

A Second Life experiment in sex education with pre-service teachers and its contribution to the development of their proto-TPACK

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Abstract

This paper reports research in Finland into how pre-service teachers' experiences of using Second Life in a course about sex education, and how projections about the use of virtual environments like Second Life in their future teaching at primary level, contributed to the development of their proto-TPACK (Technological Pedagogical and Content Knowledge). Data collected consist of empathy-based stories and reflective discussions. Results suggest that despite challenges with the technology, the pre-service teachers offered insightful reflections on their use of Second Life in learning from the perspective of the different components of the TPACK frame, especially technological knowledge and technological pedagogical knowledge. However, the experience of using Second Life did little to extend their content knowledge (of sex education).

Key words: TPACK, Second Life, Sex Education, Pre-Service Teachers, ICT

Introduction

Recent research suggests that many pre-service teachers find new technological tools easy to use, but lack the expertise to integrate them into their lessons and are sceptical towards their use in education (Sadaf, Newby & Ertmer 2012; Lei 2009; Valtonen T. et al. 2011.; Özcün-Koca, Meagher & Edwards 2009/2010). Polly et al. (2010) stress that rather than learn certain technological skills, pre-service teachers need support in integrating information and communication technology (ICT) into their courses, especially to see exemplary use of advanced technologies like 3D virtual learning environments in authentic classroom situations.

It has been shown that compared to traditional teaching, virtual learning environments can be used as pedagogical tools to provide students with more active, immersive and engaging learning experiences (Cheng 2014). Earlier studies of using virtual learning environments in role play show promising signs of bringing motivation, informal conversation and conceptual richness to learning situations (Gao, Noh & Koehler 2009). In the research reported here, pre-service teachers worked with the virtual learning environment Second Life (SL) in a 'Second Life experiment' investigating the usefulness of Second Life in teaching and learning about sensitive issues in sex education.

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For teacher education, it is important to have insights into how pre-service teachers develop their professional knowledge. The TPACK (technology, pedagogy and content knowledge) framework offers a means of investigating knowledge related to ICT for teaching and learning. TPACK defines teachers' knowledge as the interplay of three different knowledge areas: technology, pedagogy and content (Mishra & Koehler 2006).

Kontkanen et al. (2014) suggest that pre-service teachers do not have TPACK in the sense that working teachers have it since they have not experienced the diversity of ways different pupils may work even with the same technology. What they do bring with them to their studies is so called proto-TPACK which develops and matures during their teacher education and early professional careers. Research has shown that pre-service teachers' development of TPACK is connected with their changing identity from learners to teachers and that integrating technological pedagogical knowledge (TPK), technological content knowledge (TCK) and TPACK into their studies helps them in this shift (Özcün-Koca, Meagher & Edwards 2009/2010). Their own experiences as learners and what they have seen their teachers doing contributing to their so called 'proto-TPACK', (Kontkanen et al. 2014) affects the ways in which they plan and assess learning activities with and without ICT and their subsequent development of a more mature TPACK (Hofer & Harris 2010; Meagher, Özcün-Koca & Edwards 2011; Özcün-Koca, Meagher & Edwards 2009/2010; Polly et al. 2010). In the research reported here, we are interested in how pre-service teachers' experiences of using Second Life contribute to the development of their proto-TPACK. The context of this study is a biology course that uses Second Life as an exemplary platform to explore sensitive topics in sex education through role play, but it should be noted that the focus of the paper is proto-TPACK and that sex education is discussed only in terms of the content element of proto-TPACK.

Theoretical background

The paper is theorised around the knowledge elements of the TPACK components technology, pedagogy and content.

Second Life (technology)

Second Life, launched by Linden Lab in 2003, is an on-line virtual learning environment, in which users can interact and communicate with each other as avatars in a three-dimensional world. Avatars may take any form users choose (human, animal, vegetable, mineral, or a combination thereof). Almost every aspect of an avatar is fully customisable, e.g. voice through 'voice morphing'. They can communicate via local chat, group chat, global instant messaging, and voice (see Second Life n.d.).

These characteristics make Second Life an interesting possibility for learning, especially in collaborative practices, by increasing students' interest, participation and amusement (see Andreas et al. 2010). Warburton (2009) lists several educational activities in Second Life, for example displays and exhibits, role plays and simulations, treasure hunts, quests and creative writing. Research about Second Life in medical and health education mainly reports its use as an information library or place for professionals to practice some medical situations. This research also acknowledges Second Life's potential in student collaboration (see Boulos et al. 2007). Use of Second Life in teacher education and primary education contexts is as yet under-researched.

According to Cheng (2014) active learners mostly value the ease of use and usefulness of Second Life whereas verbal students were mostly satisfied with its communication and identity features. Gao, Noh and

Koehler (2009) found that shy students saw Second Life as an environment where they might better express themselves e.g. while dealing with sensitive topics. Cole and Griffiths (2007) found that many of the 'players' in 3D game-like virtual learning environments would discuss sensitive issues with their online friends, issues they would not necessarily discuss with their real life friends. Second Life's features, like the appearance of an avatar and voice morphing, can keep identities secret and were the reasons it was chosen for this research. Technical challenges identified in previous studies (e.g. Baker, Wentz & Woods 2009), e.g. the need to frequently update software, high capacity requirements for the computer, and also pre-service teachers' skills and attitudes toward new technology, were taken into account and confronted.

