

Phil Diegmann, Manuel Schmidt-Kraeplin, Sven van de Eynden

Selected Issues II
Major Information Systems

**Benefits of Augmented Reality in Educational
Environments**

Dr. Dirk Basten

Köln, Juni 2014

Table of Contents

Index of Abbreviations	III
Index of Tables	IV
Index of Illustrations	V
1. Introduction	1
1.1 Problem Statement.....	1
1.2 Objectives	1
1.3 Definition of "Augmented Reality"	1
1.4 Augmented Reality in Educational Environments.....	1
2. Research Approach	2
2.1 Systematic Literature Review	2
2.2 Data Analysis	2
3. Findings	3
3.1 Benefits of Augmented Reality	3
3.1.1 State of Mind.....	3
3.1.2 Teaching Concepts.....	3
3.1.3 Presentation	3
3.1.4 Learning Type	3
3.1.5 Content Understanding	3
3.1.6 Reduced Cost	4
3.2 Mapping of the Benefits to the „Five Directions“	5
3.2.1 Discovery-based Learning	5
3.2.2 Objects Modeling	5
3.2.3 AR Books	5
3.2.4 Skills Training.....	5
3.2.5 AR Gaming	5
4. Discussion.....	7
5. Conclusion.....	8
Bibliography	9

Index of Abbreviations

Index of Tables

Tab. 3-1: Mapping of Benefits and Directions.....	6
---	---

Index of Illustrations

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

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 lead to a total of 600 results. Those results then were checked against our include- and exclude-criteria 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.

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