

Reading List: Machine Learning and Artificial Intelligence in Education – A Critical Perspective

Edited by: Pati Ruiz, Aditi Mallavarapu, and [Arun Balajjee](#)

The following reading list was compiled to provide an overview of the current state of Machine Learning (ML) and Artificial Intelligence (AI) in education, also referred to as AI in Education Research (AIED). Some articles are focused broadly on research themes in AI/ML as they are applied for teaching and learning scenarios, while others more specifically on the intersection of equity, bias, ethics, of using ML/AI methods and the mechanics of the methods themselves. An additional reading section identifies relevant news articles, reports, and a podcast on these topics.

Included under each article is a brief bulleted overview of what each article covers and how much technical background each article requires.

Last Updated: 9/19/2022

Overview

Algorithmic Bias in Education

Citation: Baker, R. S., & Hawn, A. (2021). Algorithmic Bias in Education. *International Journal of Artificial Intelligence in Education*. <https://doi.org/10.1007/s40593-021-00285-9>

Background Needed: Low/Medium

Covers:

- This review focuses on solidifying the current understanding of the concrete impacts of algorithmic bias in education.
- The authors discuss theoretical and formal perspectives on algorithmic bias and review the evidence around algorithmic bias in education.
- Finally, the authors propose a framework for moving from unknown bias to known bias and from fairness to equity and discuss obstacles to addressing these challenges and propose four areas for mitigating and resolving the problems of algorithmic bias in AIED systems and other educational technology.

Academic Articles

Culture in Computer-Based Learning Systems: Challenges and Opportunities

Citation: Baker, R. S., Walker, E., Ogan, A., & Madaio, M. (2020). Culture in Computer-Based Learning Systems: Challenges and Opportunities. <https://doi.org/10.5281/zenodo.4057223>

Background Needed: Medium

Covers:

- The paper reviews various learning theories related to culture that can be used to predict learning behavior.
- Identifies that it is not necessarily true that learners from collectivistic cultures would participate in group collaborative behavior since some results also indicate that learners from individualistic cultures also participate well in group discussions.
- Compares and contrasts [Hofstede's model of culture](#) with a simpler [Inglehart-Welzel model](#) as a trade-off between simplicity and degree of validation of individual values/individualism. Also, discusses [Culture Based Learning](#) (while there is no set definition, the paper cites literature that discusses Culture Based Learning).
- The paper authors also acknowledge their own cultural background in the context of this discussion and that their perspectives may or may not be biased because of this background.

Algorithmic Fairness in Education

Citation: Kizilcec, R. F. & Lee, H. (2022). Algorithmic Fairness in Education. In W. Holmes & K. Porayska-Pomsta (Eds.), Ethics in Artificial Intelligence in Education, Taylor & Francis. <https://arxiv.org/abs/2007.05443>

Background Needed: Medium

Covers:

- Draws parallels to prior literature on educational access, bias, and discrimination.
- Examines core components of algorithmic systems (measurement, model learning, and action) to identify sources of bias and discrimination in the process of developing and deploying these systems.
- Provides recommendations for policy makers and developers of educational technology offer guidance for how to promote algorithmic fairness in education.

Unwritten Magic: Participatory Design of AI Dialogue to Empower Marginalized Voices

Citation: Buddemeyer A., Nwogu J., Solyst J., Walker E., Nkrumah T., Ogan A., Hatley L., and Stewart A (2022). Unwritten Magic: Participatory Design of AI Dialogue to Empower Marginalized Voices.

<https://doi.org/10.1145/3524458.3547119>

Background Needed: Medium

Covers:

- Participatory Design of dialogue systems with students of color in middle school.
- One-week Youth Advisory Group (YAG) at a middle school in Washington D.C., to learn programming in Scratch.
- Understand the linguistic features needed to develop a cultural-sensitive dialogue system.

Towards a Tripartite Research Agenda: A Scoping Review of Artificial Intelligence in Education Research

Citation: Wan, T., & Cheng, E. C. K. (2022). [Towards a Tripartite Research Agenda: A Scoping Review of Artificial Intelligence in Education Research](#). In E. C. K. Cheng, R. B. Koul, T. Wang, & X. Yu (Eds.), *Artificial Intelligence in Education: Emerging Technologies, Models and Applications* (pp. 3–24). Springer Singapore.

Background Needed: Low/Medium

Covers:

- This paper reviews research studies on artificial intelligence in education (AIED) published from 2001 to 2021
- 135 manuscripts meeting the selection criteria were analyzed and three primary research areas were identified for AI in education research (AIED):
 - Learning from AI
 - Learning about AI, and
 - Learning with AI

On the genealogy of machine learning datasets: A critical history of ImageNet

Citation: Denton, E., Hanna, A., Amironesei, R., Smart, A., & Nicole, H. (2021). On the genealogy of machine learning datasets: A critical history of ImageNet. *Big Data & Society*.

<https://doi.org/10.1177/20539517211035955>

Background Needed: Medium

Covers:

- This paper conceptualizes machine learning datasets as a type of informational infrastructure in response to growing concerns of bias, discrimination, and unfairness perpetuated by algorithmic systems.
- The paper examines the norms, values, and assumptions embedded in machine learning datasets and examines the histories and modes of constitution at play in their creation.
- The researchers trace the discourses around large computer vision datasets and contribute to the development of the standards and norms around data development in machine learning and artificial intelligence research.

Evolution and Revolution in Artificial Intelligence in Education

Citation: Roll, I., & Wylie, R. (2016). [Evolution and Revolution in Artificial Intelligence in Education](#).

International Journal of Artificial Intelligence in Education, 26(2), 582–599. Evolution and Revolution in Artificial Intelligence in Education | SpringerLink

Background Needed: None/Low

Covers:

- The authors take a historical perspective to identify the past foci that occupy the field of AIED. They consider 47 papers from three crucial years (early, middle, and recent years of AIED) in the history of the Journal of AIED (1994, 2004, and 2014).
- The historical perspective considers focus of research (e.g., modeling, system review, evaluation), domain (e.g., STEM, language learning), types of problems (e.g. sequential problems, complex problems), collaboration structures (number of learners and machines), technology (e.g., computers, hand-helds), settings (e.g. school, workplace) and learning goals of each of the works.
- They map this historical trajectory to current developments along the three dimensions of (1) Goals, (2) Practices and (3) Environments in AI research for education.

A Review of Artificial Intelligence (AI) in Education from 2010 to 2020

Citation: Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., Liu, J. B., Yuan, J., & Li, Y.

(2021). A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. Complexity, 2021, 539–547.

<https://doi.org/10.1155/2021/8812542>

Background Needed: Medium (technical jargon)

Covers:

- This paper presents a content analysis of 100 papers where artificial intelligence (AI) has been applied to the education sector.
- Explores research trends as well as challenges for education that may be caused by AI including inappropriate use of AI techniques, changing roles of teachers and students, as well as social and ethical issues.
- The authors define three layers of research interests: development layer – which includes mostly the methodology (classification, matching, recommendation, and deep learning), application layer which includes the end goal of applying the methods (feedback, reasoning, and adaptive learning), and integration layer that connects the computational elements in the methods back to the learning processes and targets (affectation computing, role-playing, immersive learning, and gamification).
- The authors also discuss challenges caused by AI due to inappropriate use of AI techniques, changing roles of teachers and students, and consideration of social and ethical issues along these perspectives.

Additional Readings and Resources

News and Magazine Articles

Datasheets for Datasets

Citation: Gebru, T., Morgenstern, J., Vecchione, B., Vaughan, J. W., Wallach, H., III, H. D., & Crawford, K. (2021). Datasheets for Datasets. *Communications of the ACM*, 64(12), 86–92.

