Systematic Review of Research on Learning Environments and Technology: A Very Special Issue (of ETR&D) Curt Bonk, Vanessa Dennen, Meina Zhu, Florence Martin, Tian Luo, Fei Gao, Byron Havard, and colleagues Wednesday November 4, 2020



#### Special Issue: Martin, F., Dennen, V. P., & Bonk, C, J. (Eds.) (2020). Systematic Reviews of Research on Emerging Learning Environments and Technology. *Educational Technology Research and Development (ETR&D) 68*(4).

#### Key Points:

- AECT presidential session in 2018 in KC.
- Suggested by Lin Lin, UNT and editor of AECT.
- 80+ reviewer pool (many IU IST alums...thank you!).
- Completed 6 months ahead of original schedule.
- Published in August 2020.
- 13 main pieces from 48 submissions.
- 100 free copies of issue coming soon, some at next year at AECT.
- Free preface, intro, and end.
- Great people!







## Top 10 Disciplinary Categories

| Category                                 | Number of<br>Articles | Percent of Articles |
|--|-----------------------|---------------------|
| Education Educational Research           | 208                   | 18.8%               |
| Public Environmental Occupational Health | 99                    | 8.9%                |
| Business                                 | 98                    | 8.9%                |
| Communication                            | 96                    | 8.7%                |
| Psychology Multidisciplinary             | 62                    | 5.6%                |
| Health Care Sciences Services            | 53                    | 4.8%                |
| Social Sciences Interdisciplinary        | 52                    | 4.7%                |
| Information Science Library Science      | 50                    | 4.5%                |
| Education Scientific Disciplines         | 48                    | 4.3%                |
| Psychology Experimental                  | 43                    | 3.9%                |



# What Data Types and Data Collection Methods Are Being Used?



| opics: Education-rela         | ated articles |         |
|-------------------------------|---------------|---------|
|                               |               |         |
|                               | Number of     |         |
| Торіс                         | articles      | Percent |
| Teaching and learning tool    | 104           | 46.4%   |
| Adoption, use, and beliefs    | 40            | 17.9%   |
| Digital literacy              | 19            | 8.5%    |
| Effects of use and exposure   | 10            | 4.5%    |
| Identity                      | 8             | 3.6%    |
| Student-teacher relationships | 7             | 3.1%    |
| Activism and social issues    | 5             | 2.2%    |
| Other                         | 31            | 13.8%   |
| TOTAL                         | 224           | 100.0%  |



## Big takeaways

- Limited work done across disciplinary lines
  Social media is approached as a discrete
- phenomenon in a single context
- There are many opportunities for connecting across disciplines
- EDUCATION + mental health? + info literacy? + identity?

## Summary Thoughts

- Consider the systemic nature of social media use when situating and communicating research
- Conduct studies that bridge disciplines and contexts







## Methods

- Reviewed 477 empirical MOOCs research published from 2009 to June 2019.
- In addition to the above, we will investigate MOOC research from the standpoint of phases of MOOC evolution; Phase I (2009-2016): MOOCs primarily were free and open, and Phase 2 (2017-2019): MOOCs increasingly discussed from the standpoint generating revenue and offering credentials (Shah, 2018a)

## **Data analysis**

- For Research Question (RQ) #1, the authors calculated the number of publications from each publication outlet.
- RQ #2 & 3

**AEE** 

**AEE** 

Table 2 MOOC research methods and foci coding scheme

| Items    | Research methods | Research foci      |
|----------|------------------|--------------------|
| Sub-item | Quantitative     | Design-focused     |
|          | Qualitative      | Student-focused    |
|          | Mixed methods    | Instructor-focused |
|          |                  | Commenting         |

## Data analysis

- To answer RQ #4, we calculated the locations of all the MOOC first authors' affiliations in this study.
- For RQ #5, the researchers calculated the countries of the MOOC being studied.
   For the studies which did not specify the location of MOOC delivery, the authors coded them as "Global."































