Constructivist teaching using the IVA course management system

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1. Abstract

The article aims to identify necessary ICT competences of teachers, which facilitate their teaching practice and the students learning process. The article describes the design procedure of a course for teachers to increase their ICT competences for the pedagogical context at Viljandi Culture Academy, in Estonia. In addition, the results of the evaluation of the course will be presented, including an evaluation on the teachers' readiness to use constructivist teaching, the teachers' feedback on the course and finally the results of the evaluation impact, which aims to identify, the impact of the course on teachers' ICT competences.

Käesoleva artikli eesmärk on välja selgitada õpetajatele olulised IKT pädevused, mida rakendada pedagoogilises kontekstis. Artikkel kirjeldab kursuse disaini ja protseduuri, mis koostati Viljandi Kultuuriakadeemia õppejõududele IKT pädevuste tõstmiseks nende õppetöös. Artiklis esitatud hindamistulemused hõlmavad järgmisi valdkondi: õpetajate valmisolek konstruktivistliku õpetamise rakendamiseks, õppetajate tagaside kursusele ja kursuse mõju nende IKT pädevustele.

2. Key words

Constructivism, Learning Management System, teacher training

3. A course management system for applying principles of constructivism.

3.1. Introduction

According to an Estonian national survey, computers are only occasionally used in schools in Estonia despite the fact that schools are sufficiently equipped with up-to-date computers and network connections (found on Laanpere et. al, 2002). This can be caused by a lack of educational software, which meet the needs of the teachers, or by a lack of know how of the teachers to use the hardware and software available. This paper addresses the latter as being the main concern when implementing ICT in a higher educational institution. According to Singer (2000), the effort required by teachers to master new technologies is underestimated. He states that one of the reasons why technology innovations fail to take hold in schools is because teachers do not have proper guidance on how to make use of them. In addition, another important issue which isn't taken into consideration when teachers implement ICT, concerns how teachers can stimulate the learning process of students when using ICT. According to Shulman (1987) teacher trainings, which teach how to use technology, is not the same as knowing how to use technology to improve student learning. What teachers need in order to help students learn with technology is specific pedagogical content knowledge and strategies to help teach content using particular methodologies and tools (Margerum-Leys & Marx, 2000).

The focus of this research is to develop teachers' ICT competences at Viljandi Culture Academy in Estonia. Viljandi Culture Academy is a state owned applied higher educational institution, which provides courses in fields such as theatrical art, dance, music, national handicraft, youth work as well as library and information sciences. Besides theoretical knowledge, graduates obtain practical experience in the particular fields. An additional priority of the curricula of the academy is to develop the pedagogical skills of the students.

For so far, the use of ICT tools for teaching and learning has been minimal. Some teachers have experimented with different ICT tools, but, until now there has not been a clear policy on ICT implementation for the whole academy. This study aims to address the following research questions in order to facilitate the implementation of ICT for the Academy:

1. Which ICT competences are needed for teachers?
2. Which setup should the learning session have?
3. What kind of impact did the learning session have on teachers ICT competences?

3.2. Defining ICT competences for teachers

ICT competences of teachers will not be thoroughly analysed, they will be defined based on a literature review. According to several researches, (Veen, 1993; Dillemans et. al, 1998; Watson and Tinsley 1995; Watson, 2001) introducing ICT tools at schools should not have a techno-centric focus but rather present teachers with knowledge on how they can use ICT tools for their own teaching and how it will benefit students. Fullan (1991) points out that in order to implement innovations at schools, teachers should participate in skill-training workshops, where they can learn new skills, and discuss possible change with colleagues. Another issue that is raised in order to solve problems faced when implementing ICT in the curriculum is that ICT needs to provide consistency. Fishman et al. (2001) emphasize that beside a clear pedagogical approach when using ICT, there is also a need for consistency when using forms of technology. He points out that there are too many forms of technologies for teachers to learn. Instead of this fragmented use, teachers should be provided with a technological tool which supports the whole curriculum. This can be realised when using a Learning Management System (LMS). De Boer (2004) defines a learning management system as a Web-based database-driven system that enables or supports learning.

As a first result of these findings, it can be concluded that necessary ICT competences for teachers are related to carrying out teaching activities and facilitating the students' learning process. Therefore effective ICT implementation should take into consideration a modern pedagogical context in accordance with teaching and learning methods. Teachers should be informed and become aware of how the use of new technology will support a certain pedagogical approach. Secondly, teachers should be introduced to a learning management system, which provides teachers with a usable framework for the whole curriculum.

These two principles can be integrated, by introducing a learning management system, which facilitates a modern pedagogical context. A learning management system called IVA is developed to advocate constructivist teaching and learning, which is a learner centred pedagogical approach aiming to activate and motivate students to construct their own knowledge and develop their pedagogical thinking skills (Laanpere et al, 2003).

