC part responds to the question "What is the student's relationship to the technology" with one of three responses: Passive, Interactive, or Creative. The RAT (Hughes et al., 2006) part responds to the question "How is the use of technology influencing the teacher's existing practice" with one of three responses: Replacement, Amplification, or Transformation. Answers to these two questions are organized into a 3x3 visual matrix (with PR on the bottom left and CT on the top-right; see Figure 1). Practices are interpreted hierarchically with more active, more effective, and better-justified classroom technology practices generally occurring at the top-right of the matrix.

Because technologies are always changing and educational contexts vary so greatly from one another, teacher educators and professional development providers need tools to train teachers that are simple, flexible, and practical while guiding educators in self-improvement through reflective practice. PICRAT is a framework to help teachers and teacher education students to be self-reflective in their technology integration practices and to engage in learning activities that are more interactive and creative for students while amplifying or transforming their own practices (Kimmons et al., 2020). The PIC part of the matrix loosely aligns with Bloom's taxonomy of educational objectives for the cognitive domain (Bloom et al., 1956; see Figure 2), where passive learning activities might favor lower-level cognitive objectives like remembering, interactive activities might favor mid-level objectives like applying, and creative activities might favor higher-level objectives. The RAT part of the matrix suggests that teacher practices with technologies exhibit differing levels of relative advantage to a teacher's pedagogy (Hughes et al., 2006), with some practices being more pedagogically beneficial than others.

Figure 1

The PICRAT Matrix

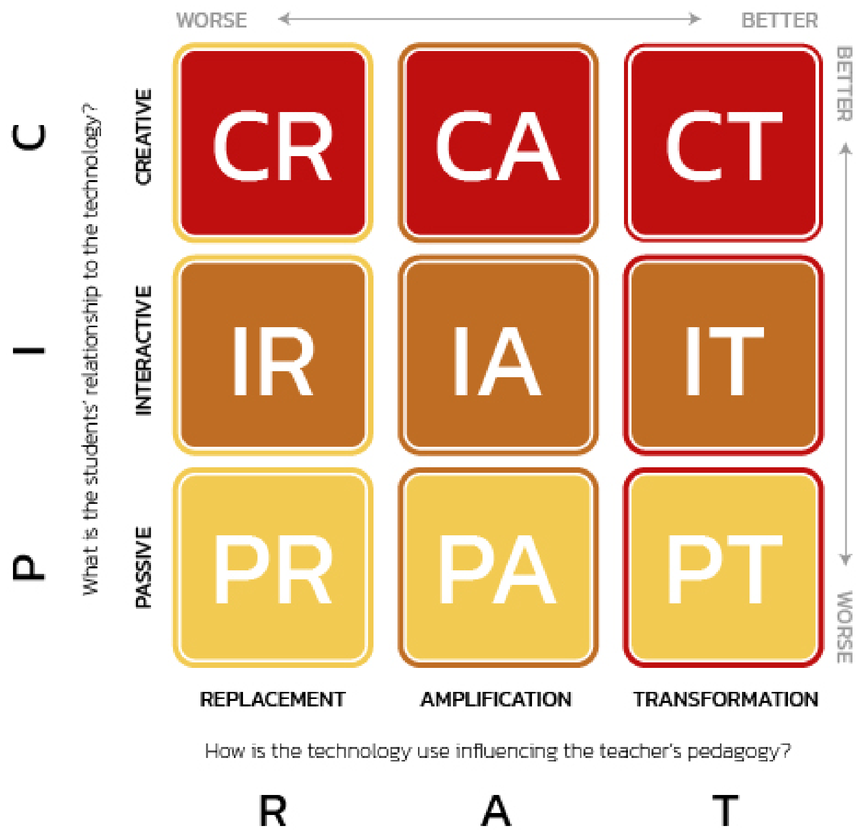
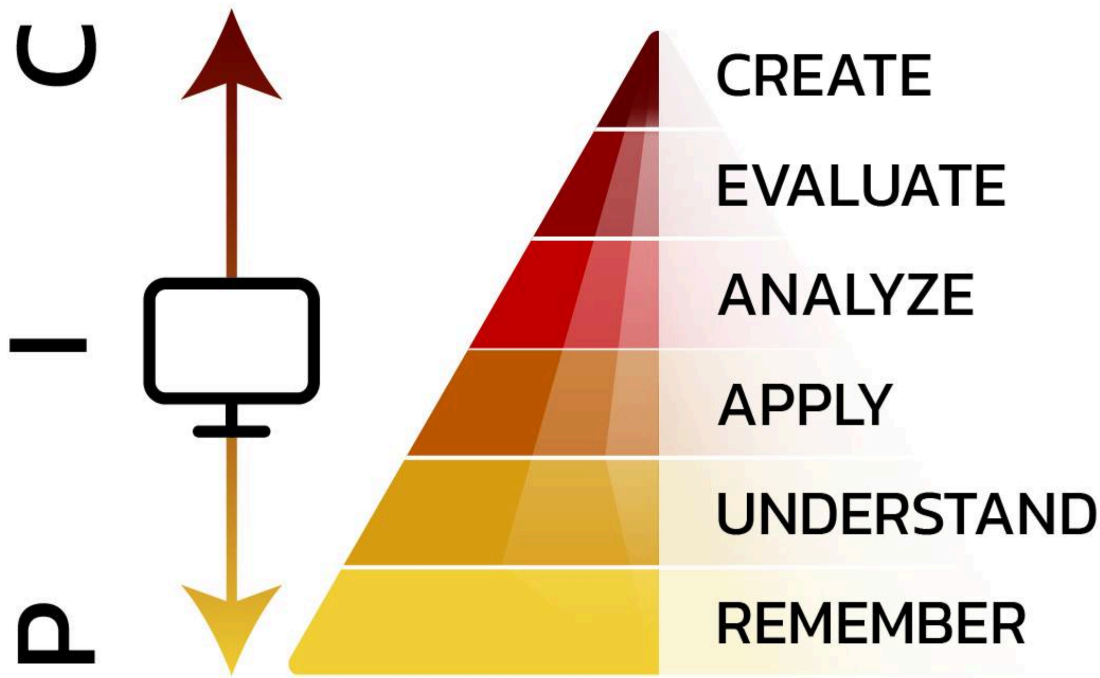


Figure 2

Alignment of PIC to Bloom's Taxonomy



The PICRAT matrix can be particularly useful when teachers reflect upon their practice by analyzing existing or proposed learning activities according to the framework. Intended to assist teachers in ongoing improvement efforts, teachers using PICRAT consider how their past or potential future practices might make better use of technologies, thereby improving both student engagement and learning outcomes. Consider, for example, the teacher who might traditionally lecture from a PowerPoint presentation full of text (Passive Replacement or PR). Improved instructional experiences like the following could be considered:

- Students are provided a copy of the PowerPoint slides to peruse at their own pace and self-direction (I or Interactive).
- The teacher inserts rich media throughout the self-paced PowerPoint lesson, to improve comprehension of difficult concepts (A).
- The teacher uses Nearpod or Peardeck instead of PowerPoint, embedding Drag & Drop, Draw It, or other activities throughout the lesson, encouraging students to engage with the instructional material (IA).
- Students create their own presentation showcasing their knowledge (C).
- The entire class uses Lucid Spark to engage in a live, whole-class brainstorming session, allowing teachers and students to see the thought processes of others as they participate and generate knowledge together (CT).

One key insight of PICRAT is that any technology might be used in a variety of ways, with some practices being more educationally valuable than others. Consider, for example, the myriad ways that the Nearpod application might be used by a science teacher (see Table 1). Depending on the educational goal, teachers may elect to work within any cell of the framework, even when using the same tool. This means that the practices surrounding technology use are better indicators of educational merit than the technologies themselves (e.g., just because teachers are using Nearpod does not mean that they are doing things that are particularly valuable for their students or practice).

