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Selected Issues II
Major Information Systems

Benefits of Augmented Reality in Educational Environments

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1. Introduction

1.1 Problem Statement

I cite.[1]

And again.[2] Or again the first footnote.[1]

1.2 Objectives

1.3 Definition of "Augmented Reality"

1.4 Augmented Reality in Educational Environments

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1 Chang et al. (2014)

2 Dünser et al. (2012)

2. Research Approach

We applied a two-step research approach, whereby we first conducted a systematic literature review to identify relevant publications before analysing the identified publications for the coding of benefits and directions. After coding, we grouped all found benefits.

2.1 Systematic Literature Review

For the identification of papers addressing Augmented Reality in educational environments, we applied a systematic online literature database search. We included databases which were specialised on more information systems centered papers, namely Institute of Electrical and Electronic Engineers (IEEE) Xplore Digital Library, ProQuest (ABI / INFORM), Association for Information Systems Electronic Library (AISel) and Association for Computing Machinery (ACM) Digital Library, as well as more general databases, namely EBSCO Host and ScienceDirect.

To find relevant papers, we searched within all databases with on the following attributes: title, abstract and author supplied keywords. Within these keywords we had three mandatory groups of keywords. Every article had to include the keyword "Augmented Reality". Additionally, every article needed to have at least one synonym for education and benefits. Namely we searched for "Educat*", "Learn*", "Teach*", "College" or "School" as synonyms for education and "Benefi*", "Advan*", "Improv*", "Enhanc*", "Driver*" or "Value*" as synonyms for benefits. To deal with the limitations of some databases, we had to split our query and conduct multiple queries on the database and merge them together by hand.

This database query resulted in a total of 600 articles. Those results then were checked against our include- and exclude-criteria, which are listed in Tab. 2-1, and were coded into one of the five directions. This process was performed by ourselves and each article was read by two of the authors.

After merging our results, a total of 63 articles remained. Those articles were then read again in full, each one by two of the authors and further checked against our include- and exclude-criteria. Also we refined our mappings into the different directions and selected the different benefits found in the articles.

Finally, 25 articles remained in compliance with our include- and exclude criteria.

Include Criteria	Exclude Criteria
Empirical works	theoretical works, grey literature, dissertations
A teaching problem is solved with the help of Augmented Reality or a teaching concept is improved by Augmented Reality	untried or untested technologies, concepts without empirical evidence
Lists positive effects of the application of Augmented Reality	No control-group or control-scenario provided, no comparison without Augmented Reality applications
Human learning	Machine learning
English language	Other language
Peer-reviewed	not peer-reviewed

Tab. 2-1: Include- and Exclude-Criteria

2.2 Data Analysis

3. Findings

3.1 Benefits of Augmented Reality

3.1.1 State of Mind

3.1.1.1 Increased Motivation

3.1.1.2 Increased Attention

3.1.1.3 Increased Concentration

3.1.1.4 Increased Satisfaction

3.1.2 Teaching Concepts

3.1.2.1 Student Centered Learning

3.1.2.2 Improved Collaborative Learning

3.1.3 Presentation

3.1.3.1 Increased Details

3.1.3.2 Easy Accessible Information

3.1.3.3 Interactivity

3.1.4 Learning Type

3.1.4.1 Improved Learning Curve

3.1.4.2 Increased Creativity

3.1.5 Content Understanding

3.1.5.1 Development of Spacial Abilities

3.1.5.2 Improved Memory

3.1.6 Reduced Cost

3.2 Mapping of the Benefits to the „Five Directions“

3.2.1 Discovery-based Learning

3.2.2 Objects Modeling

3.2.3 AR Books

3.2.4 Skills Training

3.2.5 AR Gaming

		Discovery-based Learning	Object Modelling	AR Books	Skills Training	AR Gaming	Sums
State of Mind	Increased Motivation	7	4	2	1	1	15
	Increased Attention	2	0	1	0	0	3
	Increased Concentration	2	0	0	0	1	3
	Increased Satisfaction	1	2	0	1	1	5
Teaching Concepts	Student Centered Learning	2	0	1	0	0	3
	Improved Collective Learning	1	2	0	0	0	3
Presentation	Increased Details	0	0	0	1	0	1
	Easy Accessible Information	0	0	0	1	1	2
	Interactivity	1	0	1	0	0	2
Learning Types	Improved Learning Curve	6	4	1	6	1	18
	Increased Creativity	2	0	1	0	0	3
Reduced Costs	Reduced Costs	0	1	0	1	0	2
Content Understanding	Development of Spatial Abilities	0	2	1	1	0	4
	Improved Memory	1	1	0	2	0	3

Tab. 3-1: Mapping of Benefits and Directions

4. Discussion

5. Conclusion

Bibliography

Chang et al. (2014)

Chang, K.-E., Chang, C.-T., Hou, H.-T., Sung, Y.-T., Chao, H.-L., Lee, C.-M. (2014): Development and Behavioral Pattern Analysis of a Mobile Guide System with Augmented Reality for Painting Appreciation Instruction in an Art Museum. In: Computers & Education. Jg. 71, pp. 185–197

Dünser et al. (2012)

Dünser, A., Walker, L., Horner, H., Bentall, D. (2012): Creating Interactive Physics Education Books with Augmented Reality. In: Proceedings of the 24th Australian Computer-Human Interaction Conference. Melbourne, Victoria, Australia, Nov. 26–30, 2012, pp. 107–114