<https://doi.org/10.1145/3458723>

Background Needed: None

Covers:

- Identifies issues with machine learning models that can reduce or amplify unwanted societal biases embedded in their training datasets.
- Describes datasheets as a way to address the gap in documenting machine learning datasets by documenting the contexts and contents of datasets including: motivation; composition; collection processes; and recommended users.

The problems AI has today go back centuries

Citation: Hao, K. (2020, July 21). The problems AI has today go back centuries. *MIT Technology Review*.

<https://www.technologyreview.com/2020/07/31/1005824/decolonial-ai-for-everyone/>

Background Needed: None

How to solve AI's inequality problem

Citation: Rotman, D. (2022, April 19). How to solve AI's inequality problem. *MIT Technology Review*.

<https://www.technologyreview.com/2022/04/19/1049378/ai-inequality-problem/>

Background Needed: None

Reports

AI and education: Guidance for policy-makers

Citation: Miao, F., Holmes, W., Ronghuai Huang, & Hui Zhang. (n.d.). AI and education: Guidance for policy-makers. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000376709>

Background Needed: Low

Trustworthy artificial intelligence (AI) in education (No. 218)

Citation: Vincent-Lancrin, S., & Vlies, R. van der. (2020). Trustworthy artificial intelligence (AI) in education (No. 218). OECD Publishing. <https://doi.org/10.1787/a6c90fa9-en>

Background Needed: Low

Podcasts

AI in Education Podcast

Citation: Bowen, D., Worrall, B., & Hickin, L. (n.d.). AI in Education Podcast. <https://aipodcast.education/>

Background Needed: None

Books

You Look Like a Thing and I Love You: How Artificial Intelligence Works and Why It's Making the World a Weirder Place

Citation: Shane, J. (2019). [You Look Like a Thing and I Love You: How Artificial Intelligence Works and Why It's Making the World a Weirder Place](#). Little, Brown.

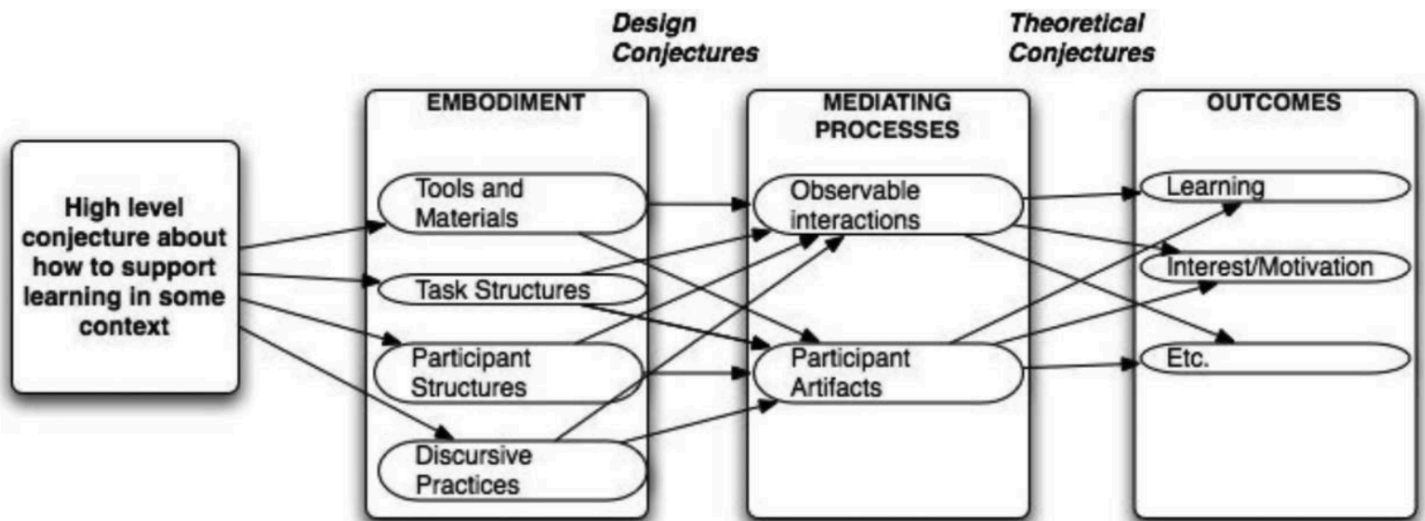
Background Needed: None



Reading List: Conjecture Mapping

Edited by: Michael Chang

This reading list provides an overview of conjecture mapping, a tool proposed by Sandoval (2014) initially designed for learning scientists to systematically approach design-based research. The list includes introductory materials to conjecture maps and provides examples about how other learning scientists have used, adapted, and interpreted conjecture maps in their own work. One common point of confusion for researchers about conjecture maps is the term “Mediating Process” (see the third column in the below figure). To help readers understand how to consider mediating processes in the creation of the conjecture maps, we’ve also included a few papers that show how researchers may identify mediating processes that emerge from their designs. For those unfamiliar with the design-based research process, this reading list also contains introductory materials for design research.



Conjecture Map Tool framework as initially proposed by Sandoval (2014)

Last updated: 05/10/2022

Overview

[Conjecture Mapping: An Approach to Systematic Educational Design Research](#)

Resource Type: Academic article (not open access)

Citation: Sandoval, W.A. (2014). Conjecture mapping: An approach to systematic educational design research.

Journal of the Learning Sciences, 23, 18 – 36. <https://doi.org/10.1080/10508406.2013.778204>

Background Needed: Medium

Covers:

- Motivates the need for a systematic approach towards design research (See below for readings about what design research is)
- Presents the initial idea of a conjecture map, which helps researchers connect design, mediating processes (e.g., how individuals or groups of individuals take on the elements of the design), and learning outcomes through a series of conjectures

[Developing Learning Theory by Refining Conjectures Embodied in Educational Designs](#)

Resource Type: Academic article

Citation: Sandoval, W.A. (2004). Developing learning theory by refining conjectures embodied in educational designs. Educational Psychologist, 39, 213 – 223. https://doi.org/10.1207/s15326985ep3904_3

Open access link: [https://teep.tufts.edu/wp-](https://teep.tufts.edu/wp-content/uploads/sites/5/2017/04/sandoval2014_58f0e472a70f1.pdf)

[content/uploads/sites/5/2017/04/sandoval2014_58f0e472a70f1.pdf](https://teep.tufts.edu/wp-content/uploads/sites/5/2017/04/sandoval2014_58f0e472a70f1.pdf)

Background Necessary: Medium

Covers:

- Predecessor to the conjecture map framework, and introduces a construct called embodied conjectures, which is a theoretical conjecture about how a design element influences learning
- Provides some insight into methodology that designers may use to refine their embodied conjectures

Examples of Conjecture Maps in Practice

[Teachers, Students, and After-School Professionals as Designers of Digital Tools for Learning](#)

Resource type: Book chapter (not open access)

Citation: Wilkerson, M.H. (2017). Teachers, students, and after-school professionals as designers of digital tools for learning. <https://doi.org/10.4324/9781315630830-13>

Background Needed: Low

Background Needed: Low

Covers:

- Details how Wilkerson developed and iterated through conjecture maps in the development of the SIMSAM project

- Strong focus on how different participant stakeholder groups (e.g., teachers, students) shaped the conjecture map over different experiments

[Augmented Reality Game-Based Learning: Enriching Students' Experience During Reading Comprehension Activities](#)

Resource type: Academic article (not open access)

Citation: Tobar-Muñoz, H., Baldiris, S., & Fabregat, R. (2017). Augmented reality game-based learning: Enriching students' experience during reading comprehension activities. *Journal of Educational Computing Research*, 55, 901 – 936. <https://doi.org/10.1177/0735633116689789>