Table 1

Examples of Nearpod Classroom Activities within a Biology Classroom Revealing Different PICRAT Levels

Creative	Teacher assigns each student a genetic term to define and has students present their terms to the class via Nearpod.	Teacher provides an ethical dilemma regarding genetic modification along with online resources for students to explore in Nearpod small groups; they then report their solution to the entire class.	Students engage with each other and the teacher using a Nearpod collaboration board to collect and thematically organize examples of current genetics research.
Interactive	Teacher begins the class session with a Nearpod quiz, covering the previous night's homework on cellular structure.	Teacher embeds Draw It activities among Nearpod slides to encourage student participation.	Teacher embeds Drag and Drop activities among Nearpod slides to assess student understanding, making instructional adjustments on the fly.
Passive	Teacher shows Nearpod slides detailing cellular replication during a whole-class lecture.	Teacher embeds instructional videos in Nearpod slides to better explain difficult concepts.	Teacher uses Nearpod + Zoom integration to virtually host a geneticist from a research center to provide a guest lecture.
	Replacement	**Amplification**	**Transformation**

The more difficult parts of PICRAT for educators to understand and master in practice often include the Creative and Transformative levels. To clarify, by "Creative," PICRAT authors mean knowledge artifact creation, similar to constructionism (cf., Kafai & Resnick, 1996), rather than artistic creativity. Additionally, whether technology can ever play a transformative role in education is a contested idea in itself (Clark, 1994; Kozma, 1994), and even if transformation exists, the line between Amplifying and Transformative practice may seem a bit ill-defined. PICRAT authors contend that some instances of technology integration in classrooms increase efficiencies or opportunities to such a degree that it no longer seems reasonable to treat them merely as amplifying or functional improvements, meaning that they should be treated as Transformative (Kimmons et al., 2020). Furthermore, by leaving the line between Amplification and Transformation a bit blurry, professionals are empowered to use their best judgment to grapple with this important issue in their own settings. Rational professionals can disagree on whether a particular instance of technology use is Amplifying or Transforming practice, but PICRAT authors contend that having such reflective discussions (either with colleagues or with oneself) is a valuable exercise, as it forces educators to constantly grapple with the effects technology applications have upon their practice.

In addition, one common concern with PICRAT is that its hierarchical structure might be viewed as delegitimizing some technology practices that are educationally valuable. For example, if a teacher shows a YouTube video to a class, this activity might be interpreted as poor practice, because the students are Passive, and the video might just consist of a talking head, thereby Replacing a lecture (PR). Rather than interpreting this to mean that teachers should never show YouTube videos to students, PICRAT should be used to consider (a) whether there are additional ways to have students engage in the learning process beyond watching the video (i.e., Interaction and Creation), (b) whether some videos might be better than others (i.e., those that provide Amplifying or Transformative learning opportunities), and (c) whether practices near the bottom-left are being done for their educational merit or due to lack of planning and reflection. Even the best classrooms using technology will likely exhibit some practices that fall near the bottom-left of PICRAT, and this is expected. However, if all practices with technology are of this type or if teachers are seeking ways to use technology to improve pedagogy or to make learning more active and engaged, then practices that would be classified more toward the top-right of the matrix should also be sought after.

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Dr. Joe Backman, Curriculum Director of Professional Learning and Elementary Mathematics for Alpine School District (largest in Utah) has led out on professional learning in all 62 elementary schools in Alpine to ensure students acquire the essential knowledge, skills, and dispositions they need to thrive in life. Joe has been an elementary teacher, BYU partnership facilitator and CFA, school principal, and curriculum director. He has presented nationally and internationally on the work and research in Alpine. He led his school and district to partner with universities, businesses, and has helped schools network as multi-school PLCs. He continues to perform educational research at BYU and has been an adjunct professor. Dr. Backman received his undergraduate degree in Elementary Education, and a Master's Degree and Ph.D. in Educational Leadership at BYU. Joe and his wife are proud parents of four awesome boys and one beautiful baby girl.

Q Methodology

Brandy Walker, Robert Maribe Branch, & Jennifer Johnston

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Methodology Subjectivity Perspectives Q sort Individuality

Q Methodology is a unique approach to research tailored for discerning and quantifying subjective perspectives. Developed by Stephenson (1935) in response to perceived reductionism in the psychological and social sciences, it prioritizes the individual's unique perspective rather than generalized characteristics seen across large populations. Q methodology merges both quantitative and qualitative measures in data collection, with the Q sort, a forced-sort process, standing out prominently. Analyzing Q data requires a blend of statistical methods and qualitative exploration, enabling a nuanced understanding of the subject's viewpoint. Brown (1993) emphasizes this interplay, positioning the mathematical component as auxiliary. Finding its application spread across diverse fields like health sciences, psychology, journalism, education, and environmental policy, Q methodology features two main design paradigms: single-participant design and multiple-participant design. While single-participant design delves deeply into individual self-perspectives, multiple-participant design explores shared viewpoints among different groups. Q methodology's unique lexicon features terms such as Concourse, Q set, and P set, which underscores its comprehensive approach to studying subjectivity.

Q Methodology is a data collection procedure featured in research designs of systematic inquiry intended to determine human subjectivity around a particular subject, theme, topic or question. Q methodology (also known as Q Sort) was developed specifically to identify and quantify subjective perspectives. A Q Sort is a quasi-naturalistic structure developed from secondary sources as a way to order a series of sub-themes and questions, often around a theoretical framework that can be deductive or inductive and promotes theory testing. The Q method involves a specific data collection process and an analysis process that features multiple iterations of participant input. The main purpose of both processes in Q methodology is to reveal subjective structures, attitudes, and perspectives from the perspective of the person or persons being observed, also known as operant subjectivity (Brown, 1980, 1996). Stephenson (1935,1953), a pioneer in Q methodology, observed an excess of reductionism within psychological and social science research, and was interested in the traits that make an individual unique rather than the accumulation of traits that characterize large populations. Q methodology is based on beliefs about holism and multiple constructed realities, focusing on the study of subjectivity (including perceptions and experiences) as it is manifested in attitudes and behaviors.

The unique Q method of data collection combines quantitative and qualitative measures. The Q analysis process combines the techniques of statistical analysis while simultaneously allowing for flexibility in the analysis of data reflective of qualitative techniques. Data is collected through a forced-sort process (the Q sort). The Q method takes the sorting information in quantitative and qualitative form for analysis. Brown (1993) highlights the qualitative aspects of the methodology by comparing the quantitative aspects in Q methodology: “the fact that the resulting data are also amenable to numerical treatment opens the door to the possibility of clarity in understanding through the detection of connections which unaided perception might pass over. In Q, the role of mathematics is quite subdued and serves primarily to prepare the data to reveal their structure” (p. 107). Even within the statistical processes, Q methodology supports the use of judgmental and theoretical exploration of the data to develop a more accurate and robust picture of the whole, thereby providing a scientific approach for studying subjectivity while retaining the depth, diversity, and individuality of a more humanistic approach (Brown, 1980; Ellingsen et al., 2010). Thus, Q Methodology is appropriate for study conditions that seek to rank participant perspectives about qualitative statements.

Q methodology is often used in research studies that seek to reveal subjectivity. This is particularly true in the social sciences, including health sciences (Akhtar-Danesh et al., 2008; Churruca et al., 2021; Stenner et. al., 2003; Cross, 2005), psychology research (Miners, et al., 2023; Shemmings, 2006), mass communication and journalism (Giannoulis et al., 2010; Popovich et at., 2003), education studies (Ernest, 2011; Ramlo et al., 2008; Yang 2023), and environmental policy (Addams & Proops, 2000; Karalliyadda, et al., 2023; Webler et al., 2009). Even in the variety of applications, there are two basic design types of Q methodological work, namely single-participant designs and multiple participant designs.

