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ACTIVELEARN

Fuzzy concepts and large literature corpi: Addressing methodological challenges in systematic reviews.

KATJA BUNTINS, MELISSA BOND, SVENJA BEDENLIER, MICHAEL KERRES & OLAF ZAWACKI-RICHTER

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Theoretical Background

Assumption

The use of learning technologies does not necessarily make learning more successful

(Tamim et al., 2011)

However: Learning technologies have the potential to make teaching and learning processes *different and more intensive* (Kerres, 2013)

Theoretical Background

Several systematic reviews analyze the impact of a specific educational technology tool or didactic approach on learning outcomes or student engagement, e.g.:

- the influence of virtual reality-based instruction within different learning environments (Merchant et al., 2014)
- the influence of flipped classroom in nursing education (Betihavas, Bridgman, Kornhaber & Cross, 2016) or engineering education (Karabulut-Ilgu, Cherrez & Jahren, 2018)
- the effect of podcasts on learning in higher education (McLoughlin & Lee, 2007)
- the effect of serious games in medical education and surgical skills training (Graafland & Schijven, 2012)

The studies explore very specific conditions

Scientist–Practitioner Gap

However, practitioners have to implement the learning environments that are conducive to their pedagogical goals

(Kerres, 2018)

These kind of studies do not help to select the optimal design for learning goals

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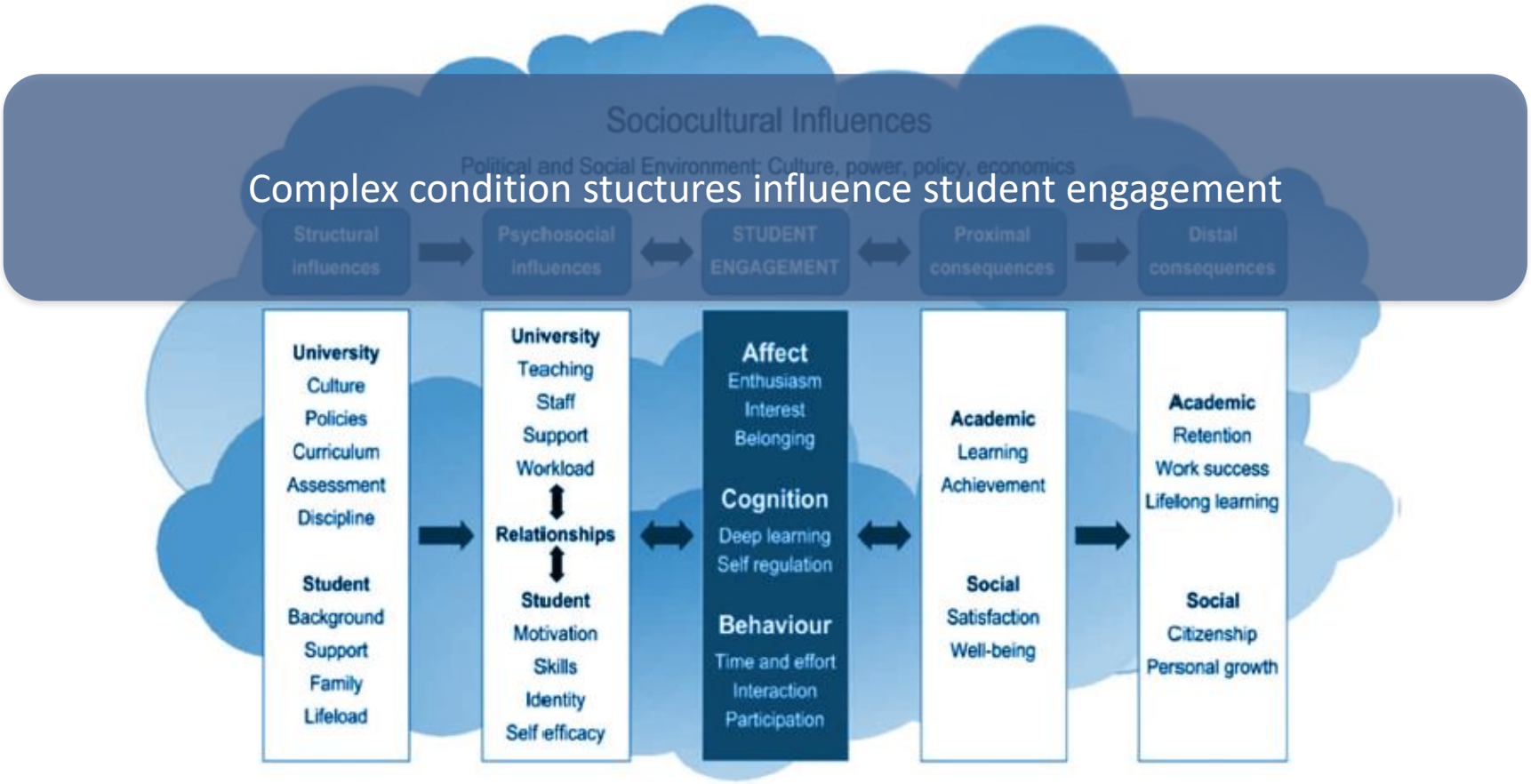
Fuzzy Concepts