## Conclusion

Given the growth of MOOCs in the past few years toward revenue models, it is important to extend the previous line of research that concerned the initial era of free and open MOOCs, namely the ones by Liyanagunawardena et al. (2013), Gašević et al. (2014), Veletsianos and Shepherdson (2015, 2016), and by Deng and Benckendorff (2017). This study provided a more comprehensive systematic review by including MOOC empirical research from the first arrival of MOOCs to present. We suggest future research continue to expand upon methodological approaches and topics that are perceived to be critical to MOOC sustainability, growth, and evolution in the coming decade.

**AEI** 



## Systematic review of adaptive learning research designs, context, strategies, and technologies from 2009 to 2018

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## Adaptive Learning Definition

 "An emerging learning technology that dynamically adjusts instructional content to provide interactive and personalized learning paths to the individual to facilitate learning." (Martin et al., 2020, p. 1910).

|   | Authors   | Year<br>Published | Article  | Years<br>Research<br>Reviewed | Number of<br>Studies<br>Reviewed | Adaptive<br>Focus                               |
|---|---|-------------------|--|-------------------------------|----------------------------------|---|
| 1 | Normadhi, Shuib,<br>Nasir, Bimba, &<br>Bolokrishnon | 2019              | Identification of personal traits in adaptive learning<br>environment: Systematic literature review, Computers<br>5 Education 130, 169, 100  | 2010 to 2017                  | 78                               | Personal Traits                                 |
| 2 | Kumar,Singh, &<br>Ahuja                             | 2017              | a Eudotation, 190-190.<br>Learning styles, hole 1s0.<br>Learning styles based adaptive intelligent tutoring<br>systems: Document analysis of articles published<br>between 2001. and 2016. International Journal of<br>Cognitive Research in Science, Engineering, and<br>Educetion. 5(2). | 2001 to 2016                  | 78                               | Learning Styles                                 |
| 3 | Nakic, Granic, &<br>Glavinic,                       | 2015              | Anatomy of student models in adaptive learning<br>systems: A systematic literature review of individual<br>differences from 2001 to 2013. Journal of Educational<br>Computing Research, 51(4), 459-489<br>Adaptive activational humanifications  | 2001 to 2013                  | 98                               | Individual<br>Differences                       |
|   | Akbulut & Cardak                                    | 2012              | learning styles: A content analysis of publications<br>from 2000 to 2011. Computers & Education, 58(2),<br>835-842   | 2000 to 2011                  | 70                               | Learning Styles                                 |
| 5 | Vandewaetere,<br>Desmet, &<br>Clarebout             | 2011              | The contribution of learner characteristics in the<br>development of computer-based adaptive learning<br>environments. Computers in Human Behavior, 27(1),<br>118-130.   | 1993 to 2009                  | 52                               | Learning<br>Characteristics                     |
| 5 | Verdú, Regueras,<br>Verdú,, De Castro, &<br>Pérez   | \$ 2008           | Is adaptive learning effective? A review of the<br>research. In WSEAS International Conference.<br>Proceedings. Mathematics and Computers in<br>Science and Engineering (No. 7). World Scientific<br>and Engineering Academy and Society.  | 1997 to 2007                  | 15                               | Effectiveness of<br>Adaptive Learnin<br>Systems |



## **Adaptive Learning Framework**

- Learner Model, also known as the student model, refers to the learner characteristics of what a student knows and does.
- Content Model, also known as the expert or domain model, refers to the content or knowledge base for the course.
- Instructional Model, also known as the pedagogical model, refers to the algorithm that assists in adapting the instruction based on the content and learner model. The Instructional Model is also referred to as the adaptation model as it defines what, when, and how adaptation can occur.

## Adaptive Source and Target

- Adaptive Source The learner model is referred to as the adaptive source. The content model and the instructional model are together called the adaptive target (Vandewaetere et al. 2011).
- Adaptive Target While the adaptive source refers to the characteristics ("to what will it be adapted"), the adaptive target refers to the content and instruction that will be adapted ("what will be adapted")
- Adaptive Engine can be described as an artificial intelligence (AI) sequence generator where a learning map with instructional content will be created for the learner in the instructional model.