While Q methodology studies tend to focus on the exploratory analysis of operant subjectivities at a single point in time, there is a body of work with Q methodology that explores experimental and quasi-experimental repeated measure designs from which structure is drawn. Other studies using quasi-experimental designs have been conducted with Q as the central method of analysis, including Davies and Hodges (2012) in a longitudinal study of shifting environmental perspectives; Gaebler-Uhring (2003) in a study exploring uses of Q methodology in health care to assess affective learning outcomes; and Popovich, Masse, and Pitts (2003) in a study assessing an intervention in higher education. Watts and Stenner (2012) point out that although Q methodology is not a test of difference, the perspectives of two different groups can be compared after the initial analyses of each group have been completed independently using theoretical and statistical comparisons of each group and individual members between times.

Finally, Q methodology utilizes some unique terminology specific to its techniques. The terms most often associated with the development of instruments used in Q methodology are defined in Table 1.

Table 1

Key terminology in Q methodology. From Brown (1993), McKeown and Thomas (1988), and Watts and Stenner (2012).

Term	Definition
Concourse	the flow of communicability surrounding any topic in the ordinary conversation, commentary, and discourse of everyday life
Q set	a set of stimulus items (usually statements) derived from the concourse and provided for ranking according to a personal and subjective response to the condition of instruction
Source: Naturalistic	stimulus items developed from oral or written communication such as interviews conducted specifically for the development of the Q set
Source: Quasi-naturalistic	stimulus items developed from secondary sources external to the study including interviews from people who will not conduct the Q sort, and literature related to the topic

Term	Definition
Source: Ready made	stimulus items created from sources other than communications regarding the concourse, usually drawn from conventional rating scales or otherwise standardized sets of data
Structure: Unstructured	considers the subject of the concourse as a single whole and attempts to create a representative sample in relation to the whole without necessarily covering all areas of the concourse
Structure: Structured	breaks down the subject of the concourse into a series of component sub-themes or issues, often around a theoretical framework that can be deductive or inductive, promoting theory testing
P set	participant group
Condition of instruction	instruction that sets the context for how participants are to consider each statement when sorting the Q set on the response grid
Q sort	the process where participants take part in a Q methodology study; involves the participant modeling his or her point of view by rank ordering the statements along a continuum, defined by a condition of instruction

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RAT

The RAT Technology Integration Model

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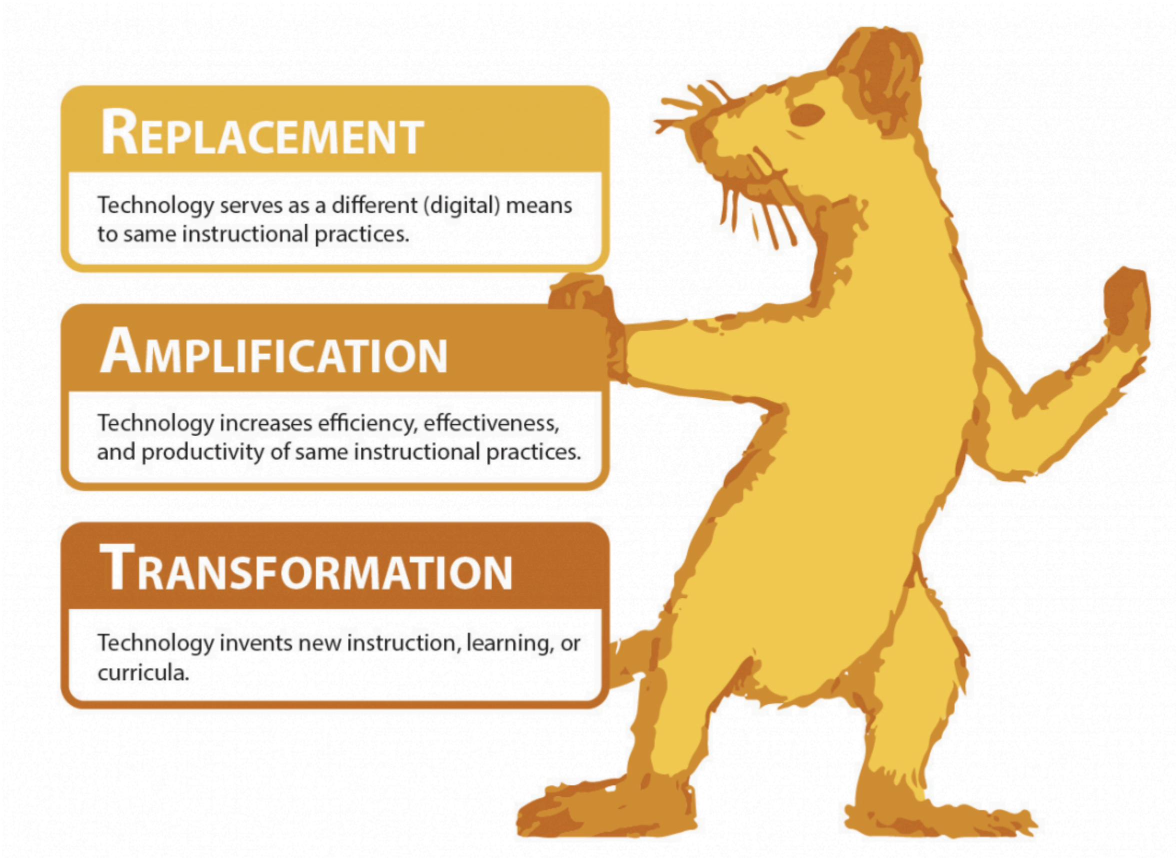
Technology Integration | Teacher Education | Higher Education | Preservice Teachers | Technology Integration Model | Transformation | K12 | Post-secondary Education | Inservice Teachers

The Replacement, Amplification, Transformation (RAT) framework is a technology integration model and assessment tool that instructors can use to critically consider how their integration of technology in their classrooms serves their students and themselves. Originally developed by Dr. Joan Hughes in 1998, the RAT model aimed to study how teachers developed and integrated technology for teaching, learning, and curriculum development (Hughes, 2022). Hughes, Thomas, & Scharber (2006) further positioned the model as a framework for self-assessing technology integration "as a means to some pedagogical and curricular end." In her RAT Question Guide (2022), Hughes provides suggestions for extending this self-assessment to the school/district level. There are three primary purposes for technology integration outlined within the framework: to Replace existing, often non-digital, practices; to Amplify existing practices; and to Transform teaching, learning, and curricular goal development through digital practices.

The ways in which instructors use technology in the classroom impacts instructional methods, student learning, and/or the development of curricular goals via replacement, amplification, or transformation of existing lessons and activities (Hughes, et al., 2006). The Replacement, Amplification, Transformation (RAT) model (Hughes, 1998) identifies the primary purposes for technology integration. Figure 1 defines these technology-use purposes.