Research question

Under which *conditions* does *educational technology* support *student engagement* in *higher education*?

Fuzzy concepts in the research question

Under ***which conditions*** does *educational technology* support *student engagement* in *higher education*?



Model of student engagement (Kahu, 2013)

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Facets of positive student engagement

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Affective	Cognitive	Behavioural	Agentic
Enthusiasm	Deep learning	Time on task/staying on task/ Persistence	Proactive contribution
Interest	Self-regulation Stay on task/focus	Participation/Interaction/ Involvement	Enriching learning activity
Sense of belonging	Learning goals	Positive conduct / following rules	Students personalising lessons
Positive attitude about learning	Investment in learning	Effort	
Positive interactions with peers, teachers	Positive self-perceptions and self-efficacy	Concentration	
Values learning	Operational reasoning	Attention/Focus	
Sense of connectedness	Preference for challenging tasks	Attendance	
Pride	Positive perceptions of teacher support	Study habits	
Satisfaction	Follow-through/care	Homework/assignment completion	
Vitality/Zest	Purposeful	Action/initiation	
Excitement	Thoroughness	Attempting	

(Kahu, 2013; Filsecker & Kerres, 2014; Appleton, Christenson, & Furlong, 2008; Fredricks, Blumenfeld, & Paris, 2004; Mahatmya, Lohman, Matjasko, & Feldman Farb, 2012; Reeve, 2012; Reeve, 2013; Skinner & Pitzer, 2012)

Facets of student disengagement

Affective	Cognitive	Behavioural
Boredom	Aimless	Procrastination
Disinterest	Helpless	Giving up
Frustration	Resigned	Restlessness
Anger	Unwilling	Half-hearted
Sadness	Opposition	Unfocused/inattentive
Worry/anxiety	Avoidance	Distracted
Shame	Apathy	Mentally withdrawn
Self-blame	Hopeless	Burned out/exhausted
	Pressured	Unprepared
		Absent
		Poor conduct
		Task incompletion

(Skinner & Pitzer, 2012; Martin, 2012)

Research questions

Arising from our systematic review, two unusual methodological challenges have been encountered so far:

1. How to plan a systematic review when the constructs of interest are fuzzy?
2. What options are there to deal with a large article population?

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Dealing with fuzzy concepts

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comprehensive search strategy