Using avatars as a form of role play (pedagogy)

Role play is a form of experiential learning through which transformation of experience creates knowledge (Jarmon et al. 2009). It is also a form of simulation and a creative teaching strategy (O'Sullivan 2011; Feinstein, Man & Corsun 2002). Role play in education requires students to imagine they are either themselves or someone else in certain situations and behave as they feel that person would, and thus learn something about the people involved and the situation (Van Ments 1989).

Gao, Noh and Koehler (2009) compared Second Life and face-to-face interaction and claimed that Second Life offers a more informal environment for conversation in role play, but that non-verbal communication is more constrained. Arvaja et al. (2003) claim that role play in a web-based learning environment affects knowledge construction and sharing and, despite social and contextual features, the level of the web-based messages remains quite low. This might be due to the asynchronous web environment they used.

According to Mäkitalo (2006) 'grounding' is important in collaboration, where participants have to share their understanding, knowledge, beliefs, assumptions and presuppositions before they can collaborate effectively. Grounding is especially important if learners are working at a distance or are unfamiliar with each other (real or imagined).

'Scripts' may be used to encourage collaborative working. Scripts include rules, instructions and tools to support purposeful and productive communication (Dillenbourg 2002). One well-known script is de Bono's 'thinking hats' which uses role play to encourage discussion. In this script, there are six different coloured hats which symbolise different perspectives in the discussion (objective, reflective, creative, evaluative, integrative and emotional). Participants in the discussion take a role or 'hat' and mediate their conversation accordingly (Schellens et al. 2007). In this study we use anonymous avatars in a way that is similar to de Bono's thinking hats.

Sex education (Content)

According to the Finnish national curriculum 2004, sex education ought to begin in childhood and extend throughout life. The aim of sex education is to increase pupils' understanding of sexuality, support their sexual development, and promote a broad understanding of factors related to sexual health. In Finland, sex education is a part of health education in schools. It is mainly provided by teachers and school nurses and ought to be taught in every grade based on the pupils' developmental levels. The content of sex education concentrates on contraception and pregnancy and the prevention and treatment of sexually transmitted diseases (National core curriculum for basic education 2004).

Allen (2008) reported students' experiences of sex education to be clinical, de-eroticized and didactic and called for more content about emotions in relationships, teenage parenthood, and abortion, and how to make sexual activity pleasurable. Previous research (e.g. Goldman 2011; Buston et al. 2002) identified a number of factors that contribute to making sex education a positive experience: clarity of goals; consideration of the age of learners and their cultural backgrounds; grounding of teaching within the theoretical approaches; an adequate amount of time; versatile teaching methods; and well-prepared teachers. Kontula (2010), reporting a study in Finland, noted that teachers who teach attitudes of naturalness and tolerance toward sexuality, speak easily of their own personal life and sexual issues in general, and use various techniques in teaching like drama, role-play and presentations, positively developed students' sexual knowledge.

As a new element in teacher education in Finland, sex education is not well developed, especially its attitudes and values dimensions (National core curriculum for basic education 2004; WHO 2010). Thus sex education is a challenge in teacher education. The integration of ICT into sex education provides new possibilities but also more challenges. Using Second Life in sex education is one way of developing attitudes and values around issues that are sensitive and hard to express and discuss face-to-face.

Reasons for choosing Second Life as an environment for sex education

Second Life was chosen for this study for two reasons. First, sex education is a sensitive topic demanding teaching methods where students feel comfortable about discussing and collaborating i.e. methods like drama and role-play (see Kontula, 2010). In this research, Second Life offered the possibility of creating personal role-play characters, avatars, with changed voices. Second Life with fictional avatars provided an environment where pre-service teachers were able to discuss sensitive issues they would not necessarily discuss in face-to-face situations (c.f. Cole and Griffiths, 2007). Second, Second Life provided pre-service teachers with experiences of learning in 3D environments. Typically, the online learning environments used in Finnish teacher education are learning management systems like Moodle or more developed cloud services like Office365 or Google Apps for Education (GAPE) that are mainly based on textual communication. Second Life provided new experiences of learning and offered pre-service teachers' new ideas about taking advantage of virtual environments that are typically not used for educational purposes.

Research questions

The aim of this research was to investigate pre-service teachers' experiences of using Second Life as a technological tool for discussing sensitive topics in sex education and, in the light of their experiences, explore how they thought Second Life might be used pedagogically in their future teaching. The research questions, which are thus at the interface of technology, pedagogy and content in the TPACK framework were:

- How did the pre-service teachers experience the Second Life environment in their own learning?
- How did the pre-service teachers reflect on their experiences with Second Life and what views did they have about its use in their future teaching?