Figure 1

Artwork Depicting the RAT Framework

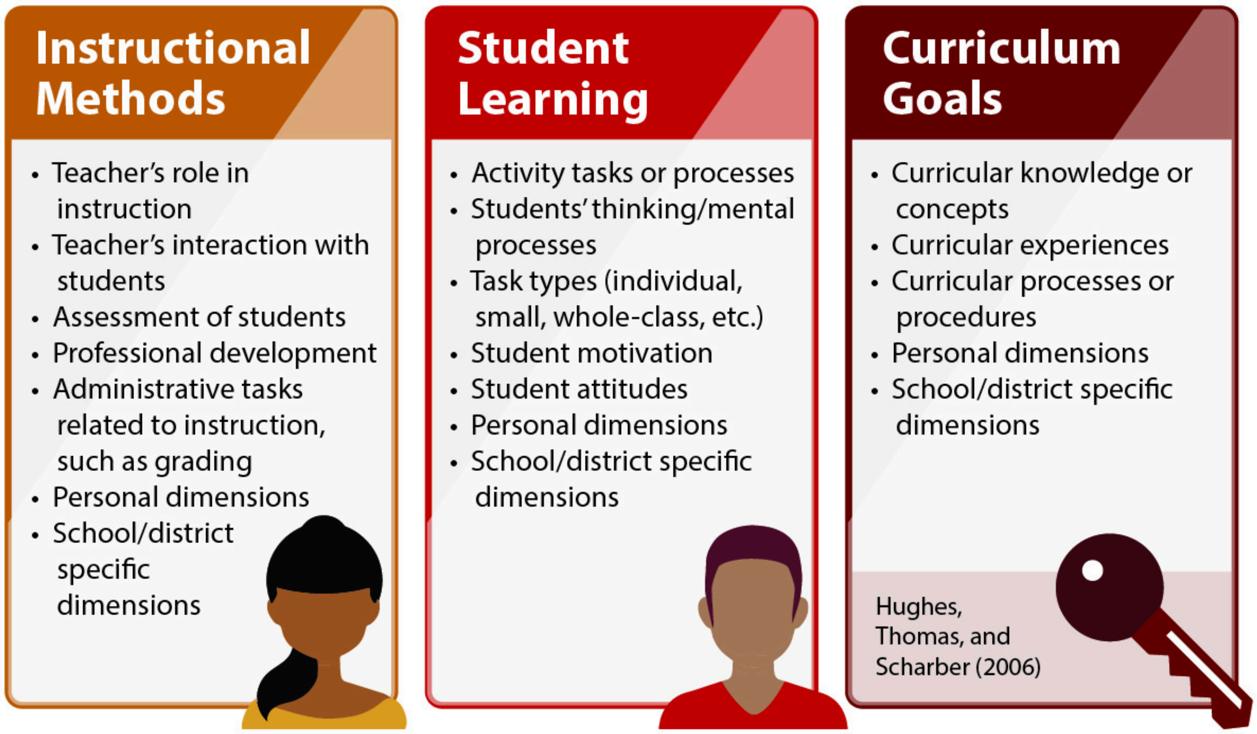


Based on CC BY artwork by Paleo-Beast-Emperor; Techedges.org by J. Hughes, 2022.
This rat-themed graphic defines the three classroom-based technology-use purposes: 1) replacement, when technology serves as a different (digital) means to same instructional practices; 2) amplification, when technology increases efficiency, effectiveness, and productivity of same instructional practices; and 3) transformation, when technology invents new instruction, learning, or curricula.

Originally developed as a research tool to study the "nature of technology-supported practices teachers developed and implemented in their teaching" (Hughes, 2022), the tool was later developed for use as an instructor self-assessment framework for critically determining how an instructor's use of technology best served themselves and their students "as a means to some pedagogical and curricular end" (Hughes, Thomas, & Scharber (2006). The RAT framework is organized around three themes and dimensions outlined in the RAT Question Guide (Hughes, 2022). In this guide, Hughes also proposes ways to consider these themes and dimensions at the school/district level. Themes include instructional methods, student learning, and curriculum goals (Hughes, et al., 2006). Each of the themes is further broken down into dimensions (see Figure 2).

Figure 2

Technology Use Impact Themes and Dimensions of the RAT Framework



Based on CC BY artwork by Dr. Michelle Read

See the RAT Question Guide, Table 1: Dimensions of Educational Themes for a screen-readable version of this information.

Table 1 and the following discussion focus on an example of a grammar lesson that might be taught in an elementary classroom by purpose. The more impact the technology use has on the three dimensions (instructional methods, student learning, and/or curriculum goal development), the more likely the use is transformative for that particular instructor and their learners.

Table 1

RAT Framework: Examples by Purpose

Original Activity: Students use highlighters in different colors to mark parts of speech on a worksheet printed from the teacher's computer files. Students might exchange papers for grading purposes.

Purpose	Examples
Replacement	This is replaced by having students use the built-in highlighter tool in Google Docs, Microsoft Word, or some other related app to identify different parts of speech (Hughes, et al., 2006).
Amplification	Allow students to use built-in tools in Google Docs to help define unknown words, or new vocabulary, and identify the parts of speech in use. Further, have them create their own sentences and use the tools to make sure they are writing complete sentences using all the desired parts of speech. Using commenting, or Track Changes (MS Word) or Suggestions (Google Docs), students can engage in peer review asynchronously or synchronously.
Transformative	After learning about the parts of speech, have students demonstrate their knowledge by creating a game in PowerPoint or a printable worksheet in Google Docs or some other game development tool. For example, they could create a sentence builder activity using images or a Jeopardy round, using PowerPoint templates. They must include an answer key. Students play each other's game and

Purpose	Examples
	evaluate the game for accuracy. Imagine how exciting this might be if they were exchanging their games with other students from other schools around the nation, or even the world.

Using the example from Table 1, as a replacement, technology moves the non-digital instructional methods, objectives, and ungraded or graded activities to an internet-based format. The use of a digital document as replacement for a printed document, which still asks students to highlight the parts of speech in different colors, does not change how the educator teaches, how/what the students learn, or the previously established curriculum goals.

As amplification, technology enhances or makes more efficient the instructional methods, the student learning processes, and/or the curriculum goals. For example, Hughes et al. (2006) describe a teacher who created tests, handouts, and other documents in a word processing application in the early days of technology use in the classroom as opposed to using handwritten or typewritten documents. This act served as amplification, according to the teacher's self-assessment, because it created an archive that she could later modify without having to recreate the whole document. In the early days of migration from workbooks and mimeo copies to digital files stored on computers, this would have been revolutionary. Although it did not enhance student learning or curriculum goals, this act significantly enhanced instructional preparation, making this use of technology an example of amplification.

In the Table 1 example of amplification, students are still identifying parts of speech, but they are using technology to help identify words that may not already be familiar with, such as vocabulary terms from new content being learned, and the tools allow the students to create their own sentences containing all the proper parts of speech. The technology use also changes curriculum goals by moving beyond parts of speech identification into application and evaluation of that knowledge and enhances the learning process for students by making the experience more student-centered and relevant. Moreover, the technology use amplifies the student learning process by expanding student interaction and knowledge exchange with each other within a space designed for back-and-forth dialogue around the application of learned skills. Finally, the use of commenting and editing tools in either synchronous or asynchronous modes allows for increased efficiency in peer review.

For transformative technology integration, the technology must significantly change any of the identified dimensions within the educator's instructional methods, the students' learning processes, and/or curriculum goals. In Table 1, an example of transformative technology included having students use technology to create a game and learn from each other or from students in other classrooms as they played and evaluated the accuracy of each others' creations. This changes all three themes of teaching and learning and various dimensions within those themes in the following ways:

- **Instructional methods:** Primarily, the instructor's method of assessing the students' knowledge has changed. Rather than a multiple choice test or grading highlighted parts of speech, the instructor is now assessing a product students have created to apply their knowledge of parts of speech.
- **Student learning:** The learning process for students has been transformed and made more rigorous. They have moved beyond identifying parts of speech and are now creating artifacts that rely on their knowledge for success. Students are more motivated, and their cognitive load is increased. If working with others, they are also increasing their collaboration skills.
- **Curriculum goals:** Creating a game or activity that relies on knowledge of the parts of speech requires students to use higher-level cognitive skills rather than simply being able to identify parts of speech. This means that students can identify the parts of speech, define their purpose, apply them appropriately, and evaluate their use and application by others.

The RAT framework was created to help educators to develop technology-integrated lessons and to assess the worthwhile use of the chosen technology (Hughes et al., 2006). Originally developed for K12 preservice and in-service teachers and later applied to K12 school administrators at a programmatic level, the RAT model has been implemented in higher education also. For example, Billingsley, Smith, Smith & Meritt (2019) used the RAT framework as a lens to conduct a systematic literature review of immersive virtual reality (VR) used in teacher preparation programs to help address today's field placement limitations. Specifically, the authors looked at studies that explored the potential revolutionary use of immersive VR in teacher education as a training tool to learn about specific concepts, develop classroom and behavioral management skills, engage in role-playing scenarios or simulations, etc. They explained their rationale for using the RAT framework as follows:

> *By knowing the extent to which VR has been previously utilized, whether the technology replaced, enhanced, or transformed learning, teacher educators can decide whether these virtual experiences, indeed, broaden teacher candidates' learning experiences and justify the resource commitment (Billingsley et al., 2019).*

In another example, Dang, Smidt, Schumann, Funke, & Magassouba (2012) used the RAT framework as a lens to identify technology-use purposes related to the affordances found through a CMS/LMS system. While 9 professors and their courses were studied, this paper focused on one of the professors and his use of technology tools within the LMS for his online graduate-level education course. Overall, increased efficiency made using the LMS an amplification of typical physical classroom practices. When broken down by specific tools used within the LMS, some were identified as replacement, while others were marked as amplification.