Background Needed: Low

Covers:

- Researchers take a design research approach to explore how an augmented reality game influences youth reading comprehension and engagement
- Provides overview of conjecture maps, and clearly presents how their in-classroom studies proved/disproved certain elements of their original conjecture

[Augmenting Formative Writing Assessment with Learning Analytics: A Design Abstraction Approach](#)

Resource type: Conference paper

Citation: Knight, S., Shibani, A., & Shum, S.B. (2018). Augmenting formative writing assessment with learning analytics: A design abstraction approach. ICLS. <https://repository.isls.org/bitstream/1/856/1/502.pdf>

Background needed: Low

Covers:

- Knight et al. describes how effective writing skills can be developed by augmenting tasks with learning analytics
- Interesting use of conjecture maps where a non-learning analytics conjecture map is augmented with AI-based learning analytics

[Understanding the mediating role of teacher inquiry when connecting learning analytics with design for learning](#)

Resource type: Academic article

Citation: Alhadad, S.S., & Thompson, K. (2017). Understanding the mediating role of teacher inquiry when connecting learning analytics with design for learning. *IxD&A*, 33, 54-74. <https://doi.org/10.55612/s-5002-033-003>

Background needed: High

Covers:

- This research links the importance of teacher inquiry (i.e., teacher practices that link pedagogy to data and evidence) to inform and development to the effectiveness of learning analytics towards supporting learning inside a classroom
- They approach this by applying ACAD (Activity-Centered Analysis and Design) as a way of attending to designed elements (with a focus on social interaction), learning activity, and learning outcomes, before connecting them specifically to design through conjecture mapping

Mediating Processes

[Seven Affordances of Computer-Supported Collaborative Learning: How to Support Collaborative Learning? How Can Technologies Help?](#)

Resource type: Academic article (not open access)

Citation: Jeong, H., & Hmelo-Silver, C.E. (2016). Seven affordances of computer-supported collaborative learning: How to support collaborative learning? How can technologies help? *Educational Psychologist*, 51, 247 – 265. <https://doi.org/10.1080/00461520.2016.1158654>

Background Needed: Low

Covers:

- Following a discussion about the affordances of CSCL (computer supported collaborative learning), Jeong & Hmelo-Silver urge designers to carefully consider and study how teachers and students ultimately take on the design, and to understand how that connects to learning
- This key point urges us to move away from technological determinism (i.e., theory that claims that technology is directly responsible for society's behavior) and explore the complex ways that stakeholders take on technology but also how the stakeholders eventually come to shape the technologies themselves

[Schooling Mobile Phones](#)

Resource type: Academic article (not open access)

Citation: Philip, T.M., & Garcia, A. (2015). Schooling Mobile Phones. *Educational Policy*, 29, 676 – 707. <https://doi.org/10.1177/0895904813518105>

Background Needed: Low

Covers:

- This paper explores the divergent ways in which adults (and the likely designers of the technology) and youth make sense of handheld devices, and is used to explain what happens when technology is introduced into classrooms without theorizing, and testing, the relationship between a technology-based design and learning

Implementing learning analytics for learning impact: Taking tools to task

Resource type: Academic article (not open access)

Citation: Knight, S., Gibson, A., & Shibani, A. (2020). Implementing learning analytics for learning impact: Taking tools to task. *Internet High. Educ.*, 45, 100729. <https://doi.org/10.1016/j.iheduc.2020.100729>

Background Needed: Low

Covers:

- This paper emphasizes the criticality of relating learning analytics to learning outcomes, and share some insights about what factors in learning analytics may come to shape learning
- This paper may be helpful for researchers unsure how to apply conjecture mapping to learning analytics

Overview Literature on Design Based Research

Design-Based Research: An Emerging Paradigm for Educational Inquiry

Resource type: Academic article (not open access)

Citation: Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, 32 (1), 5 – 8. <https://doi.org/10.3102/0013189X032001005>

Background Needed: Low

Covers:

- A critical work about design-based research which motivates the need to blend together empirical educational research and learning theory
- Drives forward the question: why is it that this learning support worked in a particular learning context?

Design Research: Theoretical and Methodological Issues

Resource type: Academic article (not open access)

Citation: Collins, A.M., Joseph, D., & Bielaczyc, K. (2004). Design research: Theoretical and methodological issues. (2003). *Journal of the Learning Sciences*, 13, 15 – 42. https://doi.org/10.1207/s15327809jls1301_2

Background Needed: Medium

Covers:

- Provides some historical background around design-based research and present case studies about how one might approach design research
- Approaches precede development of conjecture mapping

What is design based research?

Resource Type: Video

Citation: CIRCLS. (2021, October 22). What is design-based research? [Video]. Youtube. <https://www.youtube.com/watch?v=iaxWolxXyec>.

Background Needed: Low

Covers:

- Overview of Design-based Research and techniques associated with it, including conjecture maps



Reading List: Brain Computer Interfaces for Education

Edited by: Leah Friedman

In the following reading list, you'll find popular science and academic articles that provide overviews of Brain Computer Interfaces (BCI) for education.

Included under each article is a brief bulleted overview of what each article covers and how much technical background each article requires.

Last updated: 6/16/2021

Overview

[Brain Computer Interface in Enhanced Learning System](#)

Resource Type: Academic Primer

Citation: Zaharija, G., Bogunović, P., & Mladenović, S. (2018) Brain Computer Interface in Enhanced Learning System. INTED2018 Proceedings, 198-205. DOI: 10.21125/inted.2018.1029

Background Needed: Low

Covers:

- High level components of BCI
- High level overview of some BCI applications
- High level overview of EEG for BCI

[Brain Computer Interfaces for Education](#)

Resource Type: Popular Science Article written by a BCI Company

Citation: Impulse Neiry (2020, Jul 22). Brain Computer Interfaces for Education. Medium.

<https://medium.com/impulse-neiry/brain-computer-interfaces-for-education-afa3bccf606d>

Background Needed: None

Covers:

- Adaptive and personalized learning
- Basic EEG technique for accessing and assessing cognition

- Very basic machine learning for BCI
- How EEG measures apply to education

[Brain-computer interfaces and education: the state of technology and imperatives for the future](#)

Resource Type: Academic Article – Literature Review and Field Overview

Citation: Wegemer, C. (2019). Brain-computer interfaces and education: the state of technology and imperatives for the future. *International Journal of Learning Technology*. 141(14) 10.1504/IJLT.2019.101848.

Background Needed: Medium

Covers:

- Describes the state of BCI technology
- Presents current learning science research that utilises BCI's
- Discusses the potential of BCI technology for educational applications
- Summarizes historical relationship between education technology and academic outcomes
- Draws relevant parallels to offer suggestions for researchers and policymakers

Academic Articles

The following are some samples of emerging research on using brain assessment to augment/complement/assess students and learning. The selection of articles also covers a few different tools being used in this area such as EEG and NIRS. Open sources articles are listed first.

[Brain Computer Interfaces for Educational Applications](#)

Citation: Spüler, M., Krumpal, T., Walter, C., Scharinger, C., Rosenstiel, W., & Gerjets, P. (2017). Brain-Computer Interfaces for Educational Applications. 10.1007/978-3-319-64274-1_8.