Building on cumulative responses to these questions, we reflect on the contribution of Second Life to the development of the pre-service teachers' proto-TPACK.

Research subject and materials

Research context and participants

The research was conducted in the spring of 2013 through an optional course 'Pedagogical views of human biology' for second year primary school pre-service teachers (n = 20). The majority of participants were females (n = 15), reflecting the gender distribution in pre-service teacher education in Finland. The age of participants varied from 21 to 31 years. Participants were asked to fill in background questionnaires about their ICT skills before the experiment. They evaluated their general skills of using ICT as moderate (mean = 4.45) (1-6 Likert type statement, 1 = strongly disagree, 6 = strongly agree). Most of them did not know Second Life before the experiment (mean = 1.25) and none of them had used Second Life for studying.

Course design and research design

The sex education experiment in Second Life was one of the course themes and was thus a compulsory part of the course. Permission to collect data for this research was granted by the participants and they had the possibility to decline the use of their data without any consequences to participation in the course and grades. None of the students declined permission to use the data. All in all, pre-service teachers were excited about using Second Life in this new context.

Figure 1 shows the stages involved in making a 'common ground' in this experiment. At the beginning of the course, the lecturer briefed the pre-service teachers on the protocols of working in Second Life (ethicality, equality, responsibility, respect for others etc.) (WHO 2010). Freedom of opinion was to be respected and nobody would be pressured to contribute more than they felt comfortable with. Before the actual experiment in Second Life, there was a lecture on sex education (2h) focusing especially on the teacher's responsibilities. Pre-service teachers' preconceptions and suggestions about the topic were also discussed before the experiment.