- **Replacement:** The Survey tool used to gather student feedback about the course simply replaced a traditional printed survey.
- **Replacement:** The News and E-mail tools were also identified as replacement as they provided general feedback and course study guides and encouraged participation.
- **Amplification:** The Quizzes tool was used to create random selections of 30 questions from a 100-200 item question bank, which could be timed and retaken. Furthermore, students had access to their notes, which allowed for use of the quizzes for both assessment and as a guided learning tool.
- **Amplification:** The inclusion of 10-minute, instructor-made videos within the LMS that chunked the professor's typical classroom lectures into manageable segments for the students, which they could stop and review or rewatch later, was, as noted by the authors, "...the essence of amplification" (Dang et. al, 2012.)
- **Amplification:** the use of Dropbox and Gradebook tools made turning in assignments and grading more efficient.

While no transformative purposes were identified, the potential existed for the professor's use of several tools. The authors identified three tools used as having current amplification purposes with the potential for transformative use: (a) the professor's minimalist use of the Content tool that helped students in the flow of learning new material; (b) the structure, both small group and whole class, within the Discussion tool that helped to create "content-rich and student-driven discussions" (Dang, et. al, 2012); and (c) the purposefully-designed use of small-group chat.

Although transformative technology use often elevates the learning experiences of students and helps to engage higher-level cognitive thinking skills, the RAT framework does not suggest that all classroom technology use must be transformative, nor that it is a level of technological use to be achieved as part of a sequential technological improvement plan. In fact, there are times when instructors may purposefully decide not to make their lessons transformative due to time constraints, technology access barriers, or misalignment with school/district scope and sequence plans. Furthermore, transformative technology use as defined in the RAT model is subjective and, in the case of teacher self-assessment, a personally-determined attribute—meaning that what might be transformative use for one instructor, their students, and/or their curriculum goals may not be considered transformative for others. In RAT, transformative use of technology is not synonymous with the use of revolutionary technologies or the use of the latest technology tools and trends, unless it happens to support transformative teaching and learning and/or development and achievement of transformative curricular goals. Rather, technology integration should be a purposeful, planned event with the benefits and drawbacks of its use fully realized and understood.

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The RAT Technology Integration Model

Watch on YouTube

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Self-Efficacy

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Learning Theory | Faculty Development | Efficacy | Self-efficacy | Motivation | Social Learning Theory | Student Learning

Self-Efficacy is grounded in Albert Bandura's Social Learning Theory (1977, 1986) and is the belief that motivation to learn as a student, or acquire new teaching strategies as a teacher, is based on two variables: (1) the belief that one can successfully learn and apply the subject and (2) the belief that there is a positive outcome from the learning. Self-efficacy theory is robust in that it applies to all disciplines and behaviors. To achieve maximum student learning, educators must be attuned to the self-efficacy levels of their students as well as their own levels. Research by Hickman (1993, 2019), DeMoulin (1993), and Ashton (1985) have drawn clear correlations between levels of self-efficacy and student achievement. For faculty, self-efficacy is related to openness in acquiring new strategies, adopting technological innovations, avoiding burnout, and remaining current in their fields (Hickman & Sherman, 2019).

Self-efficacy theory posits that one is likely to attempt a new task, whether it be a challenging assignment, learning new technology, or adopting new teaching strategies, if one feels the task can be performed successfully and there is a positive outcome for doing so (Bandura, 1977, 1986; Pajares, 2005; Peiffer, 2015). Thus, being aware of the self-efficacy levels of students, and aware of your self-efficacy level as an educator is critical. Assessing self-efficacy levels is often quick and simple: Educators can give short, guided questions and/or pre-tests to students, and educators can reflect on their comfort and competence of the course's content. For example, Hickman and Sherman (2019) provide sample 10-question questionnaires that can be given to students, faculty, and even parents to help discern a students' levels of self-efficacy and create a shared strategy to help raise their students' levels of self-efficacy.

Faculty innovations, especially adopting new teaching strategies revolving around technology, have always been a challenge. Moving educators from chalkboards, filmstrips, and 16mm projectors to laptops, PowerPoint, real-time videos embedded in their presentations, and even entirely online courses has sometimes been slow and met with resistance. Resistance to change is usually expressed in ways that mask the true fear of the change. For faculty, resistance usually involves doubting the change is as good as the methods they are used to using and fearing that student learning will be adversely affected. For students, they openly resist increasingly difficult assignments by questioning the value of learning such things and questioning whether they should continue on the path of science, math, or technology. Usually, what is behind these doubts are a fear of failure and/or not seeing a connection between being successful and obtaining outcomes the educator or student values.

If self-efficacy levels of either educators and/or students are low, there are four primary ways to raise them. These four ways are not exclusive but are the primary ways and are discussed in order of strength:

Enactive Mastery

Successfully performing a task is the best reinforcement to continue doing it. If one masters a task, a foundation is laid on which to attempt additional skills. To achieve "mastery" can require failed attempts and different approaches to be successful. Thus, it is important that students be provided opportunities to experiment and fail without penalty. For faculty learning new teaching strategies, laboratories can be constructed to "try out" new approaches and be comfortable presenting in new ways (e.g., with new technologies) without failing or making embarrassing mistakes in front of a live class.

Vicarious Experiences

Students and educators alike consciously and unconsciously compare themselves to peers. Providing opportunities to observe these peers successfully complete the desired change or task enables the observer to internalize a belief that they, too, can successfully perform in the same way as their peers. Observing peers' mistakes and failures is equally valuable, especially as they watch their peers eventually figure out what works for them. Allowing students and educators to learn from peers is a powerful way to instill beliefs that they, too, can achieve the goal.

Verbal Persuasion

Encouraging students or educators in their development is very important and is rarely done properly. Voicing well-meaning but hallow platitudes such as "You can do this," "You got this," "You're smart," or "I believe in you" do not often resonate with the learner because they have not yet internalized nor believe those messages. What the learner thinks is "I don't know if I can do this and maybe I'm not as 'smart' as you think and I'm afraid I will disappoint you." Instead, effective verbal persuasion are phrases like, "You have changed before and I will help you with this change," or "Let's figure this out step by step. If you're not successful, we'll figure out exactly what went wrong so you get it" or "Let's start with what you know and build from there. Here is why it is important that you master this task."

Physiological States

Tackling a new or difficult assignment or being asked to adopt new teaching technologies can be stressful. The body can react to stress by increasing heartrate, shallow breathing, sweaty palms, or a generalized nervousness. These physiological cues heighten the anxiety level of a person, and the focus can become their own bodies instead of learning the task at hand. Creating a non-stressful learning environment is key to aborting these physiological cues that one is scared of. A relaxed atmosphere, freedom to experiment and fail, and an assurance that guided help is available in eventually achieving mastery is essential to drive the attention away from cues of nervousness to attention to detail.

Self-efficacy plays a crucial role in behavior, willingness to change, and motivation to attempt new skills. It can be applied to new curricular content, learning and employing technology, new sports, health management, and even phobias (Bandura, 1986; Hickman & Sherman, 2019). It is easy and accurate to assess, and, using the four strategies above, easy to raise. Doing so sets both learners and educators on a productive path for lifelong learning.