## Purpose of this Study

- In this review, we also emphasize the instructional model along with the content model for adapting instructional content.
- Specifically, we examine the adaptive strategy used in adjusting the instruction.

## **Research Questions**

- 1. What are the publication trends of adaptive learning research?
- 2. What is the **context** of adaptive learning research published?
- 3. What research outcomes, research design, and data collection methods are used in the studies reviewed?
- What is the focus of research on adaptive learning studies?
   What adaptive strategies are used in the adaptation of instructional content based on the learner model, content model,
- instructional content based on the learner model, content model and instructional model?
- 6. What are the **adaptive technologies** used in the research published?

#### Methods

#### **IES Guidelines**

- Institute of Education Sciences (2017), What Works Clearinghouse Procedures and Standards Handbook, Version 4.0.
  - 1) developing the review
  - protocol
  - identifying relevant literature
     screening studies
  - 4) reviewing articles
  - reporting findings
- Databases, Search terms, Years
- Education Research Complete and ERIC
- "Adaptive Learning"
- 2009 and 2018
- 2000 and 201

| Inclusion                      | /exclusion  |   |
|--------------------------------|---|---|
| Criteria                       | Inclusion   | Exclusion   |
| Publication date               | 2009 to 2018  | Prior to 2009 and after 2018  |
| Publication type               | Scholarly articles of original research<br>from peer reviewed journals  | Book chapters, technical reports,<br>dissertations, or proceedings  |
| Focus of the article           | The research focused primarily on<br>adaptive learning for instruction.   | Articles that did not include adaptive learning for instruction.  |
| Research Method and<br>Results | There was an identifiable method and<br>results section describing how the<br>empirical study was conducted and the<br>findings. Quantitative and qualitative<br>methods were included. | Reviews of other articles, opinion, or<br>discussion papers that do not include<br>a discussion of the procedures of the<br>empirical study or analysis of data<br>such as product reviews or<br>conceptual articles. |
| Language                       | Journal article was written in English  | Other languages were not included   |



## Data Coding & Analysis

- Multiple coders
- Interrater reliability 89%
- Descriptive tables, including frequency and percentage
- Thematic Analysis for narrative data



| able4. Journals and frequency of publication of adaptive learning               | research             |                      | Country         | Number of studies | Percent    |
|---|----------------------|----------------------|-----------------|-------------------|------------|
|   | Number of<br>studies | Percent              | Taiwan          | 18                | 29.5       |
| computers & Education   | 12                   | 19.67                | United States   | 11                | 18.0       |
| ompater Applications in Engineering Education                                   | 6                    | 9.84                 | United Kingdom  | 4                 | 6.6        |
| ilucational Technology & Society  | 4                    | 6.56                 | Not prowided    | 3                 | 4.9        |
| ternational Journal of Emerging Technologies in Learning                        | 4                    | 6.56                 | the provided    |                   |            |
| eitish Journal of Educational Technology  | 3                    | 4.92                 | Austrana        | 2                 | 3.5        |
| ilucation and Information Technologies  | 3                    | 4.92                 | India           | 2                 | 3.3        |
| teractive Learning Environments   | 3                    | 4.92                 | Saudi Arabia    | 2                 | 3.3        |
| sumal of Education for Business   | 2                    | 3.28                 | Serbia          | 2                 | 3.3        |
| nemal of Education Research   | 2                    | 3.28                 | Spain           | 2                 | 3.3        |
| senal of Interactive Molia in Education   | 2                    | 3.28                 | Turkey          | -                 | 2.2        |
| fuline Learning   | 2                    | 3.28                 | Turkey          | -                 | 3.5        |
| ul of Education Research<br>nd of Interactive Media in Education<br>ne Learning | 2 2 2                | 3.28<br>3.28<br>3.28 | Spain<br>Turkey | 2 2 2             | 3.3<br>3.3 |