Background Needed: High

Covers:

- Overview of research that aims to identify cognitive workload of learners
- Description of study that aims to assess and predict workload with electroencephalography during arithmetic exercises

[Put your thinking cap on: detecting cognitive load using EEG during learning](#)

Citation: Mills, C., Fridman, I., Soussou, W., Waghray, D., Olney, A.M., & D'Mello, S.K. (2017) Put your thinking cap on: detecting cognitive load using EEG during learning. In *Proceedings of the Seventh International Learning Analytics & Knowledge Conference (LAK '17)*. Association for Computing Machinery, New York, NY, USA, 80–89. DOI:<https://doi.org/10.1145/3027385.3027431>

Background Needed: High

Covers:

- Describes a study that uses electroencephalography (EEG) to assess cognitive load while using an intelligent tutoring system
- Demonstrates viability of using EEG to model learners' mental states

[Predicting Student Performance Using Machine Learning in fNIRS Data](#)

Citation: Oku, A., & Sato, J. R. (2021). Predicting Student Performance Using Machine Learning in fNIRS Data. *Frontiers in human neuroscience*, 15, 622224. <https://doi.org/10.3389/fnhum.2021.622224>

Background Needed: High

Covers:

- Describes a study that uses functional Near Infrared Spectroscopy (fNIRS) to assess attention during a video lecture
- Study also uses machine learning to predict lapses in attention during lecture

[Online EEG-Based Workload Adaptation of an Arithmetic Learning Environment](#)

Citation: Walter, C., Rosenstiel, W., Bogdan, M., Gerjets, P., and Spüler, M. (2017). Online EEG-Based Workload Adaptation of an Arithmetic Learning Environment. *Front. Hum. Neurosci.*, 11. DOI=10.3389/fnhum.2017.00286

Background Needed: High

Covers:

- Demonstrates closed-loop EEG that adapts learning material to improve success in learning arithmetic
- Developed adaptive learning environment that adjust material based on brain state

[Tracking Students' Mental Engagement Using EEG Signals during an Interaction with a Virtual Learning Environment](#)

Citation: Khedher, A., Jraidi, I. and Frasson, C. (2019) Tracking Students' Mental Engagement Using EEG Signals during an Interaction with a Virtual Learning Environment. *Journal of Intelligent Learning Systems and Applications*, 11, 1-14. doi: 10.4236/jilsa.2019.111001.

Background Needed: High

Covers:

- Explores feasibility of using electroencephalographic signals (EEG) as a tool to monitor the mental engagement index of novice medicine students during a reasoning process

fNIRS-based classification of mind-wandering with personalized window selection for multimodal learning interfaces

Citation: Liu, R., Walker, E., Friedman, L. et al. (2020) fNIRS-based classification of mind-wandering with personalized window selection for multimodal learning interfaces. J Multimodal User Interfaces. <https://doi.org/10.1007/s12193-020-00325-z>

Background Needed: High

Note: this article is not open source

Covers:

- Describes a study that uses functional Near Infrared Spectroscopy (fNIRS) to assess mind wandering (lapses in attention)
- Study also uses machine learning to predict lapses in attention

NIRS-Based Language Learning BCI System

Citation: Watanabe, K., Tanaka, H., Takahasi, K., Niimura, Y., Watanabe, K., Kurihara, Y., (2016). NIRS-based Language Learning BCI System. IEEE Sensors Journal 16(8) doi: 10.1109/JSEN.2016.2519886

Background Needed: High

Note: this article is not open source

Covers:

- Describes a study non-invasive near-infrared spectroscopy to assess language learning and listening

Additional Readings and Resources

The following resources provide different perspectives on and overviews of BCI for education. There is an article written by an academic, a teacher, and a news organization focused mostly on BCI for Education in China.

Brain Data, Neurotechnology, and Education

Resource Type: Academic blog post on educational BCI

Citation: Williamson, B. (2017, May 4). Brain data, neurotechnology and education [web log]. <https://codeactsineducation.wordpress.com/2017/05/04/brain-data-neurotechnology-and-education/>.

Background Needed: Medium

Covers:

- Brain Data: general BCI and brain-inspired R&D, especially in industry
- Ed-Neurotech: brief review of neurotechnology and education studies in academia & industry

- Mentions government and policy interest in BCI research, including investment from DARPA
- Neurotechnology Governance: brief review of emerging ethical and government guidelines

Learning Assessment Using Brain-Computer Interfaces: Are You Paying Attention?

Resource Type: Journal article on an industry website

Citation: Hamza-Lup, F. (2019, February 24). Learning Assessment Using Brain-Computer Interfaces: Are You Paying Attention? [web log].<https://elearningindustry.com/brain-computer-interfaces-paying-attention-learning-assessment>.

Background Needed: Low

Covers:

- Brief overview of types Brain-Computer Interfaces and what they measure
- Includes types of “brain data” that BCI’s often “read”

Brain Computer Interfaces, how does it connect with Education as we know it?

Resource Type: Blog post for a teacher about BCI for education

Citation: Kemp, C. (2014, August 29). Brain Computer Interfaces, how does it connect with Education as we know it? [web log].<http://mrkempnz.com/2014/08/brain-computer-interfaces-how-does-it-connect-with-education-as-we-know-it.html#:~:text=Brain%20Computer%20Interfaces%3F,they%20will%20apply%20those%20skills>.

Background Needed: None

Covers:

- Links to existing BCI work, not specific to education
- Speculation about impacts in the classroom
- Speculative tips on how teachers can prepare and adapt for BCI in the classroom

Could brain-machine interface help education?

Resource Type: News article on educational BCI implementation (primarily in China)

Citation: Khan, Q. (2019, November 7). Could Brain-Machine-Interface Help Education? EqualOcean.
<https://equalocean.com/news/2019110712186>.

Background Needed: Middle

Covers:

- BrainCo, an Educational BCI company in China
- Public skepticism of BCI in China and abroad
- Brief mention of data privacy concerns



CIRCLS

Center for Integrative Research in
Computing and Learning Sciences

Journals: What We're Reading and Where We're Publishing

Edited By Dalila Dragnić-Cindric

We have created an interdisciplinary list of publications that reflects the richness of CIRCLS members' interests and contributions to literature. We do not intend this list to be an all-inclusive collection of publication outlets. Instead, we aim to provide a cross-section of trusted and rigorous resources to serve as a starting point. Please [contact us](#) if you would like to make a contribution to this list.

ACM Journals and Publications

- [Communications of the ACM](#) (CACM)
- [ACM Transactions on Computer-Human Interaction](#) (TOCHI)

AERA Journals

- [AERA Open](#)
- [Educational Researcher](#)
- [Review of Educational Research](#)

[CIRCLS Rapid Community Report Series](#)

[Cognition and Instruction](#)

[Cognitive Science](#)

[Computer-Based Learning in Context](#)

[Computers and Education](#)

[Computers in Human Behavior](#)

[Educational Psychologist](#)

[Educational Technology Research and Development](#)

[IEEE Transactions on Learning Technologies \(TLT\)](#)

[Instructional Science](#)

[International Journal of Artificial Intelligence in Education](#) The official publication of the International AIED Society

[International Journal of Designs for Learning](#)

International Society of the Learning Sciences (ISLS) Journals

- [International Journal of Computer-Supported Collaborative Learning](#)
- [Journal of the Learning Sciences](#)

[Journal of Artificial Intelligence Research](#)

[Journal of Educational Data Mining \(JEDM\)](#)

[Journal of Learning Analytics](#) The official publication of the Society for Learning Analytics Research (SoLAR).