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Technocentrism

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Technology Digital Technologies Technocentrsim Technocentric Thinking Technology-Centered Approach Technology-Driven Change Technology-Based Education

Technocentrism is the tendency to view technology as a central component for addressing complex social issues and driving transformative changes. In the context of education, technocentrism manifests as an excessive focus on the use of technology in teaching, learning, and assessment processes through prioritising the adoption of technological tools, platforms, and digital resources to enhance educational outcomes without adequately considering the broader educational context. According to Papert (1987), technocentric thinking leads to questions that investigate the impact of technology on human interaction and development, such as learning, without considering the complexity of the context in which the technology is situated. Technocentric thinking separates digital technologies from their social and cultural context and suggests a one-way influence of technology on educational policies and practices, including pedagogy, teacher roles, and education objectives. Researchers in the digital education field have proposed several approaches to address technocentrism in education by acknowledging the role of technology and the complexity of the relationships between different social and material components in the educational setting (cf., Brennan, 2015; O'Donoghue et.al, 2001; Papert, 1988).

EdTech companies, media, and education intermediaries often describe educational success as a direct result of the adoption and development of software, platforms, and technology systems (Suoranta et al 2022). Within the formal education sector, policy documents, reports, and evaluations of learning interventions have a tendency to attribute the recent, ongoing or potential change to the demands or opportunities of technology. Digital technologies are often perceived as means to shake things up, fix a broken education system, and reconstruct education provision in appropriate ways for current and future demands (Burch & Miglani, 2018; Selwyn, 2016). Such technocentric thinking and assumptions are prevalent also within the field of educational technology research and practice (Selwyn, 2016). The influence of technocentric thinking on the field can be observed in the way technology is conceptualised, adopted, and implemented in educational contexts.

Technocentrism suggests an oversimplification of a complex relationship, such as that between human and non-human actors in an educational space or setting. It is one result of holding a theory of *technological determinism*, which "seeks to explain social and historical phenomena in terms of one principal or determining factor" (Chandler, 1994). It is a factor in technological solutionism, which sees social, educational, and other problems as being amenable to being solved through new technologies or new applications of technology. When Papert used the term technocentrism in 1987, he contrasted it with his preferred approach, "computer criticism", which was concerned with placing computers in socio-cultural perspective. As an example of technocentric thinking, he offered the question: "What is THE effect of THE computer on cognitive development?" (p.23) – and criticised this question for ignoring factors such as skill, design, social structure, and cultural integration. While such critical responses to technocentrism in education began early, many commentators in digital education are still centring digital technology in the learner's experience. In their view, "the learning is focused on learning about the tool/technology or the effects of the tool/ technology itself, rather than learning with or through the technology" (Brennan, 2015, p.289). The technology itself takes precedence over other crucial factors, such as the specific needs of learners, the pedagogical considerations, or the social and cultural dynamics of the learning environment. Instead of leveraging the potential of the technology to support and amplify meaningful learning, it becomes an end in itself. The critical exploration of ideas, the development of critical thinking skills, and the cultivation of creativity and collaboration take a backseat to the mastery of technological tools and platforms.

Hamilton and Friesen (2013) describe an 'essentialist' approach to educational technology that maps closely to technocentrism: the expectation that "technical functionality will lead to the realization of an associated human potential once the technology is in place" (p.4). They note that an alternative approach, instrumentalism, appears to work in opposition to essentialism because it frames technology as a tool that operates according to human goals and delivers intended outcomes. Instrumental approaches can be seen in phrases such as "the pedagogy must lead the technology", which attempts to assert the dominance of human intention (Cousin 2004). For instance, Harris and Hofer (2011) claim that effective integration of the technology in the classroom requires a structured planning known as technology, pedagogy, content, and context knowledge (TPACK). However, Hamilton and Friesen argue that instrumentalism, by privileging human intentions, also oversimplifies the relationship between technology and social, cultural, economic, and other factors in education.

Another approach to countering technocentrism in educational technology draws on sociomaterial and posthumanist theory to attempt a more nuanced account of how technology emerges from and within networks of human and non-human actors and cannot be seen as separate from them (Fenwick, Edward, & Sawchuk 2011). These approaches engage with materials from a relational perspective and help account for unintended consequences and for the range of practices and outcomes that are associated with digital education. Sociomaterial research redefines educational activities such as learning and knowing as shaped by materiality and emerging from webs of interconnections among human and materials actors. In recent years, postdigital approaches to education have provided another productive way of viewing digital technology as sufficiently interwoven with contemporary learning and teaching contexts that it is not possible or desirable to identify its consequences or impacts in technocentric terms (Jandrić, et al., 2018). Fawns' work on entangled pedagogy further supports this argument by highlighting the intertwined nature of technology and pedagogy (Fawns, 2020). The concept of entangled pedagogy emphasises that technology and pedagogy cannot be considered in isolation. Instead, they mutually shape and influence each other in complex ways.

While technocentric thinking is prevalent in a range of digital education research and practice, nobody would claim to be technocentric. Technocentrism is generally a term that is applied in a critical way to others' work rather than a description of an established position in educational research. Pea (1987), responding to Papert, highlighted the way that technocentrism is positioned as a less advanced form of criticism, one that must be diagnosed and overcome (p.5). He asks "whether anyone but a straw person actually holds the technocentric beliefs that Papert describes" (p.5), and suggests that they do not. Nevertheless, technocentrism continues to be observable in both practical and theoretical forms in the field of digital education. At the same time, the ongoing efforts of some researchers and educators to work against forms of technocentrism have made an impact on the field of educational technology. Their critical examination of technocentrism has led to new insights, alternative perspectives, and more balanced approaches to considering technology in educational contexts.

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Technology Infusion in Teacher Preparation

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Technology Integration · TPACK · Faculty Development · Teacher Preparation · Preservice Teachers · Technology Infusion · Preparation Programs · Teacher Candidates · Technology Self-Efficacy · Technological Pedagogical Content Knowledge

A technology-infused preparation program teaches candidates how to use technology as a program-deep and program-wide curricular area. The goal of an infused program is to graduate PK-12 educators who are technology-capable from day one as certified teachers. In contrast to the common practice of addressing technology integration through a single course, technology-infused programs require a continual approach to supporting teacher candidates by addressing their ever-changing, developmental needs. Some PK-12 preparation programs adopt a technology-infused approach because they want to systematically address technology integration in a concerted effort. An infused approach is founded on Technological Pedagogical Content Knowledge (TPACK; Koehler & Mishra, 2009; Mishra & Koehler, 2006). Given that an infused approach represents a system-wide effort, Foulger suggested preparation programs address the pillars in their design. preparation programs can leverage the four pillars when they conceptualize their approach. The four pillars include (a) technology integration curriculum, (b) modeled experiences, (c) practice with reflection, and (d) technology self-efficacy (Foulger, 2020; Borthwick et al., 2020). Scholars recommend preparation programs should strive to recognize the interrelatedness of the pillars (for example, Warr et al., 2023; Jin et al., 2023; Sprague et al., 2023; Williams et al., 2023). As the ultimate measure of success, a program-wide design establishes technology self-efficacy, defined in part by candidates' confidence in their preparedness to teach with technology in future contexts (Buss, 2020).