|                       |                   |         | ·                          |                      |            |
|-----------------------|-------------------|---------|----------------------------|----------------------|------------|
| Instructional context | Number of studies | Percent | Subject                    | Number of<br>studies | Percentage |
| Instructional sector  |                   |         | Computer colones           | 16                   | 26.2       |
| Government            | 1                 | 1.6     | Computer science           | 7                    | 20.2       |
| Healthcare            | 1                 | 1.6     | Devinant                   | 7                    | 11.5       |
| Higher ed             | 41                | 67.2    | Not enacified              | 7                    | 11.5       |
| K-12                  | 16                | 26.2    | English                    | 5                    |            |
| Other                 | 2                 | 3.3     | Education                  | 5                    | 8.2        |
| Study duration        |                   |         | Engineering and technology | 5                    | 8.2        |
| Years/semesters       | 9                 | 14.7    | Multiple subjects          | 4                    | 6.6        |
| Weeks/months          | 17                | 27.9    | Mathematics                | 3                    | 4.9        |
| Hours                 | 3                 | 4.9     | Psychology                 | 1                    | 1.6        |
| Not specified         | 32                | 52.5    | Pharmacy                   |                      | 1.6        |

| aavah Mathadalamu   |                                  |                  |  |
|---|----------------------------------|------------------|--|
| earch Methodolog  | IY                               |                  |  |
| -   | -                                |                  |  |
| Table 8 Research methodological components (outcon<br>nethods) in adaptive learning studies | me variables, research design an | d data collectio |  |
| Research methodological components  | Number of studies                | Percentage       |  |
| Outcome variables   |                                  |                  |  |
| Cognitive (e.g., achievement)   | 41                               | 67.2             |  |
| Affective (e.g., attitude)  | 23                               | 37.7             |  |
| Behavior (e.g., time spent)   | 25                               | 41.0             |  |
| Other   | 6                                | 9.8              |  |
| Research design   |                                  |                  |  |
| experimental  | 27                               | 44.3             |  |
| Non-experimental  |                                  | 18.0             |  |
| Qualitative   | 6                                | 9.8              |  |
| Mixed-method  | 17                               | 27.9             |  |
| Data collection methods   |                                  |                  |  |
| Fest data   | 43                               | 70.5             |  |
| Survey  | 40                               | 65.6             |  |
| Extant data (Email, recording, discussion data)   | 25                               | 41.0             |  |
| nterview  | 9                                | 14.7             |  |
| Observation   | 5                                | 8.2              |  |
| liekstream data/log files   | 4                                | 6.6              |  |

## **Research Focus**

| Research focus   | Number of studies | Percentage |
|--|-------------------|------------|
| Needs analysis for adaptive system                         | 2                 | 3.28       |
| Focused on learner characteristics                         | 13                | 21.31      |
| Design and development of adaptive learning systems        | 24                | 39.34      |
| Implementation and evaluation of adaptive learning systems | 22                | 36.07      |

## **Adaptive Sources**

| Learner Characteristics                             | Number of<br>Studies | Adaptive Source Measuring Learner Characteristics  |
|---|----------------------|--|
| Learning Style                                      | 14                   | Felder-Silverman Learning Style Model, VARK Questionnaire, Kolb's learning<br>style inventory, Solomon and Felder ILS inventory, Keefe's learning style test |
| Cognitive Style and Thinking Style                  | 8                    | Swellerm van Merrienboer and Paas, Pask's Holist-Serialist dimension,<br>Witkin's GEFT test, Student preferences for content and components                  |
| Learner Prior Knowledge and<br>Background Knowledge | 8                    | Pretest, Knowledge test, psychological tests for initial comprehension level   |
| Learner Knowledge and<br>Metacognitive Knowledge    | 6                    | Content Result, Semantic description   |
| Learner Preference                                  | 4                    | Ignatian Teaching Methods  |
| Learner Behavior                                    | 3                    | Time spent   |
| Learner Profile                                     | 3                    | Log data   |
| Learner Ability                                     | 2                    | Proficiency level  |
| Multiple Learner Characteristics                    | 2                    | Learner needs and personal characteristics, self-efficacy and learning<br>efficiency   |
| Learner Interest                                    | 1                    | Student interest survey 5  |

