online
Heidelberg Journal of Religions on the Internet
Institute for Religious Studies - University of Heidelberg

Simone Heidbrink, Tobias Knoll (Eds.)

Religion to Go!

Religion in Mobile Internet Environments, Mobile Apps, Augmented Realities and the In-Betweens

Special Issue

Volume 12 (2017)

HEIDELBERG
UNIVERSITY PUBLISHING

Table of Contents

Online – Heidelberg Journal of Religions on the Internet, Volume 12 (2017)

As an open-access journal, *Online – Heidelberg Journal of Religions on the Internet* can be permanently accessed free of charge from the website of HEIDELBERG UNIVERSITY PUBLISHING (http://heiup.uni-heidelberg.de).

ISSN 1861-5813

Contributors to this Issue:
Christiane Altmann
Sonja Gabriel
Mari Huotari
Essi Ikonen
Joshua L. Mann
Ilona Nord
Jens Palkowitsch-Kühl
Theo Zijderveld

Learning with tablets in a church

Experiences of augmented reality in religious education

Mari Huotari & Essi Ikonen

Abstract

The research of AR –technology in learning has indicated promising results, such as increased content understanding and student motivation. However, difficulties are reported as well, for example attention tunneling and usability difficulties. (for a review, see Radu 2014) Religious buildings offer a rich and authentic environment for learning about religion and understanding the surrounding culture. In an experiment with elementary school pupils (age 11-12) we wanted to explore the possibilities of augmented reality in creating a holistic learning environment in a church. Augmented reality proved a versatile tool for learning about church, biblical texts and doctrinal contents as well as learning of 21st century skills. The experiment also pinpointed challenges that need to be taken into account when designing augmented reality learning environments in a church.

Keywords

religious education, augmented reality, authentic learning environment

1 Introduction

In this paper, we describe our experiences of augmented reality (AR) in religious education in light of previous research and the Finnish National Core Curriculum for Basic Education (2014). In an experiment with primary school pupils (age 11-12) from different parts of Finland, AR was used to create a holistic learning environment in a Lutheran church.

The original idea grew out from the challenge to renew the pedagogy behind "The Bible Quiz" (Finnish *Raamattuvisa*), a nationwide competition for schools aimed to deepen pupil's knowledge of the Bible. We were asked to update the quiz to support various *21st century skills* and

competences emphasized in the curriculum, such as thinking skills, team work skills and ICT competence. Our first reaction was "how on earth are we going to do that with a quiz?"

Problem solving and authentic learning environments are emphasized in the Finnish curriculum. (Finnish National Board of Education 2014, pp 30-31) Churches are part of the national and local cultural heritage in Finland. In addition, they are authentic and holistic learning environments for learning about Christianity. (Ikonen 2016) In order to integrate learning of skills and competences to learning of Bible stories, we designed a church adventure, where the questions were hidden in a church with the help of AR technology. The participants used tablets and the AR application 'Aurasma' to view questions that were in a digital form. In order to proceed, the participants had to solve puzzles and church-related hints, navigate in the church, find new information and co-operate with their team. They were allowed to use technology, internet and other resources throughout the experiment.

The previous research of AR in education has indicated some promising results, mainly in increasing student motivation and engagement. (Freitas & Campos 2008, Karamouzis & Keffalas 2016, Salmi et al. 2016) In educational use, AR has been used to design similar activities to ours in which participants collaborate to solve problems in authentic real-world locations. (Klopfer 2008) Working in an authentic environment with the help of AR seemed to have a positive effect on pupil engagement also according to our experiment. The added value of AR was that we were able to enhance problem solving and use the church building more diversely.

The Council of Europe (2008a) has recommended schools to establish connections to local religious communities. However, collaboration, e.g. visits to religious buildings, should meet the educational goals of the school. At the same time, communities' expectations about appropriate behavior should be respected. (Jackson 2014) Pupils should be educated about the space they are visiting and given tools to understand religion. Communities have different perceptions on what kind of behavior is allowed in their places of worship, e.g. in mosques shoes are taken off and in Orthodox Christian churches visitors are not allowed to go behind the iconostasis. (Ikonen 2016) There is a need for educational practices when organizing these visits.