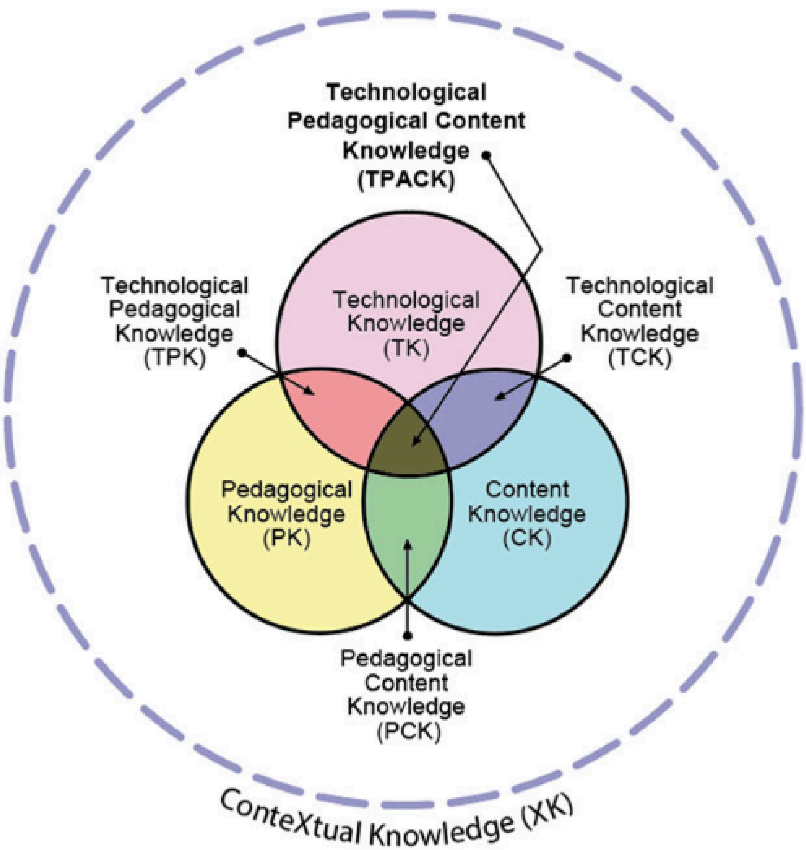
TPACK as a Theoretical Foundation for Technology Infusion

Educators who are proficient in technology have demonstrated TPACK – they understand how to represent their combined knowledge of technology, pedagogy, and content in PK-12 teaching and learning contexts, as illustrated in

Figure 1 (Mishra & Koehler, 2006; Koehler & Mishra, 2009). Notably, a study on technology-infused coursework revealed that the infused approach successfully nurtured teacher candidates' TPACK development, and that infused learning experiences also instilled in candidates a forward-looking perspective and an interest in integrating technology into their future classrooms (Foulger et al., 2021). Preparation programs that adopt an infusion model should recognize that effective implementation of a program-wide effort to address technology content will require teacher education instructors and PK-12 mentor teachers involved have the knowledge and skills (Foulger et al., 2017) to actively contribute to fostering candidates' TPACK and help candidates establish teaching with technology as an ongoing professional growth opportunity.

Figure 1

Technological Pedagogical Content Knowledge



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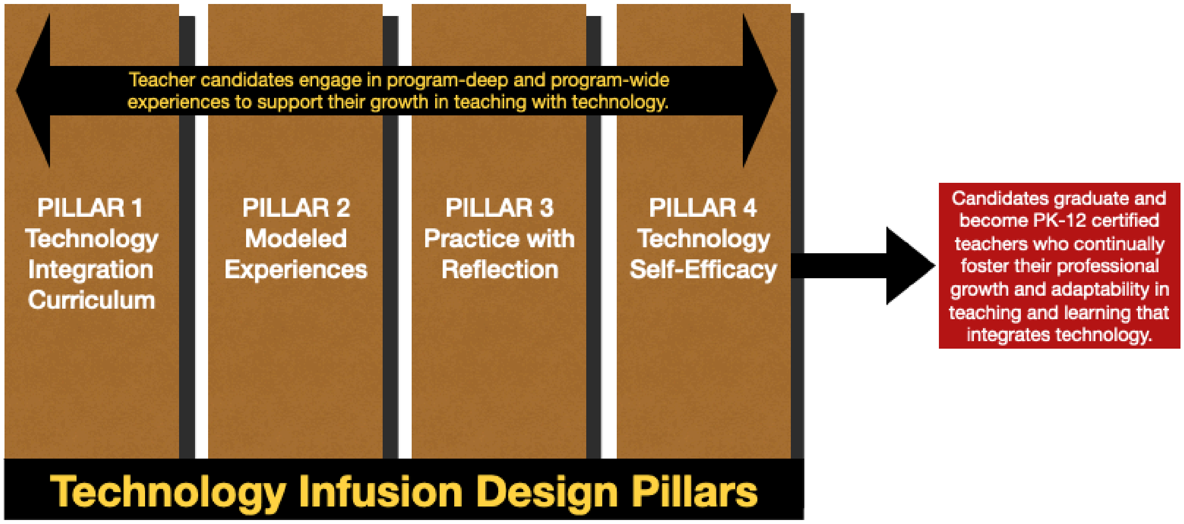
The Four Pillars of a Technology Infused Design

Preparation programs can anchor their technology-infused models by addressing four design pillars: (a) a technology integration curriculum, (b) modeled experiences, (c) practice with reflection, and (d) technology self-efficacy as posited by Foulger (2020). The four pillars are distinct yet influence each other by forming a cohesive and rich preparation experience for teacher candidates as they learn to integrate technology effectively. See Figure 2.

Figure 2

Technology Infusion Design Pillar



Pillar 1: Technology Integration Curriculum

Pillar 1, the Technology Integration Curriculum, can help programs ensure that the representation of technology becomes more complex as candidates advance. This pillar mandates that preparation programs establish a developmentally appropriate technology integration curriculum that spans all facets of preparation and is seamlessly connected to learning content. The curriculum should be explicit; sequenced to build upon students' prior knowledge and facilitate a logical progression of learning; aligned with national standards, content area guidelines, and expectations set by local PK-12 schools; and written in a way that is measurable as candidates continually evolve. Further, it should consider the local teaching environment of PK-12 contexts such as technology availability and local policy. Ideally, the curriculum should introduce the theoretical foundations of PK-12 technology integration strategies early in preparation experiences, ensuring that candidates' practice is grounded in appropriate research. Assessing candidates' growth in TPACK and self-efficacy at various points, and sharing assessment data with them, could help ensure mastery of the technology integration curriculum. For more information about Pillar 1, see Warr et al. (2023).

Pillar 2: Modeled Experiences

Pillar 2, Modeled Experiences, can help programs provide real-world exposure to teaching. This pillar accentuates the critical role of teacher preparation faculty and mentor teachers who work with teacher candidates in technology infused programs. Teacher candidates who experience modeling can provide teacher candidates with rich opportunities to gain insight into technology's role in different PK-12 settings. Additionally, modeled experiences can positively influence teacher candidates' internal perceptions about the use of technology, including (a) their critical examination of the use of technology, (b) their understanding of how knowledge of technology and pedagogy interrelate with content and work together (i.e., TPACK), and (c) their technology self-efficacy. The most impactful modeling involves teacher candidates as engaged and reflective practitioners teaching PK-12 students in their school environments. Exemplary experiences tie instructional practices to research-based theories, findings from empirical research, and the alignment to technology frameworks for effective technology integration. Modeling experiences are a critical part of an infused approach because they positively impact candidates' motivation to learn about technology and their desire to integrate technology in their future. For more information about Pillar 2, see Jin et al. (2023).

Pillar 3: Practice with Reflection

Pillar 3, Practice with Reflection, can prompt programs to provide candidates with opportunities to put their skills into action. This pillar establishes the essential need for teacher candidates to learn the intricacies of teaching with technology through deliberate practice that leverages real-world PK-12 learning environments and prompts candidates to make theoretical justifications when they design learning experiences. Because practice opportunities occur across the entire preparation program and evolve in complexity, practice experiences align with the candidate's growing proficiency in technology integration. Iterative practice opportunities can progressively move teacher candidates from being a novice at technology integration to more expert performance, ensuring their increased self-efficacy. Practice opportunities require a shared responsibility between teacher preparation and PK-12 school systems. Candidates benefit the most when they gain confidence enough to be fully responsible for the PK-12 students in their classrooms. For more information about Pillar 3, see Sprague et al. (2023).

Pillar 4: Technology Self-Efficacy

Pillar 4, Technology Self-Efficacy, suggests that preparation programs review their programs for candidates' continual growth. This pillar concentrates on ensuring candidates have confidence in their technology teaching skills and feel that they are pedagogically and technologically capable of facilitating learning experiences that use technology to improve student outcomes. Candidates who are self-efficacious quickly overcome any negative beliefs or attitudes and will take measures to guard their confidence. Preparation programs that infuse technology can influence candidates' self-efficacy in technology by addressing the way activities are designed and how activities are sequenced. To support growth in self-efficacy, the sequence of preparation activities should (a) engage teacher candidates in hands-on, mastery-learning teaching experiences and self-assessment, (b) help candidates take advantage of observational experiences where they can learn vicariously through others, (c) provide opportunities for candidates to set goals for their future use of technology and work with coaches or mentors who provide personalized feedback on their teaching demonstrations, and (d) support candidates to personally review their emotional state as an indication of their changes in beliefs about technology in teaching. For more information about Pillar 4, see Williams et al. (2023).