| ۸dar | Adaptive Targets  |   |           |  |  |
|------|-------------------|---|-----------|--|--|
| Auap | Silve larg        | 613   |           |  |  |
|      |                   |   | Number of |  |  |
|      | What was adapted? | Adaptive Target                               | Studies   |  |  |
|      | Content           | Adaptive Content                              | 9         |  |  |
|      | Assessment        | Adaptive Feedback                             | 8         |  |  |
|      | Assessment        | Adaptive course topic and question difficulty | 4         |  |  |
|      | Navigation        | Adaptive Learning Sequence                    | 5         |  |  |
|      | Navigation        | Adaptive Learning Path                        | 5         |  |  |
|      | Navigation        | Adaptive Pacing                               | 1         |  |  |
|      | Navigation        | Adaptive Navigation                           | 1         |  |  |
|      | Presentation      | Adaptive Caption Filtering                    | 1         |  |  |
|      | Presentation      | Adaptive Material Format and Presentation     | 4         |  |  |
|      |                   |   |           |  |  |



## **Implications and Future Research**

## Implications

- Designers and developers
- Instructional designers
- Instructors
- Researchers
- Future Research
  - Need for more qualitative focused studies
  - · Continue to examine aspects of adaptivity



"Like, Comment, and Share": Professional Development Through Social Media in Higher Education



> Tian Luo (Old Dominion University)
 > Candice Freeman (Old Dominion University)
 > Jill Stefaniak (University of Georgia)



## **Research Questions**

- What are the <u>current trends in research</u> involving social media and faculty professional development in higher education?
- What are the main characteristics of reviewed studies explaining higher education faculty's professional development on social media (i.e., types of studies found, social media tools identified, and academic disciplines of the studies)?
- What theoretical frameworks and research methodologies have been utilized to examine research involving social media and faculty professional development in higher education?
- What <u>guidelines and implications</u> exist in the literature with regard to facilitating sustainable online faculty development efforts on social media?







| Tupor of DD. | Earmal | VC   | Inform |  |
|--------------|--------|------|--------|--|
| Types of FD. | TOrmar | v 5. | THOIL  |  |

| Туре           | #  | Studies   |
|----------------|----|---|
| Informal<br>PD | 15 | Bombaci et al. (2016); Brock et al. (2014); Gao & Li (2017); Gao & Li (2019); Greenhow (Li & Mai (2019); Gruzd et al. (2012); Li & Greenhow (2015); Meisher-17al & Pierterse (2018); Schieffer (2016); Trust et al. (2017); Veletsianos (2012); Veletsianos & Kimmons (2013); Weisgerber & Butler (2011); Xie & Luo (2019); Xing & Gao (2018) |
| Formal<br>PD   | 8  | Cahn et al. (2013); Cain et al. (2013); Donelan (2016); Jippes et al.<br>(2013); Klein et al. (2013); Ranieri et al. (2018); Sullivan et al.<br>(2018); Velsamy & Karthikeyan (2016)  |

## Social Media Platform Stud

| Social media platform      | #  | Studies  |
|----------------------------|----|--|
| Twitter                    | 11 | Bombaci et al. (2016); Cahn et al. (2013); Gao & Li (2017); Gao &<br>Li (2019); Greenhow et al. (2019): Li & Greenhow (2015);<br>Veletsianos (2012); Veletsianos & Kimmons (2016); Velsamy &<br>Kathikeyan (2016); Xie & Luo (2019); Xing & Gao (2018) |
| Various social media tools | 5  | Cahn et al. (2013); Donelan (2016); Grudz et al. (2012); Schieffer (2016); Veletsianos & Kimmons (2013)  |
| Facebook                   | 3  | Cain et al. (2013); Klein et al. (2013); Veletsianos & Kimmons (2013)  |
| Academia.edu               | 1  | Meisher-Tal & Pierterse (2018)   |
| Google+                    | 1  | Sullivan et al. (2018)   |
| Research Gate              | 1  | Meisher-Tal & Pierterse (2018)   |
| Not specified              | 3  | Jippes et al. (2013); Ranieri et al. (2018); Trust et al. (2017)   |