Based on our experiment we suggest that the use of augmented reality in religious buildings could be one solution for designing authentic learning environments for religious education. AR can be used to create motivating learning activities that support the development of 21st century skills. In addition, it can be used to create learning solutions for different kinds of pupils as it enables the use of whole body and the use of multiple senses in learning. With the help of AR, information on symbols, art and customs concerning the space can be made visible for visitors from schools and elsewhere. However, it is crucial to consider the aims when developing the environment.

2 Augmented Reality in education

Augmented reality (AR) is a technology that allows real and virtual objects co-exist in the same space. Users are able to see the physical world around them at the same time they use AR through special device (smartphone, tablet, headsets). In short, AR can be used to supplement physical reality by adding virtual layers onto physical objects. (Azuma 1997) AR can be used in both mobile and non-mobile devices. During past years, the development of AR has concentrated on development of smartphone and tablet applications. In education AR has been used e.g. for motivation, visualizations and simulations. Most research done in the educational use of AR has focused on AR in science education (Bacca et al. 2014, Radu 2014, Salmi et al. 2016)

The previous research has indicated that AR has potential to improve learning. However, more research is needed on the subject. Positive outcomes of AR in education are noted as follows: increased content understanding, learning spatial structure and function, learning of language associations, retention in long-term memory, improved physical task-performance and increased student motivation. Negative outcomes reported in research were attention tunneling, usability difficulties, ineffective integration in classroom use and learner differences. (for a review, see Bacca et al. 2014 and Radu 2014)

For example, Freitas and Campos (2008) studied SMART, an augmented reality educational system developed for 2nd grade. The system enabled pupils to observe and manipulate 3D virtual models while learning concepts such as different animals and means of transportation. The classes were videotaped and the pupils were tested on learning and motivation afterwards. The research obtained some promising results on improving motivation amongst all the pupils and learning results especially amongst poor-achieving students. It was also observed, that the use of AR improved class collaboration and engagement.

Salmi, Thuneberg and Vainikainen (2016) have researched the use of AR in informal science center learning contexts. The participants of their study were 11-13-year-old Finnish pupils visiting science center exhibitions, the same age level as pupils in our experiment. Their research findings suggest that AR in learning is beneficial to all learners, but especially for the lowest-achieving pupils and the girls. In conclusion, they suggest that AR might be a tool for developing new out-of-school learning methods bridging the gap between formal and informal learning, as well as creating beneficial learning solutions for pupils who are below average in traditional school achievement.

In Religious Education AR has been previously researched by Karamouzis & Keffalas (2016) who explored the use of Augmented Reality application Aurasma in the teaching of major world religions and their music. Qualitative research was conducted with a group of 34 Greek primary school pupils aged 11-12, whose curriculum included teaching of major world religions. The pupils

were divided into two groups. First group used AR technology in their study while the other group was taught with more traditional means and materials. Based on the results, the use of AR can support deeper and more engaging learning, thus strengthening the learning process. (Karamouzis & Keffalas 2016)

In his book *Augmented learning: Research and Design of Mobile Educational Games* Eric Klopfer (2008) discusses mobile games utilizing AR as a tool for promoting 21st century skills. He focuses on games and applications in which participants move on real-world locations following storylines and seeking for information that is augmented onto physical spaces. According to Klopfer, this kind of activities have several advantages for learning. They make learning of knowledge and contents more meaningful for learners by connecting information to real world environment and offering authentic experiences. With mobile technology, it is possible to integrate various real-life tools into problem-solving. In addition, he sees the use of whole body in learning activities enabled by mobile technology as crucial. (Klopfer 2008)

3 The experiment

The latest National Core Curriculum for Basic Education in Finland is based on the idea of pupils as active actors in their own learning who learn to set goals and to solve problems both independently and together. Learning is seen to take place "in interaction with other pupils, the teachers and other adults in various communities and learning environments". (Finnish National Board of Education 2014, p 17)