Important ICT competences for teachers can therefore be seen as competences to carry out constructivist teaching when using the tools, which are provided in the IVA learning management system. In order to carry out the implementation of constructivist teaching using the IVA learning management system at Viljandi Culture Academy the following sections will elaborate on the definition of constructivism and its principles (Section 3.3.1.) and introduce the IVA learning management system (Section 3.3.2).

3.2.1. Constructivism

In order to introduce the main idea behind the constructivist teaching and learning, the ideas presented by Funderstanding about constructivist learning, constructivism is defined as: "a philosophy of learning founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own "rules" and "mental models", which we use to make sense of our experiences. Learning therefore, is simply the process of adjusting our mental models to accommodate new experiences" (Funderstanding, 2001, Constructivism section, ¶1).

In order for teachers to learn practical applications of the constructivism in teaching and learning, ten principles of constructivism were defined based on several authors (Terwel, 1999; Jonassen, 1997; Reeves, 2004; Arts in Education Institute, 2004.; South Educational Developmental Laboratory (SEDL), 1995; Funderstanding, 2001). These principles are active learning, student's own construction of knowledge, learning is contextual, complex tasks for learning, collaboration and conversation in learning, reflection of learning, formative evaluation and response in learning, highly motivated students, sufficient time for learning, and mother tongue learning and students overall cultural context.

These principles of constructivism will be the subject matter for the course for teachers at Viljandi Culture Academy. In order to make decisions about the order of the principles, which will be used for teaching, the principles are organized into clusters.

Cluster 1: Language, culture attitude, context and complex task

Language and culture attitude principles should be introduced together with the principle of the authentic context. Both are concerned with the context and materials for learning. The complex task principle is also related to the learning context, more specifically, in order to carry out constructivist teaching a complex task should be related to the authentic learning context.

Cluster 2: Activity, motivation and construction

These principles are all related to the learning subject, this is the reason why these principles are presented in one cluster. Activity is not an independent aspect. Students should be active in constructing knowledge. These aspects are also connected to motivation and goal orientation.

Cluster 3: Collaboration, conversation and time

This cluster was organised according to the social aspect of learning, from a teachers' perspective. A large part of the learning takes place through social activities rather than an isolated context. Learning through a social context requires a sufficient amount of time. This

is the link which teachers are familiar with and that is the reason why the time principle, which more generally influences all of the other principles, is presented together with the collaboration and conversation principle.

Cluster 4: Reflection, formal evaluation and response

These principles consist of elements of evaluating the learning process and its outcomes. In order to carry out an adequate reflection of the learning process, formative evaluation from the teacher is needed. Its aim is developmental for the learner and its outcome meaningful for composing personal reflection. Genuine response carries the same purpose.

In brief, the first cluster is related to the learning context. The second cluster to the subject of learning, its core element being constructing the knowledge. The third cluster is related to collaboration and conversation in learning. The final cluster is related to the process and outcome evaluation. This categorizing is useful when dividing the subject matter of the course into four separate sections for four course sessions.

As stated earlier, teachers' ICT competences are related to knowledge and skills about using constructivist teaching with the support of the IVA learning management system at Viljandi Culture Academy. In order to obtain sufficient information about the subject matter for the course, the next chapter gives an overview of the IVA learning management system and its applications.

3.2.2. IVA learning management system

IVA is a Web-based learning management system, which is developed by the Centre for Educational Technology and Department of Computer Science at the Tallinn Pedagogical University in order to advocate constructivist approaches and practices in e-learning.

The structure and functionalities of the IVA system advocate constructivist approaches to learning and teaching. The three most important conceptual pillars for designing a truly constructivist learning environment are the three C-s:

- Tools, support, time and space for personal knowledge Construction
- Meaningful and authentic Context for learning
- Support for Collaboration and group reflection and production.

Referring to these three pillars, the IVA user interface is designed in three sections (Laanpere et al 2003):

- WebTop, a section which contains tools that assist personal knowledge construction and reflection.
- BookShelf, a section which contains tools that provide context for meaningful learning.
- WorkShops, a section which contains tools that assist student collaboration and group communication.

An additional section in IVA is the Management section; it contains tools that will aid teachers to manage the course. Students of the course do not have access to this section.

Based on the findings presented in the last two subheadings, a course was designed for teachers. The aim of the course was to introduce principles of constructivism and their applications in the IVA learning management system. The main objectives of the course were: teachers will be able to understand the principles of constructivism, and teachers will know how to use IVA to implement these principles. The following subheading gives an overview of the learning sessions (Section 3.2.3).