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Topic and cluster	Search terms
student	learner* OR student*
higher education	“higher education” OR universit* OR college* OR undergrad* OR graduate OR postgrad* NOT ("K-12" OR kindergarten* OR "corporate training*" OR "professional training*" OR "primary school*" OR "middle school*" OR “vocational education” OR “adult education”)
Educational technology	“educational technolog*” OR “learning technolog*” OR “digital technolog*” OR “digital media”
Tools	“social media” OR “social network*” OR “social web” OR vodcast* OR podcast* OR “digital broadcasting” OR blog* OR weblog* OR “electronic publishing” OR microblog* OR “interactive whiteboard*” OR simulation* OR forum* OR "computer-mediated communication” OR “computer * network*” OR ePortfolio OR e-Portfolio OR eAssessment OR e-Assessment OR “computer-based testing” OR “computer-assisted testing” OR OER OR “open educational resource*” OR “open access” OR “open source*” OR “information and communication technolog*” OR “information technolog*” OR “social tagging” OR tablet* OR “handheld device*” OR “mobile device*” OR "smart*phone*" OR “electronic book*” OR eBook*
Internet	“Web 2.0” OR “user-generated content” OR “cyber space”
Learning environments	“virtual classroom*” OR “personal learning environment*” OR “virtual learning environment” OR “virtual reality” OR “augmented reality” OR “learning management system*”
Computer	“computer-based learning” OR “computer-based instruction” OR “computer-supported learning” OR “computer-supported collaborative learning” OR “computer-supported cooperative learning” OR “computer-supported cooperative work” OR “computer-mediated learning” OR “computer-assisted instruction” OR “computer-assisted language learning”
Web	“web-enhanced learning” OR “web-enhanced instruction” OR “web-based training*” OR “web-based instruction” OR MOOC OR “massive open online course*” OR “online instruction” OR “online education”
Technology	“technology-enhanced learning” OR “technology-mediated learning”
Mobile	“mobile learning” OR "m-Learning" OR "mLearning" OR “mobile communication system*” OR “mobile-assisted language learning” OR “mobile computing”
E-Learning	"eLearning" OR "e-Learning" OR “electronic learning” OR “online learning”
Mode of delivery	“distance education” OR “blended learning” OR “virtual universit*” OR “open education” OR “online course*” OR “distance learning” OR “collaborative learning” OR “cooperative learning” OR “game-based learning”

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comprehensive search strategy

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No student engagement in the search strategy

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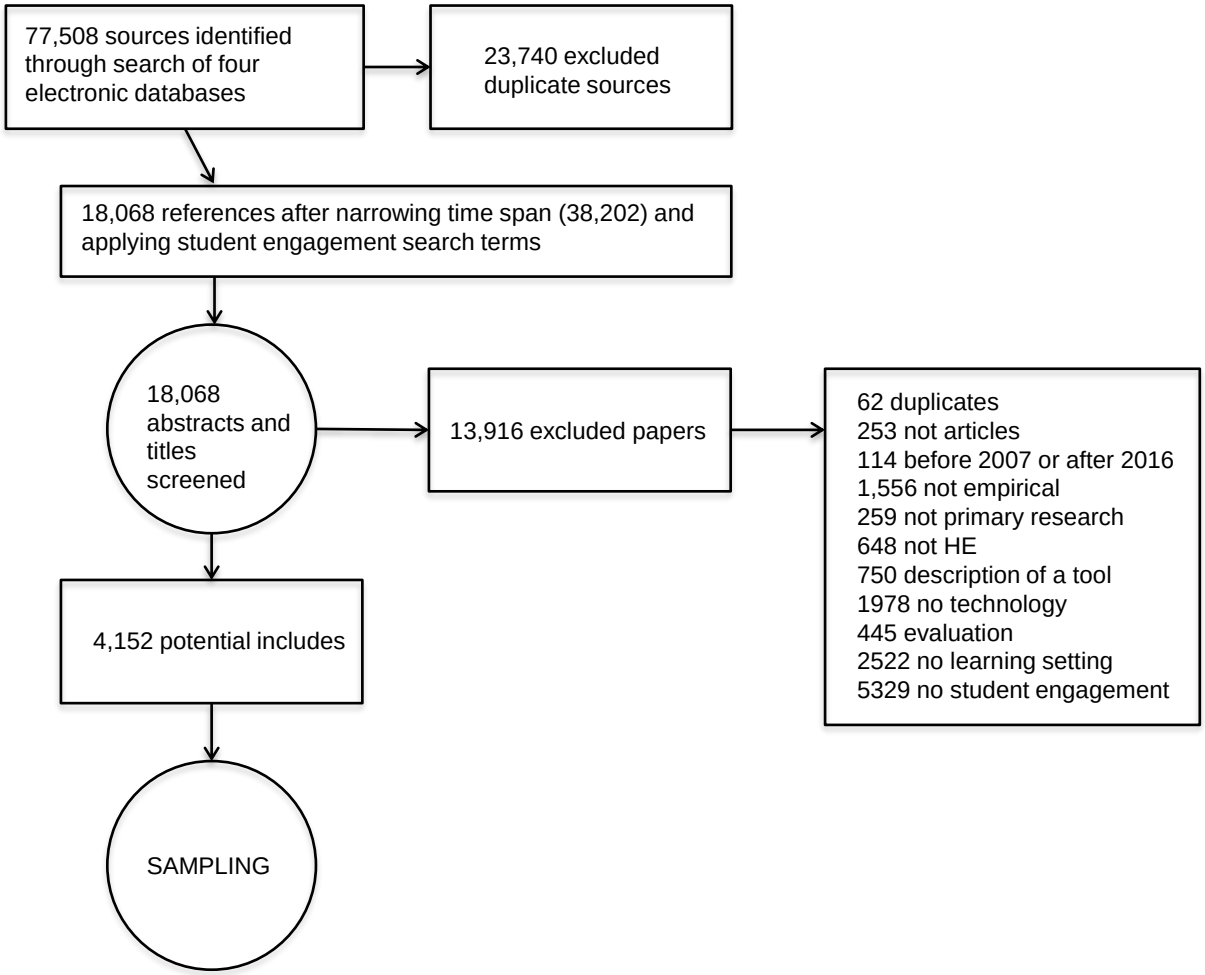
Prisma