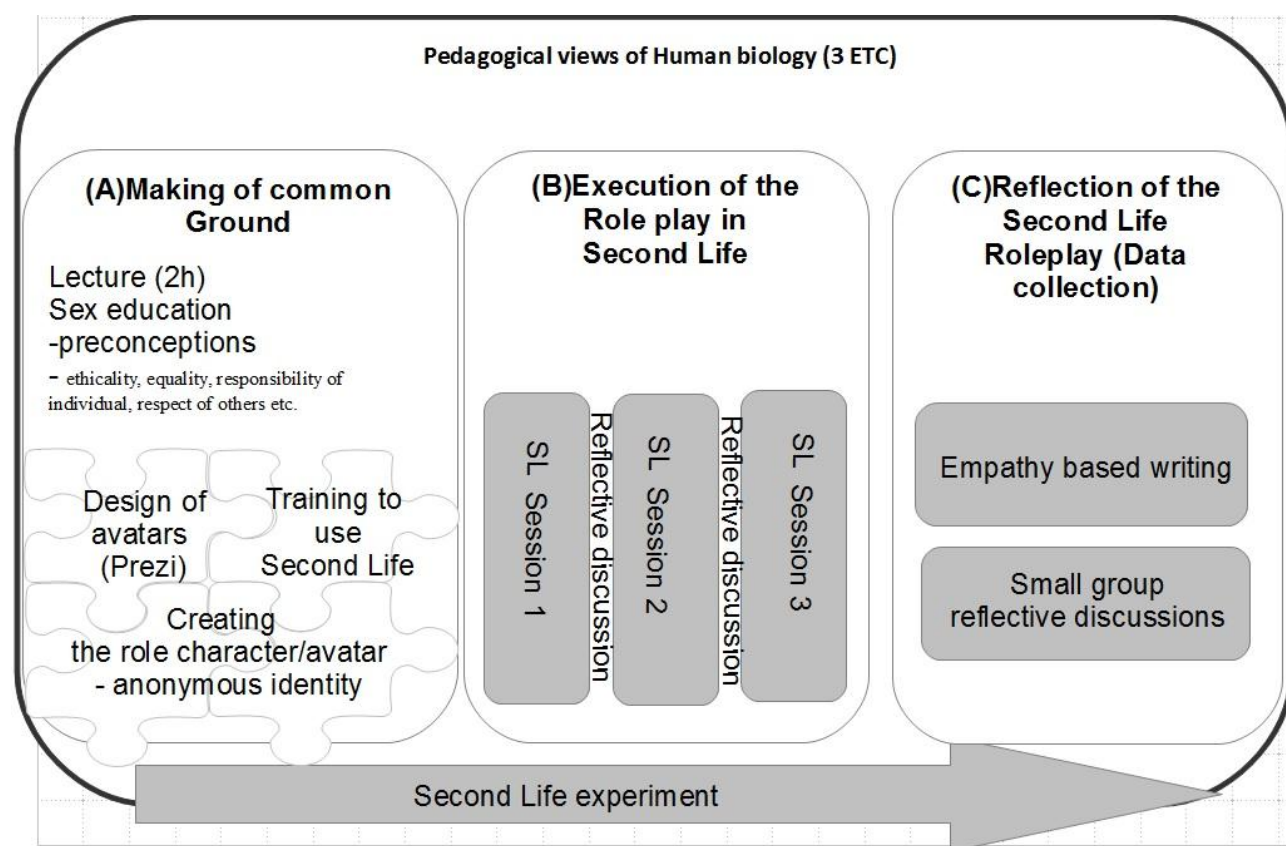


Figure 1. Course design and research design

At the beginning of the experiment pre-service teachers were asked to design a fictional avatar. Instructions were kept to a minimum and they were encouraged to be creative. They established the avatar’s gender, age, family, education, hobbies, religion, occupation, and important values and special skills. They were also asked to think about some kind of medical or sexual problem or issue important to their avatar. In this phase they were encouraged to search for information from different sources about the issue or problem to supplement the content presented in the earlier lecture on sex education. The design of avatars took place in a Prezi environment. Prezi is a cloud based presentation and storytelling tool for exchanging ideas (see Prezi, n.d.). The pre-service teachers wrote short presentation texts about their avatar in Prezi. They were free to add pictures and videos to these presentations. In this phase the course lecturer as well as all pre-service teachers in the course read the presentations in Prezi and got to know them.

All of the pre-service teachers were trained to use Second Life. After the training period, the pre-service teachers created their own avatar in Second Life, modelling its physical features according to their earlier design in Prezi. They were asked not to reveal their avatars to each other. This rule was agreed among all pre-service teachers and they did not reveal their avatars. However, the atmosphere during the course was open and many related topics were discussed face-to-face.

Sessions in Second Life took six hours (see Figure 1, (B) conducting the role play in Second Life). In the first Second Life session pre-service teachers were asked to introduce themselves in the role of their avatar and describe their avatar’s special skills or features. In the second session with Second Life, the avatars talked about their experiences about sex education in schools and homes. In the third session the

avatars talked about their experiences of puberty. The sessions in Second Life were recorded with informed consent. After every session in Second Life there was a short discussion with the pre-service teachers about their feelings or a short written task about the role play situation.

In the experiment, pre-service teachers were equipped with mini-laptop computers and head sets. The Second Life application was installed to all computers.

Data collection and analysis

Data were taken from empathy-based stories and reflective discussions (see Figure 1, (C) reflections of Second Life role play (data collection)). The purpose of these two kinds of data was to introduce triangulation (Creswell 2009) and offer a deeper picture of the experiences of the pre-service teachers.

Empathy-based method

After the Second Life experiment, and in the light of their experiences with Second Life, pre-service teachers wrote short stories around imagined scenarios of teaching with Second Life. This ‘empathy-based method’ involved the participants writing their stories according to instructions and orientation texts created by the researcher (see Eskola 1998). The purpose of the orientation texts was to help participants align with the story they were writing about using Second Life as a pedagogical device for teaching about an aspect of sex education of their choice with a stated age group of pupils (henceforth referred to as the ‘taught module’). The orientation text offered pre-service teachers two contrasting scenarios for their stories, and asked them to write about one of them. The contrasting scenarios were whether the projected outcomes of teaching the module were ‘positive’ or ‘indifferent’. The orientation text given to the pre-service teachers was:

As a teacher you have had a positive/indifferent experience of teaching a module using the Second Life virtual learning environment. What happened and why? Describe pedagogical, technological and content features of the module you ‘taught’.

During the last meeting of the course nine pre-service teachers wrote imagined scenarios with positive experiences and ten wrote imagined scenarios with indifferent experiences.

The nineteen stories (imagined scenarios) were analysed using qualitative theory-guided content analysis (Elo & Kyngäs 2008; Miles & Huberman 1994; Savenye & Robinson 2005), i.e. coding was relative to TPACK components. Analysis proceeded in four phases. First, the stories were read several times in order to gain an overview. Second, they were coded with Atlas-ti 5.2 –software. The unit of analysis was a section of story where the writer described experience concerning one of the TPACK framework knowledge areas; technological knowledge (TK), pedagogical knowledge (PK), content knowledge (CK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), pedagogical content knowledge (PCK) and technological pedagogical content knowledge (TPCK). Third, codes under each knowledge area were grouped into subcategories according to similar content. These subcategories are named using content characteristic words (see figure 2).