Transversal competence highlighted in curriculum overlaps the concept of 21st century skills. Transversal competence refers to set of "knowledge, skills values, attitudes and will" that builds the foundation of the pupil's learning in all traditional school subjects. In the curriculum, transversal competence is divided into seven areas that are interconnected. Together, they have a joint objective: to support the pupil's growth as a human being and in the membership of a democratic society. (National Board of Education 2014, p 21)

Transversal competence areas
T1: Thinking and learning to learn
T2: Cultural competence, interaction and self-expression
T3: Taking care of oneself and managing daily life
T4: Multiliteracy
T5: ICT Competence
T6: Working life competence and entrepreneurship
T7: Participation, involvement and building a sustainable future

The Finnish National Core Curriculum for Basic Education 2014

Both transversal competence and 21st century skills refer to ambiguous set of complex abilities that students need in order to succeed and flourish in the modern world. Pedagogical paradigms of constructivism, socio-cultural learning and situated learning are apparent. Situated learning, building on constructivism and sociocultural theory, emphasizes learning as a social phenomenon that takes place in communities of practice in real-world settings. (Lave & Wenger 1991) Hence, learning is seen based on actions we take and problems we encounter in social and authentic situations and environments.

Information and communication technology is defined as a key part of learning environments in the Finnish curriculum; it is both an object and a tool of learning. (National Board of Education 2014, pp 24, 31) As a part of learning environments, ICT can be used to foster the learning of transversal competence and important life skills. It is important to consider the pedagogical aims when developing and implementing ICT in learning environments. (Huotari 2016)

In the experiment we decided to focus on following skills and competences: thinking skills (especially problem solving and information seeking); cultural competence and religious literacy; multiliteracy (especially ability to read pictures and symbols); ICT competence and team-work, social skills and working life skills.

In order to integrate learning of skills and competences to learning of Bible stories we designed a church adventure, where the questions were hidden in the church with Aurasma's image recognition. Aurasma is a free AR application available for both iOS and Android operating systems. It was chosen for the experiment as it works also offline (the internet connection was weak due to the thick walls of the church) and allows users to create and share their own content (we wanted to give teachers and pupils a tool to create their own environments after the competition).

In order to find the questions, participants had to solve puzzles and church-related hints, navigate in the church based on the information as well as co-operate with their team. When the teams found the right trigger – such as the altarpiece or the crucifix – the questions came visible in their tablet computers.

Religious buildings – churches, synagogues, mosques, temples – with their religious objects, symbols, art and architecture hold many kinds of information about religion as well as about the surrounding culture. As churches are designed to reflect the dogma of Christianity and the contents of Bible, it was easy to build a learning environment where the pupils were able to use all their senses and had to combine information from different sources. For instance, the hint leading to the altarpiece was related to the Bible story of the Last Supper. After finding their way to the altarpiece – in this church a carved wood work depicting local working class people on the communion – they found a question related to the content and meaning of the communion.

The learning of skills and competences was designed as the following:

ICT competence	The use of Aurasma Taking pictures with a mobile phone Seeking information on the web Communication
Thinking skills	Combining, comparing and contrasting information from various sources Problem solving and making deductions based on the different kinds of information
Cultural competence	Recognizing and interpreting cultural art, symbols and traditions attached to Christianity
Multiliteracy	Reading and interpreting art and symbols in the church Comparing different types of information (text, pictures, symbols, spoken words, spatial information) Making deductions based on these different types of information
Team-work, social skills and working life skills	Collaboration in a group Adjusting in roles Communication Consulting experts Keeping time and organizing working

As the time was limited (75 minutes), groups had to deliver tasks. For instance one of them was using the tablet and the other one the mobile phone, the third one wrote down the answers. They also had to consult professionals in the church, e.g. to have a conversation with the priest in order to find out about the dogma of afterlife.

The participants were 5th and 6th graders, aged between 11 and 13. They worked in the groups of three pupils. Each group had a tablet and a mobile phone. In addition, they were allowed to have a Bible and their own notes with them. Groups were allowed to use their devices in any manner they wished. Some groups had a support team at home and at some points they called the team and asked them to find out something they needed to know.