[Journal on Multimodal User Interfaces](#)

[Journal of Computer-Assisted Learning](#)

[Learning and Instruction](#)

[Metacognition and Learning](#)

[Technology, Mind, and Behavior](#)

[User Modeling and User-Adapted Interaction](#)

Reading List: Open Access Readings on the Learning Sciences

Check out these free, open access, high quality resources on the learning sciences, initially compiled by [EducatorCIRCLS](#) for use in a course on the learning sciences for educators. Have you read or used any of these in your courses or work? Are there any readings would you add? [Let us know!](#)



Texts and Materials (all free and open)

- [How People Learn \(2000\)](#)
- [How People Learn II \(2018\)](#)
- [Learning Sciences – CIRCL Primer, other CIRCL Primers](#)
- [Developing Minds in the Digital Age](#)
- [Posts from CIRCL Educators](#)
- [Cyberlearning Community Report: The State of Cyberlearning and the Future of Learning With Technology](#)
- [Innovating Pedagogy 2019; Innovating Pedagogy 2017; and Previous Reports](#)
- STEM Video Showcases from [2019](#), [2018](#), [2017](#), [2016](#), & [2015](#)
- [DML Connected Learning Report](#)
- [Naples Videos](#)
- [Technology in Education What Teachers Should Know By Pedro De Bruyckere, Paul A. Kirschner, Casper D. Hulshof](#)
- [Deans for Impact Resources](#)
- [Pedagogical Knowledge and the Changing Nature of the Teaching Profession](#)
- [The Brain Basis for Integrated Social, Emotional, and Academic Development](#)
- [Relating Research to Practice Briefs](#)
- [STEM Teaching Tools](#). Check out the [research briefs](#)
- [Introduction to the Learning Sciences](#)
- [Connected Learning an agenda for research and design: A research synthesis report of the Connected Learning Research Network](#)
- [Cognitive Architecture and Instructional Design: 20 Years Later](#)
- [Knowing What Students Know The Science and Design of Educational Assessment \(2001\)](#)

- [Seeing Students Learn Science Integrating Assessment and Instruction in the Classroom \(2017\)](#)
- [Knowing What Students Know: The Science and Design of Educational Assessment \(2001\)](#)

Repositories

- [MSPnet open library of research articles](#)
- [NSF's Public Access Repository](#)

Selected (open) sections from:

- [The Cambridge Handbook of the Learning Sciences 2nd Edition \(2014\)](#)
- [Power and Privilege in the Learning Sciences \(2017\)](#)



Reading List: Epistemic Cognition

Edited By Dalila Dragnić-Cindrić



When designing emerging technologies for learning, researchers often aim both for learning specific topics as well as for learning how to think better. Epistemic Cognition is thinking about what and how we know, including the ways in which we acquire knowledge, justify, adapt, and use it. Effective epistemic cognition is key for helping students think better, carefully analyze information, and identify what they know versus what they doubt or distrust.

Barzilai, S., & Chinn, C. A. (2020). A review of educational responses to the “post-truth” condition: Four lenses on “post-truth” problems, *Educational Psychologist*, 55(3), 107-119.

<https://doi.org/10.1080/00461520.2020.1786388>

Barzilai, S., & Chinn, C. A. (2018). On the goals of epistemic education: Promoting apt epistemic performance, *Journal of the Learning Sciences*, 27(3), 353-389. <https://doi.org/10.1080/10508406.2017.1392968>

Barzilai, S., & Zohar, A. (2012). Epistemic thinking in action: Evaluating and integrating online sources. *Cognition and Instruction*, 30, 39-85. <https://doi.org/10.1080/07370008.2011.636495>

Cartiff, B. M., Duke, R. F., & Greene, J. A. (2020). The effect of epistemic cognition interventions on academic achievement: A meta-analysis. *Journal of Educational Psychology*. Advance online publication.

<http://dx.doi.org/10.1037/edu0000490>

Chinn, C. A., Buckland, L. A., & Samarapungavan, A. (2011). Expanding the dimensions of epistemic cognition: Arguments from philosophy and psychology. *Educational Psychologist*, 46, 141-167.

<https://doi.org/10.1080/00461520.2011.587722>

Chinn, C. A., Rinehart, R. W., & Buckland, L. A. (2014). Epistemic cognition and evaluating information: Applying the AIR model of epistemic cognition in D.N. Rapp & J.L. Braash (Eds.), *Processing inaccurate*

information: Theoretical and applied perspectives from cognitive science and the educational sciences (pp. 425-453). The MIT Press.

Chinn, C., & Sandoval, W. (2018) Epistemic Cognition and Epistemic Development. In International Handbook of the Learning Sciences. Routledge. <https://doi.org/10.4324/9781315617572-3>

Goldman, S. R., Britt, A. M., Brown W., Cribb G., George M., Greenleaf C., Lee, C. D., Shanahan, C., & Project READI (2016). Disciplinary literacies and learning to read for understanding: A conceptual framework for disciplinary literacy, *Educational Psychologist*, 51(2), 219-246.

<https://doi.org/10.1080/00461520.2016.1168741>

Greene, J. A., Duke, R. F., & Cartiff, B. M. (2018) A meta-analytic review of the relationship between epistemic cognition and academic achievement. *Journal of Educational Psychology*, 110(8), 1084-1111.

<https://doi.org/10.1037/edu0000263>

Greene, J. A., Sandoval, W. A., & Bråten, I. (Eds.). (2016). *Handbook of Epistemic Cognition*. Routledge.

<https://doi.org/10.4324/9781315795225>



Greene, J. A., & Yu, S. B., (2016). Educating critical thinkers: The role of epistemic cognition. *Policy Insights from the Behavioral and Brain Sciences* 3(1), 45-53.

<https://doi.org/10.1177/2372732215622223>

Herrenkohl, L. R., & Cornelius, L. (2013). Investigating elementary students' scientific and historical argumentation. *Journal of the Learning Sciences*, 22(3), 413-461.

<https://doi.org/10.1080/10508406.2013.799475>

Hofer, B. K., & Bendixen, L. D. (2012). Personal epistemology: Theory, research, and future directions. In K. R. Harris, S. Graham & T. Urdan (Eds.), *APA Educational Psychology Handbook* (Vol. 1: Theories, constructs, and critical issues, pp. 227-256). American Psychological Association. <https://doi.org/10.4324/9780203424964>

Louca, L., Elby, A., Hammer, D. & Kagey, T. (2004). Epistemological resources: Applying a new epistemological framework to science instruction. *Educational Psychologist*, 39(1), 57-68.

https://doi.org/10.1207/s15326985ep3901_6

Rosenberg, S., Hammer, D., & Phelan, J. (2006). Multiple epistemological coherences in an eighth-grade discussion of the rock cycle. *Journal of the Learning Sciences*, 15, 261-292.

https://doi.org/10.1207/s15327809jls1502_4

Sandoval, W. A. (2012). Situating epistemological development. In J. van Aalst, K. Thompson, M. J. Jacobson & P. Reimann (Eds.), *The future of learning: Proceedings of the 10th international conference of the learning sciences* (Vol. 1, pp. 347-354). International Society of the Learning Sciences.

Sandoval, W. A., Greene, J. A., Bråten, I. (2016). Understanding and promoting thinking about knowledge: Origins, issues, and future directions of research on epistemic cognition. *Review of Research in Education*, 40(1), 457–496. <https://doi.org/10.3102/0091732X16669319>

(First Draft, 11/24/2020; last updated 11/25/20)

Thank you to Dr. Jeff Greene for contributions to this list.

Reading List: AI and Education Policy

Edited by: Leah Friedman and Pooja Saxena

The following reading list was compiled by CIRCLS' AI and Education Policy Expertise Exchange, which convened from March-June, 2021. The reading list reflects discussions and topics that surfaced during the Exchange.

Some articles and websites are focused specifically on the intersection of governance, AI, and EdTech, while others more broadly cover AI governance without a focus on education. There is also a section on AI Literacy and resources for educators, which surfaced as an important future topic to address through policy.

Included under each article is a brief bulleted overview of what each article covers and how much technical background each article requires.

All contributors from the group are credited at the bottom of this reading list.

Last Updated: 7/21/2021

Overview

Global AI and Ed Policy Overview:

[UNESCO Guide to Artificial Intelligence in Education](#)

Type of Article: Policy brief/Popular Science Post

APA Citation: UNESCO. (2021, May 31). Artificial intelligence in education. UNESCO.