Reflective discussions

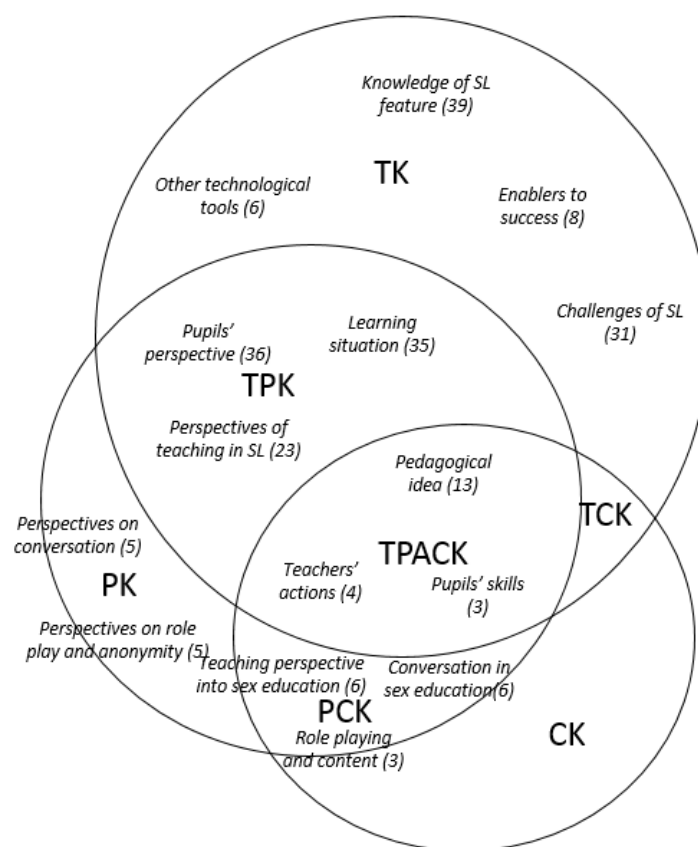
After the Second Life experiment, 16 of the pre-service teachers had reflective discussions in four groups of 3-5 students. They were asked to reflect on their experiences of the course through the following questions:

- What did you learn about Second Life through the experiment? (TPK)
- What did you learn about sex education? (CK)
- What factors supported/did not support your learning? (TPK)
- How could you apply these experiences in future as a teacher? (TPCK)
- How could you utilise role playing in a virtual environment in future as a teacher? (TPK)

The reflective group discussions were recorded and transcribed and analysed in four stages using qualitative theory-guided content analysis (Elo & Kyngäs 2008; Miles & Huberman 1994; Savenye & Robinson 2005) as described above. The unit of analysis was a single comment or a longer discussion concerning one topic.

Results

Data for empathy-based stories and reflective discussions are taken together in reporting results because they contained similar subcategories. In total there were 330 units of analysis. The data did not cover every knowledge area of the TPACK framework even-handedly, but emphasised TK and TPK. In Figure 2 the spread of mentions in the different TPACK knowledge areas is illustrated with circles, where the size of the circle approximates to the number of mentions. Examples of statements made by pre-service teachers have been translated from Finnish and reported with minor grammatical corrections.



Note. Texts in italics are subcategories from data. Numbers in parentheses are frequencies of subcategories.

Figure 2. Relative incidence of subcategories in TPACK knowledge areas

In the next section the results are outlined against the components of the TPACK framework. Positive and indifferent empathy based stories or reflective discussions are mentioned in quotations.

Technological knowledge

In the subcategory 'knowledge of Second Life feature' e.g. avatars as characters, different forms of communication and movement, and voice morphing were mentioned. The technological knowledge required by the teacher was seen as a challenge.

As a teacher, I felt that I was not ready to face and fix the technical problems I confronted; I could not get any help either. (Indifferent story)

In the subcategory 'other technological tools', pre-service teachers compared the Second Life environment with other technologies. Complementary technologies to Second Life (e.g. Smartboard) and an example of a similar virtual environment (Habbo Hotel) were mentioned. In the opinion of some, there were better technologies than Second Life: MinecraftEdu (virtual game environment), Poll everywhere (classroom response system) and Prezi (virtual presentation tool) were mentioned.

Teacher could show pupils different points in the island [in Second Life] with the help of Smartboard. (Positive story)

In the subcategory 'enablers to success', pre-service teachers did not raise technological reasons why teaching specifically with Second Life could be positive, rather they wrote more generally about the equipment e.g. functionality, effectiveness, adequate tools.

Every pupil got personal computer every time when we used Second Life. (Positive story)

Technical devices were up to date and worked well... (Positive story)

In the subcategory 'challenges of Second Life', pre-service teachers focused on technological reasons why teaching with Second Life could be inconvenient. They brought out problems with logging in and Second Life kicking out during use. They also thought it was an old-fashioned application and slow, with clumsy graphics and unclear and uncertain voice morphing. The pre-service teachers also questioned the use of ICT in everyday life and resourcing in schools.

Student 1: And here the Second Life was unbelievable clumsy. I was so surprised how slow and clumsy it was.

Student 2: Mmm

Student 1: ...unbelievable, even though it was pretty rough looking.... You can notice that it was made in 2006 or something. (Group 2)

In addition, they highlighted the need for proper familiarisation of teachers with the technology and the skills needed by teachers to use the technology. In this sense, the experiment increased pre-service teachers' awareness of virtual learning environments in education.

Student1: Well, I learnt that I can use this kind of virtual environment in teaching.

Student2: ... the teacher has to have experience of using it [Second Life] and has to think about every issue that can happen while using it.