Participants were also advised for the use of augmented reality before the experiment. They were given a video – tutorial about how to use Aurasma and what they are supposed to do in the church. In addition, before the competition started, the tutors made sure that every group knows how to use the device and Aurasma. During the competition the tutors helped the groups if they had problems with technology, but did not help them in solving the puzzles and the answering the questions.

To prepare, participants had studied the given Bible text and some background materials related to the Bible texts and the church building before they entered the experiment. Since it was a competition with a remarkable prize – 1000 euros for the winner – the participants were highly motivated to succeed.

4 Discussion

In the research of Augmented Reality in education, AR is often linked with improving student motivation and engagement in learning activities. Motivation and engagement was highly visible in our experiment as well. Participants found searching for clues “cool” and all the groups were able to finish the given tasks.

The use of technology was easy to all participants. Pupils did not need adult help for using tablets or smartphones, scanning trigger images with Aurasma or seeking information on the web. It was remarkable that they even made their own innovations with the technology, e.g. taking screenshots of the hints and questions that became visible while using Aurasma. That was something we adult organizers had not even thought of while instructing participants before the experiment. Based on our experiment, a mobile adventure like this seems like a natural way to integrate various tools and technologies in learning.

These pupils succeeded quite well also in tasks requiring multiliteracy. For example, all teams succeeded in applying the Bible text to interpret the art pieces in the church. With regard to thinking skills we observed variation among the teams. The aim of the church adventure was not to memorize the materials studied beforehand, but to apply the knowledge to solve problems. To some groups this was challenging in the beginning. They were able to find the hidden tasks in the church, but putting the pieces together in order to proceed was more difficult. This pinpoints the need for learning solutions and environments in which pupils can practice thinking skills, multiliteracy and other higher skills important in modern life.

We did not observe any attention tunneling, perhaps due to the design of the learning environment – pupils were supposed to look and move around as well as co-operate in order to

solve the tasks. However, some difficulties in concentration were observed. Especially in the beginning some teams were so excited that they hurried forgetting some crucial steps.

Working in an authentic environment seemed to be inspiring and exciting for the pupils. When the whole space was a potential source of information, the pupils were alert and attentive to what was present. Of course, as they were after certain information, this channeled their attention to the objects and locations where they could observe something related to their goal. The role of AR in our experiment was very similar to activities described by Klopfer in his book (2008): the participants moved in a real-world location and worked as teams in order to solve problems augmented onto physical objects. According to Klopfer, activities like these make learning more meaningful for learners, as they connect contents and knowledge to real world environments and offer authentic experiences. (Klopfer 2008)

It has to be noted that in this experiment the pupils were highly motivated and well-prepared for the experiment. They had been working on the contents –both the Bible texts and the acquisition of the skills needed - for about four months and they had been selected to this final phase through two preliminary rounds. Their cognitive skills were above the average. Hence, deductions for the average class and ordinary lessons must be avoided.

However, some general observations and lessons learned can be drawn from this experiment. According to our experience, the most crucial things when designing AR learning environments are the same as when designing any learning environment. One needs to consider carefully what are the learning contents and competences the environment is supposed to promote and how the different elements in the environment work for promoting or hindering these aims. Careful and simple enough instruction is crucial as well as making the aims clear for the participants.

The added value of AR in this experiment was that we were able to enhance problem solving and use the church building more effectively. Without AR we could not have used for example the altar piece or the organ balcony as locations for the questions. In addition, the environment could be amended with music, pictures, videos etc. without leaving visible marks onto the objects. With the help of technology, church space can also be made more accessible, e.g. by offering virtual content of the places that are difficult or forbidden to access.

5 Summary

To sum up, our experiment suggests that the use of augmented reality in religious buildings could be one solution for designing authentic learning environments for religious education. It can be used to create motivating learning activities that support the development of skills and

competencies needed in the 21st century. In addition, it can be used to create learning solutions for different kinds of pupils as it enables the use of whole body and the use of multiple senses in learning. With the help of AR, information of symbols, art and customs concerning the space can be made visible for visitors from schools and elsewhere. In order to increase motivation by gamification of learning, AR can add value especially in environments – such as church – where it is not possible to enter every part the environment. However, it is crucial to consider the aims when developing the environment. Some aims – such as exploring silence, the sacred or one's personal relation to the church building - may be achieved better without using AR.