| Acader                                | nic | Disciplines   |  |
|---------------------------------------|-----|---|--|
| Academic Discipline                   | #   | Studies   |  |
| Education                             | 6   | Gao & Li (2017); Greenhow, Li & Mai (2019); Li & Greenhow (2015);<br>Veletsianos & Kimmons (2013); Veletsianos & Kimmons (2016); Xing &<br>Gao (2018)           |  |
| Medical                               | 5   | Brock et al. (2014); Cahn et al. (2013); Cahn et al. (2013); Jippes et al. (2013); Klein et al. (2013)  |  |
| Information Science and<br>Technology | 2   | Grudz et al. (2012); Xie & Luo (2019)   |  |
| STEM                                  | 1   | Donelan (2016)  |  |
| Biology                               | 1   | Bombaci et al. (2016)   |  |
| Business                              | 1   | Velsamy & Karthikeyan (2016)  |  |
| Not-specified                         | 7   | Gao & Li (2019); Meisher-Tal & Pierterse (2018); Ranieri et al. (2018);<br>Schieffer (2016); Sullivan et al. (2018); Trust et al. (2017); Veletsianos<br>(2012) |  |

| Theoretic   | cal | Frameworks   |
|---|-----|--|
| Theoretical Frameworks                                | #   | Studies  |
| Community of Practice (CoP)                           | 5   | Gao & Li (2017); Greenhow, Li & Mai, (2019); Li & Greenhow, 2015;<br>Xing & Gao (2018); Xie & Luo (2019) |
| Social Constructivism                                 | 4   | Gao & Li (2017); Li & Greenhow, 2015; Schieffer (2016); Xing & Gao (2018)                                |
| Situated Learning                                     | 2   | Greenhow et al. (2019); Trust et al. (2017)  |
| Experiential Learning                                 | 1   | Jippes et al. (2013)   |
| Learning Ecology                                      | 1   | Greenhow, Li & Mai (2019)  |
| Networked Participatory<br>Scholarship                | 1   | Veletsianos & Kimmons (2016)   |
| Online Discourse                                      | 1   | Xing & Gao (2018)  |
| Technology Acceptance Model                           | 1   | Gao & Li (2019)  |
| Unified Theory of Acceptance and<br>Use of Technology | 1   | Gruzd et al. (2012)  |
| Uses and Gratification Theory                         | 1   | Meisher-Tal & Pieterse (2018)  |

## Research Methodology

| Methodology                    | Data Sources and Analysis  | Studies   |
|--------------------------------|--|---|
| Quantitative (9)               | Survey and Questionnaire (2)<br>Tweets   | Cain et al (2013); Gao & Li (2019); Jippes et al.<br>(2013); Meisher-Tal & Pierterse (2018); Sullivan et al.<br>(2018); Trust et al. (2017); Velsamy & Karthikeyan<br>(2016); Xing & Gao (2018) |
| Qualitative (5)                | Interview<br>Tweets qualitative coding   | Greenhow, Li & Mai (2019); Gruzd et al. (2012);<br>Schieffer (2016); Veletsianos (2012); Veletsianos &<br>Kimmons (2013)  |
| Mixed methods (4)              | Tweets- Content analysis<br>open-ended survey questions; Facebook-<br>posting; Interviews, Surveys | Bombaci et al. (2015); Donelan (2016); Klein et al.<br>(2013); Veletsianos & Kimmons (2016)   |
| Social network<br>analysis (2) |  | Gao & Li (2017); Xie & Luo (2019)   |
| Design-based<br>research (1)   |  | Ranieri et al. (2018)   |
| Non-specified (2)              | CV searches<br>Website analysis  | Brock et al. (2014); Cahn et al. (2013)   |





A Systematic Review of Mobile Game-Based Learning in STEM Education



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## Introduction

1. Research shows positive effects of digital game-based learning, gamification, and mobile-based learning.

2. Reviews have been conducted on mobile learning, gamebased learning, or mobile game-based learning in general.

3. Research on mobile game-based learning in STEM education is "at a rather budding stage" (Giannakas, et al., 2018, p. 379), but has increased rapidly.