Student1: I agree. (Group 3)

Student 1: At least now we have got experience of this kind of possibility and how it should be implemented. Of course, I learned that you have to use more time on [organisational] arrangements... I think everything irrelevant took too much time. (Group 4)

Pedagogical knowledge

In the subcategory 'perspectives on conversation', pre-service teachers pointed out that getting the issue for discussion in advance makes it easier to accommodate it to the avatar and easier to think about getting reluctant pupils to engage in conversation:

Student 1: But there are some who do not speak in the class, they do not speak anywhere else either. So... (Group 3)

Conversation related also to motivation, group size and pupils' roles in groups and to the teacher's role. In the subcategory 'perspectives on role play and anonymity', pre-service teachers pointed out the desire

of the pupils to reveal to each other who is who when using anonymous avatars. They discussed if this type of role play would be more efficient in face-to-face situations.

Content knowledge

In six of the stories bullying was the focus. The content of other stories included: historical context; sex education generally; human internal organs and their functions; elements of human biology that are problematic for pupils; conversation skills; acceptance of differences; sexuality and anxieties connected to it; puberty; ethics; intoxicants; and international tolerance.

Generally in reflective discussions, some pre-service teachers said they did not learn much about sex education, whereas some said they heard about new aspects of sexuality during the experiment and found them interesting.

Technological pedagogical knowledge

The subcategory 'pupils' perspective' describes the ways pre-service teachers saw the pedagogical potential and impediments of Second Life. Pre-service teachers questioned whether the quality and functionality of Second Life meets the expectations of today's pupils and pointed out pupils' preferences for other technologies. Technical problems were connected also to lack of motivation and Second Life was seen as a potential disrupting factor encouraging pupils to do something other than studying. Pre-service teachers indicated the risk of pupils' negative behaviour and their passivity with Second Life.

Some of them went to make adventures around the environment [Second Life generally] with their figures [avatars] rather than participating in the designed learning situation in Second Life. (Indifferent story)

Similarly, Second Life was seen as a rather challenging environment, only pupils in the later classes of primary school were considered to have skills good enough for working in a virtual environment. Although some pupils would be familiar with such environments from their free time, the concern was about their lack of the skills needed and the suitability of Second Life for young pupils.

The second subcategory, 'learning situation' focused on what happens within Second Life learning activities. To teach pupils the technology properly was seen as a key element, recognising also the time required to edit avatars and to practice their functions. Support in getting to know other people's avatars and support in initiating conversation (grounding) were also seen as important. The problems with anonymity and technological difficulties with avatars were mentioned along with alternative ways of dealing with them. Pupils choosing ways to interact with each other and different technological possibilities were seen as positive factors and as ways to collaborate, to create 'team spirit' and rehearse interaction. Scepticism toward Second Life was also evident; pre-service teachers indicated similar problems of conversation and interaction as in live face-to-face situations. Also, in some comments traditional face-to-face learning was preferred to Second Life; many said they would not want to see conversation in Second Life entirely replace or reduce face-to-face conversations in class. Pre-service teachers suggested ways to further develop the pedagogical aspects of Second Life e.g. using one of the pupils or an outsider as a chairperson in a conversation, using permanent groups when studying in Second Life to help pupils to memorize the avatars of others. Having one whole school day in Second Life was also suggested. One pre-service teacher suggested using readymade avatars.

Student 1: But it worked well to have a chairman.

Student 2: Yes.

Student 1: Then the chairman gave the turns and you were supposed to answer something. There was no point to be silent.

Student 3: Mmm.

Student 2: Yes.

Student 3: On the other hand, I think it would be good if the chairman would be some outsider, like the teacher. So it would not be... that when I was a chairman I did not participate in the conversation. (Group 1)

The third subcategory, 'teachers' perspective' focused on skills, choices, possibilities and actions in using Second Life. Teachers' skills for making choices of technology, the ways they use Second Life and take advantage of different actions for different teaching methods like problem solving and for encouraging conversations during learning, were frequently mentioned. One reason for potential 'failure' in the teaching of modules was seen as the teacher's planning and skills with Second Life:

I also use [as a teacher] more time to familiarise myself with the technology to be sure that I have expertise in a case of problems with functionality. (Indifferent story)

Second Life was seen as a challenge of scheduling, with much time and effort needed from teachers and pupils. It was a concern that this kind of work would take too much time from other activities; it needs to be 'worthwhile'. Also there was concern for pupils' safety and teachers' responses to the issues raised and the actions undertaken in Second Life:

During the lesson, totally strange figures [avatars] appeared and started to yell. So, we decided with the other teacher to stop our session [in Second Life]. (Indifferent story)

Overall, pre-service teachers saw the possibilities of using virtual environments for learning. Yet, doubts about using just Second Life and their own capabilities in implementing it were prominent. The need for better technological conditions in schools for implementing this kind of teaching was mentioned.

Technological content knowledge

Mentions indicating technological content knowledge were few. Some pre-service teachers showed knowledge of suitable technological tools with certain content:

...it is possible to introduce historical cities with the help of modern games, because in them ancient cities are modelled very precisely. (Positive story)

Some mentions were about bad functionality of technology, and suggestions about alternative technologies for certain content were given.