Conclusion

While the success of technology infusion in teacher preparation programs relies on the interplay of the four pillars (Foulger, 2020), designing and adopting a technology-infused approach should consider some inevitable challenges. For example, preparation programs will need to ensure all candidates have equitable access to appropriate hardware and software that meets minimal standards. As another example, they will need to find ways for their programs to keep pace with the rapid evolution of digital tools, making sure candidates are using new technology effectively and safely when they work with PK-12 students. It will be important that all PK-12 mentor teachers recognize they must support teacher candidates applying principles of ethics when teaching with technology. Finally, leaders of technology infusion must recognize that a paradigm change will be part of the adoption process (Foulger et al., 2019) and that ongoing professional development will be a necessary scaffold for teacher education faculty (Foulger et al., 2017).

Related Terms

Technological pedagogical content knowledge (TPACK)

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TPACK

The TPACK Technology Integration Framework

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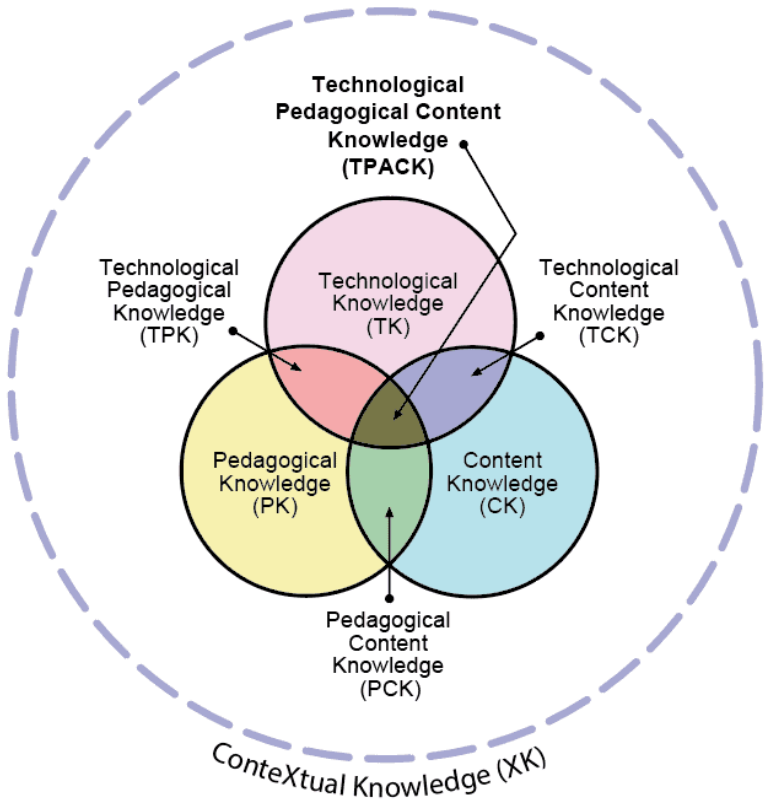
Technology Integration | TPACK | Teacher Education | Technology Integration Model

The Technological Pedagogical Content Knowledge (TPACK) Framework describes the types of knowledge required by teachers for the successful and effective integration of technology in teaching. The most current representation of the framework is in the form of a three-circle Venn diagram within a larger circle. At the center are three partially overlapping circles representing three key knowledge domains: Content Knowledge (CK), Pedagogical Knowledge (PK) and Technological Knowledge (TK). The fourth circle (typically shown as a dotted line) encompasses the three overlapping circles and represents Contextual Knowledge (XK). Most importantly, the TPACK framework proposes that effective integration of technology in teaching requires the integration of the four TPACK knowledge domains—a form of knowledge greater than the knowledge of each of these domains in isolation. It is, instead, a recognition and deep understanding that these knowledge domains exist in tension with each other and that effective technology integration requires finding the right balance that connects the affordances of the technology with the requirements of the content and the pedagogical approaches given a particular educational context.

The TPACK framework was first introduced by Mishra and Koelher (2006). The framework builds on Shulman's (1986, 1987) Pedagogical Content Knowledge (PCK)—the idea that teacher knowledge is more than mere knowledge of content and of general pedagogical principles. Shulman suggested that teachers possess a special form of knowledge that has to do with processes and techniques for transforming content in ways that are pedagogically viable. The TPACK framework extended PCK to include technological knowledge as being an important component of the kinds of knowledge teachers need to possess, and similar to PCK, TPACK is conceived as being more than individual pieces of knowledge.

Figure 1

The Technological Pedagogical Content Knowledge (TPACK) Framework (Mishra, 2019)



Content Knowledge (CK) refers to knowledge about the subject matter teachers are teaching, including the content specific to the curriculum that is being taught and a deeper understanding of disciplinary concepts and practices. Pedagogical Knowledge (PK) concerns teachers' knowledge about methods and practices of teaching and learning, including the overall goals of education, how students learn, assessment practices, and classroom management. Technological Knowledge (TK) describes a type of fluid understanding of technologies and the ability to use them productively for various learning or organizational tasks. TK is fluid and evolving because technologies continually develop over time. Finally, Contextual Knowledge (XK) is the knowledge teachers possess of the broader context within which their teaching functions. These may include knowledge of state standards and policies as well as the broader culture of the school or the district.

Central to the TPACK framework is the interaction between its knowledge domains. Thus, TPACK includes understanding how to represent concepts through technology, how to use technology to teach content, common misconceptions in curricular areas and how technology can address them, how technologies affect students' epistemologies, and how each of these factors play out in specific contexts. Teachers with effective TPACK can flexibly integrate content, pedagogy, and technology to address contextualized needs and challenges. They continually adapt to new technological tools, new concepts in content, and innovative pedagogical approaches utilizing the affordances and constraints of technologies to improve teaching and learning in their particular educational context.

Historical Context

The most recognized version of the TPACK framework was conceptualized and first reported in 2005 by Matthew Koehler and Punya Mishra, who were both faculty at Michigan State University. This was not a completely original construct as scholars since 1998 had discussed how to better understand and explain how educators should conceptualize the role of technology in education. It was becoming clear that an emphasis on technology (and the educational possibilities it engendered) was not adequate to explain what was happening in actual educational settings; adding technology into an educational process did not lead to change. In particular, it was recognized that teachers needed to understand the relationships between users, technologies, and practices, including how technologies can support the teaching and learning of educational concepts (Koehler & Mishra, 2005). Later work added the importance of context to the mix.

As previously mentioned, Koehler and Mishra built the TPACK framework by extending Shulman's (1986, 1987) Pedagogical Content Knowledge framework to include technology (Koehler & Mishra, 2005). Other scholars had proposed similar ideas (Hughes, 2005; Keating & Evans, 2001; Lundeberg et al., 2003; Margerum-Leys & Marx 2002), but it was Mishra and Koehler's (2006) description and representation of TPACK, with minor tweaks over the next few years, that became widely adopted.

After its initial introduction, TPACK scholarship was expanded through two handbooks (AACTE Committee on Innovation and Technology, 2008; Herring et al., 2016), a monthly newsletter, journal articles, conference presentations, and other publications. The newsletter and a bibliography of TPACK scholarship can be found at tpack.org. To illustrate the impact of TPACK, prior to 2021 there had been 1418 articles, 318 chapters in books, 28 books, and 438 dissertations that used it as a conceptual framework to guide their work (Harris, 2021). More important has been the impact of TPACK on practice, with schools and colleges of education across the world incorporating the TPACK framework in teacher professional development and teacher education.

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