In future, we are planning to continue the design and research of AR learning environments in churches and other places of worship. More detailed research on the user experiences of both pupils and teachers is needed to form a clearer picture of the educational value of these learning environments. In addition, the possibilities of AR in widening learning environments outside buildings – to places such as cemeteries and places of worship in the nature, remain an interesting research topic.

Bibliography

Azuma, RT 1997 ‘A Survey of Augmented Reality’, Presence: Teleoperators and Virtual Environments, vol 6, no. 4, pp. 355-385.

Bacca, J, Baldris, S, Fabregat, R, Graf, S & Kinshuk 2014 ‘Augmented reality trends in education: A systematic review of research and applications’, Education Technology & Society, vol. 17, no.4, pp. 133-149.

Finnish National Board of Education 2014, *National Core Curriculum for Basic Education*, National Board of Education. Helsinki, Finland.

Freitas, R & Campos, P 2008 ‘SMART: A system of Augmented Reality for teaching 2nd grade students’, *People and Computers XXII, Culture, Creativity, Interaction*, *volume 2*, proceedings of HCI 2008 The 22nd British HCI Group Annual Conference, Liverpool John Moores University, UK, 1 - 5 September 2008, Swinton, UK, pp. 27-30.

Huotari, M 2016 ‘Kohti taitolähtöistä uskonnonopetusta – tieto ja viestintäteknologinen osaaminen osana koulujen uskonnonopetusta’[Towards competence-based religious education – ICT competence as part of school religious education], in P Iivonen & V Paulanto (edit.), *Uudistuva uskonnon opetus,* Kirjapaja, Helsinki.

Ikonen, E 2016 ‘Kirkkotila oppimisympäristönä’ [Church space as a learning environment], in P Iivonen & V Paulanto (edit.), *Uudistuva uskonnon opetus,* Kirjapaja, Helsinki.

Jackson, R 2014, *Signposts – Policy and practice for teaching about religions and non-religious world views in intercultural education,* Council of Europe Publishing, Strasbourg, pp. 87-98.

Karamouzis, P & Keffalas, M 2016 'The Design of Educational Materials for Teaching the Most Common Religions to Students in their Final Year of Primary School – A Cross-Curricular Approach of Religious Studies and Music, Through the Use of Augmented Reality', Online – Heidelberg Journal of Religions on the Internet, vol 11, pp. 93-115.

Klopfer, E 2008, *Augmented learning*, MIT press, Cambridge, MA.

Lave, J & Wenger, E 1991, Situated Learning: Legitimate Peripheral Participation, University Press, Cambridge.

Radu, J 2014 'Augmented reality in education: A meta-review and cross-media analysis', Personal and Ubiquitous Computing, vol.18, no. 6, pp. 1533-1543.

Salmi, H, Thuneberg, H & Vainikainen M-P 2016 'Making the invisible observable by Augmented Reality in informal science education context', International Journal of Science Education, Part B, DOI: 10.1080/21548455.2016.1254358.

Biographies

ESSI IKONEN (Mssc.) is a trainer at The Church Training College in Järvenpää and a doctoral student at the University of Helsinki, Faculty of Educational Sciences. She is interested in the interplay between theory and practice and in developing research-based pedagogical models and innovations. Her research interests include the study of morality and subjectivity in education. Her dissertation in progress deals with the concept of authenticity in education.

essi.ikonen@seurakuntaopisto.fi

Th. M MARI HUOTARI is a teacher trainer and a pedagogical consultant at the Church Training College in Finland. Her background is in primary and secondary education, where she has worked as a classroom teacher and as a subject teacher for Religious Education. Her special interests are technology in learning and combining research and practice by developing research-based pedagogical models and innovations.

Mari Huotari
Kouluttaja
uskonnonopetus.fi
mari.huotari@seurakuntaopisto.fi