I promote using Minecraftedu to learn co-operation skills and build up group work skills. (Indifferent story)

They pointed out that avatars in the Second Life environment should be humans (instead of animals like some cases in the experiment) if they were going to talk about sex education. A few pointed out that the Prezi environment could be used in sex education, particularly in creating avatar figures.

Pedagogical content knowledge

In the subcategory 'conversation in sex education', pre-service teachers pointed out that face-to-face conversation and conversation as a whole is important in sex education. They mentioned the superficiality of the conversations in this experiment and the need to 'warm-up' with easier content. Pupils' thoughts and knowledge (preconceptions) were suggested as starting points for teaching modules. Pre-service teachers pointed out that content should be discussed carefully to prevent misconceptions. They highlighted that teachers should consider their own attitude toward issues in sex education.

Student 1: Well, I personally [learned] something else... how things have to be explained very much in detail for elementary school pupils. They mess up things like what is connected to what and how reproduction happens and they mess up with concepts.

Student 2: Mmm. There were quite good points then... do you have to talk about masturbation to elementary students? Like, how it happens. And things like that. Or, I at least haven't thought about it before, like what you are going to say... That kind of conversational point is very important and I think it was good that it was emphasised here.... so that those questions come from pupils and not like the teacher is showing year after year the same issues, the same slides on the wall. (Group 3)

In the subcategory 'role playing and content', pre-service teachers noticed the suitability of role play to different content in different subjects and also for face-to-face situations. One pre-service teacher mentioned the ethics of role play.

The subcategory 'teaching perspective into sex education' concerned learning situations in sex education. Some suggested that sex education content should be discussed face-to-face, girls and boys separated. They were concerned about the challenging content and that the teacher should be open and relaxed. It was also suggested that the topics of discussion should be collected anonymously through a 'post box'. The content of the teaching experiment was also discussed from the points of view of topicality and the curriculum. It was pointed out that discussion should stay focussed and not stray. They emphasised student-centeredness in sex education and suggested asking pupils what they want to know. The importance of treating pupils as individuals, recognising that each had individual feelings was noted.

As a teacher, I aim to find out how serious and complicated are the things my pupils are able and willing to talk about. (Indifferent story)

Technological pedagogical content knowledge

In the subcategory 'pedagogical idea', pre-service teachers described how combinations of technology, content and pedagogy could be organised. The pedagogical idea 'anonymous conversation in small groups' was mentioned associated with various content. Discovery learning with avatars in the context of a given historical period was suggested. The possibility of pupils teaching peers about sex in separate working areas in Second Life was raised. One suggested a role play of bullying situations in Second Life after conversations in the classroom. In another case, studying the function of human organs through avatars created by the teacher was suggested. After completing all of the tasks, rewarding with free chat with friends was suggested. In one story Second Life was mentioned to be 'just' a motivating information source at the beginning of the learning module. Themes of sexuality and drugs using anonymous avatars were proposed. One possibility was to write down anonymously pupils' thoughts and questions either on paper or in Prezi as a basis for open discussion in class.

The subcategory 'teachers' actions' described actions, decisions or behaviours that affect the learning situation. Strict limitations were seen to reduce the facility of the resource and this was one of the reasons why virtual environments were not seen as useful. Sometimes, the teacher was seen as poised between challenging pupils, motivating them and connecting information. There were questions about how to discuss with pupils their experiences in Second Life. The teaching module was seen as a form of discovery learning because pupils produced the content together with the teacher. Also 'rich' content was mentioned as a key factor for success.

In the subcategory 'pupils' skills', pupils' ability to understand and construct the content in the technological environment was questioned. However, Second Life was seen as a good way to help talking about bullying.

I realise that moral, ethics and Second Life is too challenging combination for 6th graders. (Indifferent story)

Conversations about bullying in class could be very difficult so by using Second Life it was made easier to talk about. (Positive story)

In addition, there were many points that concerned the suitability or otherwise of the Second Life learning experiment, including: supporting pupils' learning (many commented on this); utilising the idea for content other than sex education; the suitability of Second Life as a vehicle for sex education with elementary school pupils; anonymous conversation in a virtual environment making issues of sex education a taboo; and the time consuming nature of the approach. Pre-service teachers suggested different ways of using ICT for sex education e.g. discussion boards in a blog or Prezi. They also suggested having a sex educator in Second Life from whom pupils could ask questions.

Student 1: Well, anyway I learnt that there were quite memorable conversations... It is much easier to be, to talk, when you are not yourself but through a figure, to emphasise. I think, it is working. What do you others think about it?

Student 2: Well, this kind of Second Life environment was totally new for me. So, I learnt that this kind of entertainment environment is possible to use in education. (Group 1)

Student 1: If you go to that kind of virtual world to discuss. I don't know is it really a good thing because it somehow educates...uuh, this is that sort of issue, which we can't talk about face-to-face...

Student 2: Well, right

Student 1: ... so, let's hide behind these kinds of figures

Student3: Mmm, making a taboo of the content.