<https://en.unesco.org/artificial-intelligence/education>.

Background Needed: Low

Covers:

- Details UNESCO initiatives internally and for its members states in AI and Ed Policy
- Describes UNESCO initiative for teaching AI in schools
- Outlines components of the Beijing Consensus on AI & Education
- Includes an overview of in-progress UNESCO AI readiness self-assessment for states

- Links to UNESCO's longer "AI and Education: Guidance for Policy-makers"

U.S. State/National AI and Ed Policy Overview:

Artificial Intelligence (AI) and Education

Resource Type: Part of the collection Congressional Research Service Reports

Citation: Joyce, J. L., & Harris, L. A. (2018). Artificial intelligence (AI) and education. UNT Libraries Government Documents Department.

Background Needed: None

Covers:

- Current applications and advantages and disadvantages of AI in classrooms
- Steps taken by Congress to address issues of privacy of students' personal information
- Policy considerations about student privacy, teacher preparation, product procurement and support, and algorithmic accountability

Global AI & Ed Policy

Global AI and Ed Policy Resources

The following resources provide entry points for understanding the limited amount of global policies that exist on AI in Education.

UNESCO Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development

Type of Article: Working Academic Paper on policy and bulleted overview

APA Citation: Pedro, F., Subosa, M., Rivas, A., & Valverde, P. (2019). Artificial intelligence in education: challenges and opportunities for sustainable development.

<https://unesdoc.unesco.org/ark:/48223/pf0000366994>.

Background Needed: Medium

Covers:

- Links to working paper on AI in Education with a brief bulleted overview of the paper
- Covers case studies from specific countries AI initiatives and curriculums
- Presents 6 challenges (policy and otherwise) in AI and education

Institute for Ethical AI in Education(UK) and The Ethical Framework for AI in Education

Type of Article: Website with links to reports on ethics in AI education

APA Citation: European Commission of the European Union. (n.d.). AI Watch. Knowledge for Policy.

https://knowledge4policy.ec.europa.eu/ai-watch_en#featured-content.

Background Needed: Low-Medium

Covers:

- Website for the Institute for Ethical AI in Education
- Links to interim and final reports on ethics in AI Education
- Interim reports review top issues and criteria for developing ethical educational AI

[Artificial Intelligence, tech corporate governance and the public interest regulatory response](#)

Type of Article: Academic Article

APA Citation: Dignam, A., (2020). Artificial intelligence, tech corporate governance and the public interest regulatory response. Cambridge Journal of Regions, Economy and Society 13(1). p 37-54. Doi: <https://doi.org/10.1093/cjres/rsaa002>

Background Needed: Medium

Covers:

- Overviews and clarifications on AI
- Description of possible regulatory paths in favor of private vs. public interests
- Global focus, with specific attention on EU, US, and China

[The Chinese Approach to Artificial Intelligence: An Analysis of Policy and Regulation](#)

Type of Article: Academic Article

APA Citation: Roberts, H., Cows, J., Morley, J., Taddeo, M., Wang, V., Floridi, L. (2020), The Chinese Approach to Artificial Intelligence: An Analysis of Policy and Regulation. SSRN. Doi: <http://dx.doi.org/10.2139/ssrn.3469783>

Background Needed: Medium

Covers:

- Discusses socio-political background and policy debates shaping China's AI strategy
- Approaches China's policies from a lense of ethics

[International Society for Technology in Education Policy Advocacy](#)

Resource Type: Website

APA Citation: International Society for Technology Education. (n.d.). Take action for ed tech. <https://www.iste.org/advocacy>

Background Needed: Medium

Covers:

- [ISTE's Advocacy toolkit](#)

- [Policy principles](#)
- [Advocacy news](#)

Global AI Non-Ed Policy Resources

These resources survey AI policies from around the world that are not necessarily specific to educational contexts.

[Organization for Economic Co-Operation and Development](#) and [OECD National AI Policies & Strategies](#)

Type of Article: Interactive Dashboard

APA Citation:

Organization for Economic Co-operation and Development. (n.d.). OECD AI Policy Observatory. OECD.AI Policy Observatory. <https://oecd.ai/>.

Organization for Economic Co-operation and Development. (n.d.). National AI Policies & Strategies. OECD.AI Policy Observatory. <https://oecd.ai/dashboards>

Background Needed: Varies widely

Covers:

- Breaks down initiatives by country that relate to AI Policy by number of policies and allocated budget
- Categorizes policy instruments into mechanism of action

[The EU AI Watcher Site](#)

Type of Article: Compilation of articles on AI policy

APA Citation: European Commission of the European Union. (n.d.). AI Watch. Knowledge for Policy. https://knowledge4policy.ec.europa.eu/ai-watch_en#featured-content.

Background Needed: Low

Covers:

- Tracks AI policies across all EU member states

[Future of Life Institute: Global AI Policy Overview](#)

Type of Article: Primer with compiled links on global AI initiatives

APA Citation: Future of Life Institute. (2021, June 7). GLOBAL AI POLICY. Future of Life. <https://futureoflife.org/ai-policy/?cn-reloaded=1>.

Background Needed: Medium

Covers:

Links to 14 different AI issue areas with papers, reports, and articles on each

Map of global AI policy initiatives

[European Union's New Rules for Artificial Intelligence: Question & Answer](#) (May 2021)

Type of Article: Primer for policies

APA Citation:

European Union. (2021, April 21). New rules for Artificial Intelligence – Questions and Answers. European Commission . https://ec.europa.eu/commission/presscorner/detail/en/QANDA_21_1683.

Background Needed: Low

Covers:

- Q&A on new regulations from the EU on Artificial Intelligence
- Categorizes AI systems into different levels of risk and explains categories
- Reviews regulations on biometric identification and racial/gender bias in AI
- Reviews compliance and enforcement mechanisms
- Overview of the Coordinated plan between member states

[GovAI 2019 Annual Report – University of Oxford Center for Governance of AI](#)

Type of Article: Website with links to all of the center's published research

APA Citation: University of Oxford Future of Humanity Institute – AI Governance Research Group. (2019). (rep.).

GovAI 2019 Annual Report. Oxford, UK. <https://www.fhi.ox.ac.uk/ai-governance/govai-2019-annual-report/>

Background Needed: Middle

Covers:

- Website for the Oxford Center for Governance of AI
- Links to the center's research on AI governance
- Covers topics like U.S. public AI opinion, AI standards, AI scientific publishing, and more

[My Data Rights South Africa](#)

Type of Article: Website for understanding AI & Data rights in South Africa

APA Citation: Chair, C. (2021, May 27). My Data Rights: Our Data, Our Rights. My Data Rights.

<https://mydatarights.africa/>.

Background Needed: Low

Covers:

- Feminist perspective of AI, privacy, and data protection enhance digital rights
- Documentation of AI and Gender harms in South Africa
- Walkthrough of feminist approaches
- Policy questions and recommendations for AI

[Safe & Ethical Artificial Intelligence Policy from the Government of Tamil Nadu Information Technology](#)

Department

Type of Article: Report on AI with a framework and scorecards for evaluation

APA Citation: Government of Tamil Nadu. (2020). (rep.). Tamil Nadu Safe & Ethical Artificial Intelligence Policy 2020. <https://indiaai.gov.in/research-reports/tamil-nadu-safe-ethical-artificial-intelligence-policy-2020>

Background Needed: Low-Medium

Covers:

- Primer of AI in its current state and the need for safety and ethics
- Framework for evaluation of AI systems before public roll-out
- Scorecard for safe and ethical AI
- Overview of AI awareness, capacity building, and training

Coded Bias

Type of Article: Documentary

APA Citation: 7th Empire Media. (2020). Coded Bias. United States. <https://www.codedbias.com/>.