 There is a need for a systematic review of the literature to understand the potential of mobile game-based learning in STEM education.











|                                   |    | FII           | naings |   |    |
|-----------------------------------|----|---------------|--------|---|----|
| Education Levels                  | N  | Cubiest Areas | M      | Duration of Intervention                  | N  |
| Broschool                         |    | Subject Areas | N      | Within 1 day                              | 14 |
| Flementon School                  | 12 | Mathematics   | 11     | More than 1 day and less than 5           | 7  |
| Elementary School                 | 13 | Science       | 18     | days                                      |    |
| Middle School<br>Higher Education | 4  | Engineering   | 2      | More than 1 week and less than<br>4 weeks | 3  |
|                                   |    |               |        | More than 5 week and less than 8 weeks    | 2  |
| Sottings                          | N  | Sample Sizes  | N      | 3 months                                  | 1  |
| Settings                          |    | <25           | 3      |   |    |
| Formal                            | 12 | 25-50         | 6      |   |    |
| Semi-formal                       | 12 | 51-100        | 10     |   |    |
| Informal                          | 2  | 101-150       | 6      |   |    |
| Multiple Settings                 | 4  | 151-200       | 1      |   |    |
|                                   | -  | >200          | 4      |   |    |















## A meta-analysis of wearables research in educational settings published 2016–2019

Byron Havard, University of West Florida Megan Podsiad, University of Florida Cassie Arnold, University of West Florida

## Purpose, Definition, & Process

- Problem/Purpose: Provide a synthesis of the quantitative educational research that currently exists regarding the effects of wearable use on learning and motivation outcomes
- Wearable definition: "include a variety of body-borne sensory, communication, and computational components that may be worn on the body, under, over, or within clothing" (Havard and Podsiad 2017, p. 356)
- Process: (a) problem formulation, (b), literature search, (c) data evaluation, (d), data analysis, (e) interpretation of results, and (f) presentation of results by Cooper et al. (2019)
- Research Questions: Six research questions guided this study













## Literature Search & Coding

- Literature Search: Institute of Electrical and Electronics Engineers (IEEE) Xplore, Web of Science (WoS), and Education Resources Information Center (ERIC) - 62,000+ results IEEE search for "wearable"
- Inclusion criteria: Seven criteria for inclusion
- Search results: 171 articles met the search criteria and filters
- Coding: Coding manual, field parameters, procedures
- Study Characteristics

## Data Analysis & Results

- Data Analysis: IBM SPSS Statistics Version 25.0, SPSS macros Version 2005.05.23 (Wilson 2006), Comprehensive meta-analysis (CMA) version 3.0 - Hedges' g - small sample size bias correction factor (Cooper et al. 2019, p. 296)
- Wearable outcomes: overall weighted mean effect size for 20 outcomes (g = .6373, SE = .1622), cognitive learning (g = .9986, SE = .2936)



## **Results Continued**

- Research designs: two-group pretest-posttest (g = .9784, SE = .3028)
- Wearable types: Head-mounted displays/glasses (g = .7928, SE = .2615).
- Educational environments and learners: K-12 environments (g = .6967, SE = .2233), minors (g = .6919, SE = .2127)
- Strategies: Project-based strategies (g = .7129, SE = .3622).
- Publication bias: Funnel plot, trim and fill procedure, fail-safe N

## **Discussion, Implications, & Limitations**

- · Effect sizes and research designs
- Wearable types
- · Educational environments and strategies
- Research rigor and publication date range
- Theoretical foundations for strategies