PRISMA diagram (slightly modified after Brunton & Thomas, 2012, p. 86; Moher et al., 2009, p. 8)

Limited to:	**Database:**
• English-language	1. Web of Science
• Journal articles	2. ERIC
• Published between 2007-2016	3. Scopus
	4. PsycINFO

Total article number: 38,202 articles

The 38,202 were then searched using facets of student engagement.
18,068 articles were then screened on title and abstract.

we compared our abstract screening results with three raters → interrater reliabilty: k=.95
All unclear abstracts werde discussed in group
a population of 4,152 articles to screen on full were left

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Dealing with a large article population

Sample size estimation

2 different standard methods in sample size estimation (Maxwell, Kelley & Rausch, 2008)

- Power analytic perspective (Cohen, 1988; Murphy & Myors, 2004; Friston, Holmes & Worsley, 1999)
- accuracy in parameter estimation perspective (AIPE) (Hahn & Meeker, 1991, Kupper & Hafner, 1989)

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- Confidence level: 95%
- Confidence interval: 5%
- Percentage: .5

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→Sample size estimantion with R-Package MBESS (Kelley, Lai, Lai & Suggets, 2018)**: 351 articles * 2**

Stratified sampling by year

Validation

Explorative

351 articles, large coding set, creating hypothesis

Confirmatory

351 articles, limited coding set, validating hypothesis, specify the deviation, validation the method

The two subsamplings were parallelized by matching the cases according to the nearest Chi² distance

Matching variables are: Method (quantiative, qualitative, mixed, Journal (learning or field journal), pages (categorized), number of citations (categorized)

Problems

- The concepts are still fuzzy in detail.
- We have to resample a lot of articles – this iterative process needs a lot of time
- The studies are very heterogenous, maybe not enough evidence for subgroup analysis

Discussion

- Systematic reviews must be able to handle larger issues to be relevant in praxis
- So many problems arise due to the scope of the topic and the literature
- It is neceesary to refine the research in this area
- Our approach is a learning by doing task

Systematic Review

Systematic Review:

- a method to synthesize knowledge from a body of research
- a sophisticated methodology
- to deliver new insights and research knowledge

meta-analysis in Edu Tech research

- are restricted to identify positive / negative effects
- do not provide insights into the components of successful learning
- do not help in designing new learning environments

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Thank you

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For further questions, remarks and ideas:

Katja Buntins
katja.buntins@uni-due.de

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