Background Needed: None

Covers:

- Follows computer scientist Joy Buolamwini and other AI researchers who are pushing to expose bias and misuse of AI systems such as facial recognition
- Available on Netflix, PBS, and some other streaming platforms

U.S. AI & Ed Policy

U.S. Federal/State AI and Ed Policy Resources

The U.S. has limited federal and state regulations that are specific to AI. The following resources address AI and educational technology through a policy lens.

[STEM For All Video Showcase: Helping States Plan to Teach AI in K-12 and AI4K12](#)

Type of Article: Video and Website Link

APA Citation: Gardener-McCune, C., Cox, B., Delyser, L., Jacobs, K., Seehorn, D., Speed, H., and Touretzky, D. (2021). Helping States Plan to Teach Ai in K-12. Stem for All Video Showcase. TERC and National Science Foundation. <https://stemforall2021.videohall.com/presentations/2115>.

AI4K12. (n.d.). <https://ai4k12.org/>.

Background Needed: Low

Covers:

- Outlines workshop that prepared state representatives to build AI in K-12 curricula
- Describes the AI4K12 organization

[Mapping an Emergent Field of ‘Computational Education Policy’: Policy Rationalities, Prediction and Data in the Age of Artificial Intelligence](#)

Type of Resource: Academic Article

Citation: Gulson, K. N., & Webb, P. T. (2017). Mapping an emergent field of ‘computational education policy’: Policy rationalities, prediction and data in the age of Artificial Intelligence. *Research in Education*, 98(1), 14-26.

Background Needed: Medium-High

Covers:

- Identifies rationalities of the policy sciences and computational policy
- Examines issues around prediction, transparency, and data to investigate how AI and education policy converge
- Provides mapping of computational policy

[Out of the Laboratory and into the Classroom: the Future of Artificial Intelligence in Education](#)

Resource Type: Academic Article

Citation: Schiff, D. (2021). Out of the laboratory and into the classroom: the future of artificial intelligence in education. *AI & Society*, 36(1), 331-348.

Background Needed: Medium-High

Covers:

- Explores the implication of Artificial Intelligence in Education (AIEd) and provides recommendations for a responsible research agenda to AI researchers and developers through a policy lens
- Assesses the status of AIEd with a special focus on intelligent tutoring systems
- Provides a starting point to AIEd stakeholders for improving their “socially responsible research and implementation” in AI educational systems

U.S. Federal/State EdTech Non-AI Policy Resources

The following resources address policies for educational technologies that are not necessarily specific to AI but will affect the use of AI tools in educational settings.

[Reimagining the role of technology in education: 2017 National education technology plan update](#)

Resource Type: U.S. Department of Education Report

Citation: Office of Educational Technology. (2017). Reimagining the role of technology in education: 2017 National education technology plan update. U.S. Department of Education.

Background Needed: None

Covers:

- State, regional, and local visions for technology-enabled learning, teaching, assessment, and infrastructure
- The role of technology to educate and empower learners, teachers, and leaders in formal and informal contexts
- Links to the [Higher Education Supplement to the NETP](#)– a document that examines learning, teaching, assessment, and infrastructure in higher education

[Student Privacy Compass](#)

Resource Type: Webpage

Citation: Student Privacy Compass. (n.d.). About. <https://studentprivacycompass.org/about/>

Background Needed: Low-Medium

Covers:

- [Explanations on student privacy regulations for various stakeholders](#)
- [Breakdown of state laws for privacy](#)

[Senators Markey and Cassidy propose bipartisan bill to update children’s online privacy rules](#)

Resource Type: Press Release

Citation: United States Senators for Massachusetts. (2021, May 11). Senators Markey and Cassidy propose bipartisan bill to update children’s online privacy rules. <https://www.markey.senate.gov/news/press-releases/senators-markey-and-cassidy-propose-bipartisan-bill-to-update-childrens-online-privacy-rules>

Background Needed: Low

Covers:

- Information about Children and Teens’ Online Privacy Protection Act to protect both children and teenagers online
- A copy of the legislation is posted [here](#)
- This news is also covered [here](#)

[COPPA \(Children and Teen’s Online Privacy Protection Act\)](#)

Resource Type: Overview of CIPA, COPPA, and FERPA

Citation: Kozak, D. (2015). Overview of CIPA, COPPA, and FERPA. Technology Services.

<https://www.spps.org/cms/lib/MN01910242/Centricity/Domain/11270/OverviewofCIPACOPPAandFERPA12.20>

15.pdf

Background Needed: Medium

Covers:

- Breaks down the coverages of CIPA, COPPA, and FERPA in education.
- Includes press release of FTC that provides parents greater control over their kids' information.

[COPPA Guidance for EdTech Companies and Schools during the Coronavirus](#)

Resource Type: Business Blog

Citation: Schifferle, L. W. (2020, April 9). COPPA guidance for ed tech companies and schools during the Coronavirus. <https://www.ftc.gov/news-events/blogs/business-blog/2020/04/coppa-guidance-ed-tech-companies-schools-during-coronavirus>

Background Needed: Low

Covers:

- FAQ on COPPA (federal privacy regulation) for EdTech companies and Schools during COVID-19
- Additional links to [Protection of Pupil Rights Amendment\(PPRA\)](#), [FERPA and Virtual Learning](#), and [Children's Online Privacy Protection Rule: A Six Step Compliance Plan for your Business](#).

[Project Unicorn EdTech Vendor Data Interoperability Pledge](#)

Resource Type: Pledge

Citation: Project Unicorn at Innovate EDU. (2020). EdTech Vendor Pledge. Project Unicorn. <https://www.projectunicorn.org/edtechvendorpledge/>.

Background Needed: Low

Covers:

- Pledge for EdTech vendors to commit to increasing secure access, privacy, and interoperability in products
- Legally enforceable yet voluntary sign-on

U.S. Federal/State AI Non-Ed Policy Resources:

The following resources address policies for educational technologies that are not necessarily specific to AI but will affect the use of AI tools in educational settings.

[Artificial Intelligence: An Accountability Framework for Federal Agencies and Other Entities](#)

Type of Resource: Government Report and Overview

Citation: Government Accountability Office. (2021). (rep.). Artificial Intelligence: An Accountability Framework for Federal Agencies and Other Entities. Washington, D.C. <https://www.gao.gov/products/gao-21-519sp>

Background Needed: Medium

Covers:

- Government Office of Accountability report on AI that breaks the framework into Data, Monitoring, Governance, and Performance
- Developed from AI forum of experts and interviews with government officials and AI experts.
- Page links to full report as well as fast facts and a video on the topic.

[A Review of Artificial Intelligence in Government and its Potential from a Public Policy Perspective](#)

Type of Resource: Academic Article

Citation: Valle-Cruz, D., Alejandro Ruvalcaba-Gomez, E., Sandoval-Almazan, R., & Ignacio Criado, J. (2019). A review of artificial intelligence in government and its potential from a public policy perspective. In Proceedings of the 20th Annual International Conference on Digital Government Research (pp. 91-99).

Background Needed: High

Covers:

- The research question is: “What are the current AI trends in the public sector?”
- Authors reviewed 78 papers in the field. Their findings suggest that most papers published so far are normative and exploratory in nature
- The field faces immense public policy challenges in this area.

[Artificial Intelligence and Public Policy](#)

Resource Type: Academic Article

Citation: Thierer, A. D., Castillo O’Sullivan, A., & Russell, R. (2017). Artificial intelligence and public policy. Mercatus Research Paper.