Student 1: Yes

Student 3: I don't like it. (Group 2)

Student 2: But on the other hand, it just came to my mind that youngsters really ... we were talking about the taboo issues... that youngsters really do need somewhere in magazines, like... ..

Student 1: Mmm

Student 2: ...like column of Demi [a magazine] asking there like where they don't get straight answer...

Student1: True.

Student 2: ...so, in that case it could be something like sex educator there in Second Life...

Student 3: That!

Student 1: Yeah!

Student 2: ...someone who can answer those youngsters questions...

Student 1: True

Student 3: But on the other hand... yes, yes

Student 2: But right ahead, so then they don't need their own face

Student 1: Mmm, yeah right (Group 2)

Conclusions and Discussion

In terms of Abbitt's (2011) review of TPACK research this study belongs to qualitative studies of pre-service teachers' 'products', in this case their empathy-based texts and reflective discussions. In this research the TPACK framework was used as a frame for analysis to provide a versatile perspective for separate areas of pre-service teachers' thinking.

The aim was to investigate pre-service teachers' experiences of using the Second Life virtual environment. The study was implemented by analysing pre-service teachers' empathy-based stories and reflective discussions.

The Second Life environment itself was seen as outdated with many technical challenges. After the experiment pre-service teachers saw virtual learning environments generally as having potential for teaching and learning, especially to support collaborative learning practices and role play and motivating for pupils, although technical difficulties in Second Life were thought to reduce motivation. Altogether it seems that pre-service teachers valued the pedagogical design of this experiment.

The assumption was that pupils, as members of the so called 'net generation', are able to use Second Life because they are already familiar with different 3D game-like environments, was explored. However, the importance of support by the teacher was emphasised especially in work with pre-school pupils. Teaching with Second Life was seen as an area that demands certain special skills, outside normal teacher routines: in addition to technical skills, the skills of organising the learning situation with Second Life, e.g. ways of studying, scheduling and the physical environment were considered demanding.

Advantages of using role play in education were discussed especially from the perspective of pedagogical content knowledge. These results align with previous literature on the advantages of role play (e.g. Ladousse 1987) increasing motivation, building self-confidence, encouraging pupils to interact, and helping them to create their own reality. Participation and student-centred actions were identified by the pre-service teachers as positive aspects of the experiment reported in this research. Similar challenges of role play (e.g. O'Sullivan 2011) were noted, especially the possibility of misconceptions and creating taboos around some content. Anonymous conversation in small groups using virtual learning environments and avatar-like characters was thought to be plausible in sex education.

Developing proto-TPACK

Pre-service teachers emphasised especially the grounding phase (see figure 1), where they created their avatars and drew on prior experiences, making common connections and identifying areas that needed further development. They saw this as an especially valuable aspect of the experiment with potential applications in their future teaching. This aligns with earlier studies where grounding has been seen as an essential part in encouraging collaboration (e.g. Mäkitalo 2006).

These results indicate that the experience fostered pre-service teachers thinking about the use of ICT in education generally. They reflected on, and developed further, their technological knowledge and technological pedagogical knowledge and gained experience of using ICT in role play in sex education. Both in reflective discussions and empathy-based stories, pre-service teachers described many aspects of Second Life, used appropriate terminology, explored the challenges of the technology, the use of time, collaboration etc. These are consistent with findings from earlier researches into using Second Life in education (e.g. Warburton 2009; Baker et al. 2009). The affordances that Second Life brings to education, like extended and rich interactions, visualisation and contextualisation, authenticity and culture, identity play, immersion, simulation, community presence and content production (e.g. Warburton 2009), formed minor parts of pre-service teachers' stories and discussions and thus are indicative of limited application of their proto-TPACK.

Based on results, it seems that technological content knowledge is a difficult area for teachers to engage with. In contrast, there were more mentions of technological pedagogical content knowledge. However, it could be seen that pre-service teachers typically stayed with the pedagogical idea of this experiment or at least had difficulties in extending the pedagogical idea or in finding solutions for challenges they experienced during the experiment. This could indicate either that they liked the idea of the experiment in which they were engaged or that their TPACK is underdeveloped (c.f. Chai et al. 2011); they are not yet ready to find new ways of connecting pedagogy, technology and content.

The number of participants in this experiment was quite small. On the other hand the amount of qualitative data from stories and discussions was large and triangulation of data collection methods was used. Two different kinds of data, empathy-based stories and reflective discussions opened up different aspects of the experiment. The reflective discussions raised more negative points but empathy-based stories released pre-service teachers to think positively about the use of technology in education. The experiment was designed co-operatively between the researchers and the lecturer. Data collection was a significant part of pre-service teachers' tasks during the course and it gave them opportunities to reflect on their experiences of the experiment and relate those experiences to their developing professional identities (e.g. Belland 2011). Implementing this kind of experiment for pre-service teachers in different phases of their teacher education, with different technological tools, and taking them into the planning process could be a good way of probing more deeply into their TPACK and then supporting its development.

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