Background Needed: Medium-High

Covers:

- Authors argue for “prudence, patience, and a continuing embrace of permissionless innovation” in relation to digital technologies
- Comparing the onset of AI technologies to the development of the internet, the paper describes how policymakers can formulate “pro-growth” policies while focusing on “oversight and accountability” for consumers.

[Aiming for truth, fairness, and equity in your company’s use of AI](#)

Resource Type: Business Blog

Citation: Jillson, E. (2021, April 19). Aiming for truth, fairness, and equity in your company’s use of AI. Federal Trade Commission. <https://www.ftc.gov/news-events/blogs/business-blog/2021/04/aiming-truth-fairness->

[equity-your-companys-use-ai](#)

Background Needed: Low-Medium

Covers:

- Includes laws of the Federal Trade Commission for developers and users of AI.
- Discusses how to use AI equitably.

Privacy/Transparency

General AI Privacy/Transparency Policy Resources

The resources in this section address issues related to creating ethical and transparent AI technologies. These resources are not necessarily related to policy.

[Ethical and Privacy Principles for Learning Analytics](#)

Type of Article: Academic Article

Citation: Pardo, A., & Siemens, G. (2014). Ethical and privacy principles for learning analytics. *British Journal of Educational Technology*, 45(3), 438-450.

Background Needed: Medium

Covers:

- Identifies principles and pragmatic mechanisms for designing learning experiences embedded in ethical and privacy issues
- Proposes guidelines for complying with privacy principles in emerging legislative initiatives

[Building Consentful Tech Zine](#)

Type of Article: Zine

APA Citation: Lee, U., and Toliver, D. (2017). *Building Consentful Tech [Zine]*. ripplemap.io/zine

Background Needed: Low

Covers:

- What is consentful technology and why put energy into it
- What consentful tech looks like.

[Coded Bias Declaration of Data Rights as Human Rights](#)

Type of Article: Coded Bias documentary film signable declaration of data rights as human rights

APA Citation: Universal Declaration of Data Rights as Human Rights. Coded Bias. (n.d.).

<https://www.codedbias.com/sign>.

Background Needed: Low

Covers:

- Outlines demands from the coded bias documentary to treat data rights as human rights
- Site links to other coded bias resources as well as where to find the documentary.

[Artificial Intelligence, Transparency, and Public Decision-making](#)

Resource Type: Academic Article

Citation: de Fine Licht, K., & de Fine Licht, J. (2020). Artificial intelligence, transparency, and public decision-making. *AI & Society*, 1-10.

Background Needed: Medium

Covers:

- How public perception of the legitimacy of “decisions and decision-makers” in AI is affected by the transparency of those decisions
- Discusses the partial transparency about the decision making in AI and how complete transparency may not be better.

AI & Ed Literacy

AI and Ed Literacy Non-Policy Resources

The resources in this section provide information largely for educators on AI in education. These include curriculum resources, reports, webinars, and academic articles.

[Artificial Intelligence in Education: Putting Educators and Students in the Driver’s Seat](#)

Type of Article: ISTE’s Website with linked guides to AI for educators

APA Citation: International Society for Technology in Education. (n.d.). Artificial Intelligence in Education: Putting Educators and Students in the Driver’s Seat. ISTE. <https://www.iste.org/areas-of-focus/AI-in-education>.

Background Needed: Low-Middle (Varies)

Covers:

- Links to all level guides in English, Spanish, and Arabic
- Links to additional books and courses on teaching AI
- Links to case studies on educators applying AI in the classroom
- Link to other podcasts, blogs, and guides for AI in the classroom
- Additional AI ethics volumes released in 2021

[AI4All Open Learning: AI Curriculum and Community for High School Teachers](#)

Type of Article: Open AI Curriculum for K-12 Educators

APA Citation: AI4All. (n.d.). AI Curriculum and Community for High School Teachers. AI4All. <https://ai-4-all.org/open-learning/resources/>.

Background Needed: Low-Middle (Varies)

Covers:

- Short and longer curriculums on teaching AI
- Links to additional teaching resources and community events
- Included under the “bytes” section: curriculum around ethical issues in AI (Privacy, Explainability, and Fairness) where students pretend they were CEOs of a company designing an ed tech product that they consider how their ethics are going to be part of developing.

[Digital Promise: How Does Artificial Intelligence Fit into the Future of Education](#)

Type of Article: Blog post with links to webinars

APA Citation: Fusco, J., Bellin, M., & Roschelle, J. (2021, February 24). How Does Artificial Intelligence Fit into the Future of Education? [web log]. <https://digitalpromise.org/2021/02/24/how-does-artificial-intelligence-fit-into-the-future-of-education/>.

Background Needed: Low

Covers:

- What is an AI system?
- Educators, AI, and the Future of Learning Webinars
- How to get involved and other resources links.

[ISTE and SkillRise: Selecting Technology Tools for your Organization is as easy as ABC](#)

Type of Article: Blog post

APA Citation: Black, N.B. (2020). Selecting technology tools for your organization is as easy as ABC [web log]. <https://skillrise.org/article/selecting-technology-tools-your-organization-easy-abc>

Background Needed: Low-Medium

Covers:

- Covers selection of EdTech tools based on various principles
- Outlines criteria for technology aligning with a vision
- Outlines criteria for technology aligning with stakeholders.

[IBM AI Education: Free Live and On-Demand Webinars for K-12 Educators](#)

Type of Article: Resource page with links to AI for Educators

APA Citation: IBM and MindSpark Learning. (n.d.). IBM AI Education: Free Live and On-Demand Webinars for K-12 Educators. IBM and MindSpark. <https://www.mindspark.org/ibm-ai>

Background Needed: Low-Medium

Covers:

- Gives a brief overview of the necessity for AI education and webinars
- Sign up link to hear about AI webinars for educators
- Links to all IBM AI webinars for educators.

CoSN Report on Artificial Intelligence (AI) in K-12

Type of Article: Report

APA Citation: Consortium for School Networking and Microsoft. (2020). (rep.). CoSN Artificial Intelligence (AI) in K-12.

Background Needed: Low-Medium

Covers:

- Promises and challenges of AI in education
- Questions and Considerations for Schools
- Additional Resources.

Teaching Tech to Talk: K-12 Conversational Artificial Intelligence Literacy Curriculum and Development Tools

Article Type: Academic Article

APA Citation: Van Brummelen, J., Heng, T., Tabunshchik, V. (2020). Teaching Tech to Talk: K-12 Conversational Artificial Intelligence Literacy Curriculum and Development Tools. Computers and Society.

<https://arxiv.org/abs/2009.05653v1>

Background Needed: Medium-High

Covers:

- Study that evaluates a conversational agent interface with respect to eight AI competencies
- Analyzes teacher and student feedback on the interface
- Finds that student struggled most with concepts of AI ethics and learning.

Youth and Artificial Intelligence: Where we stand

Type of Article: Academic Article

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Background Needed: Medium

Covers:

- An overview of the ways that 12-18-year-olds interact with and are impacted by AI
- Spotlights some of the AI work done by Harvard's Youth and Media team
- Highlights key questions of concern and next steps for the team.

[Ethics of AI in Education: Towards a Community-Wide Framework](#)

Type of Article: Academic

Citation: Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., ... & Koedinger, K. R. (2021). Ethics of AI in education: towards a community-wide framework. *International Journal of Artificial Intelligence in Education*, 1-23.

Background Needed: Medium-High

Covers:

- Recommends critical focus on fairness, accountability, transparency, bias, autonomy, agency, and inclusion in Artificial Intelligence in Education research
- Invited 60 researchers from AIED community to respond to a survey on ethics and application of AI in educational settings
- Compiled the responses of 17 participants and described the complex issues raised by them.

Contributors

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