3.2.3. Learning Sessions

The learning sessions consisted of an introductory session and four workshops. The aim of the introductory session was to introduce to the participants the goals of the workshops, give an overview of the activities, and to inform teachers about the activities, which they have to arrange before the workshops.

The four workshops concentrated on principles of constructivism and their applications in the IVA learning management system. The workshops were designed according to different constructivist principles. The first workshop concentrated on the aspects related to the learning context and tasks. The second workshop dealt with the learning subject. The third workshop focused on collaboration and time related aspects. The fourth workshop highlighted the evaluation. In all sessions PowerPoint presentations, group-works, discussions and practical activities with IVA learning management system were used (see table 1).

Table 1: Setup of the workshop sessions

	Learning activity
1.	PowerPoint presentations will be used in order to provide teachers with information about the principles of constructivism and examples of their applications.
2.	Group assignments will be used for making reflections about the participants' previous experiences.
3.	Group-work activities will be used in order to activate teachers to think about their personal experiences in using constructivist principles.
4.	Discussions will be used to offer teachers the opportunity to share their previous gained experiences with these principles and to use good applications for their teaching practices from their colleagues.
5.	Practical assignments in the IVA course management system will give the participant the opportunity to apply the principles using the tools in the IVA course management system. Practical assignments will be related to teachers' actual teaching activities. The aim of the activities is to create in IVA course management system a course which they could use for teaching their regular lessons.

3.3. Results

3.3.1. Respondents

The evaluation data was collected before the course (pre test of teachers' readiness) from eight teachers at Viljandi Culture Academy, who applied for the course of the IVA learning management system using constructivist teaching. The course participants had different working positions, and were from different departments at Viljandi Culture Academy. Only one regular teacher took part of the course, the other seven participants teach courses and are also engaged with administrative tasks. After the course, the participants were asked to fill in

a post-test of their readiness to use the principles of constructivist teaching and a general feedback questionnaire to evaluate the course. To demonstrate the learning outcomes, teachers were asked to create courses in the IVA learning management system. These courses were evaluated from the perspective of the use of the constructivist principles using a checklist for impact evaluation.

3.3.2. Results on teachers' readiness to use principles of constructivist teaching

In order to measure teachers' readiness to use constructivist teaching in a learning management system a questionnaire was used. The questionnaire concentrates on Reeves (2004) eight opposite dimensions of a learning environment, where one side represents a traditional teaching approach and the other side represents ideas of constructivist teaching, such as, Task-oriented, Challenging, Collaborative, Constructionist, Conversational, Responsive, Reflective, and Formative. These dimensions represent features of teaching and learning.

For the readiness evaluation a pre- and a post-test was used. Participants of the course had to fill in a questionnaire consisting of eight questions on a ten-point scale about their readiness to use constructivist teaching. The left side of the scale (1-5) the principle of traditional teaching are presented and on the other side the scale (6-10) the principles of constructivist teaching are presented. Teachers were asked to choose a number that indicates their personal ideas about the use of the principles. The numbers one to five indicate a more traditional approach to teaching and the numbers six to ten a more constructivist approach to teaching.

The same questionnaire was filled in after the course. This procedure helped to identify the change in attitude of the teachers, thus their change in readiness to start to use constructivist teaching. If teachers' answers are presented on the right side of the scale, then it can be assumed that they are ready to use constructivist teaching in IVA learning management system.

In the following table (Table 2) the frequencies among readiness pre and post-test scores are presented.

Table 2: Frequencies among readiness pre and post-test scores

Dimensions of constructivism	Pre-test Mean (standard deviation)	Post-test Mean (standard deviation)
1. Authentic learning context	7.3 (0.9)	6.8 (1.6)
2. Complex task	7 (1.6)	6.9 (1.6)
3. Integral collaboration	5.6 (2.5)	5.6 (1.8)
4. Original construction of knowledge	7.6 (0.9)	7.6 (1.3)
5. Multi-faceted conversation	7.4 (1.9)	7.5 (1.3)
6. Genuine response	6.9 (1.8)	7 (1.3)
7. Deep reflection	7.6 (1.8)	7.6 (1.2)
8. Formative evaluation	7.3 (1.6)	8.1 (1.6)

As the statistical analysis showed, there was a significant difference for the formative evaluation principles between the readiness pre- and post-test scores. Before the course the teachers' readiness towards formative evaluation principle was significantly lower than after the course (t=-2.198, df=7, p=0.032). Between the other seven principles no statistical differences were found. However, as presented in table 2, in both the pre- and the post-test, readiness of teachers to use constructivism is present. All the principles tested received a mean score of 5.6 or more, which indicates a readiness to use constructivist teaching in a web

based learning environment. Three aspects of constructivism (integral collaboration, original construction of knowledge and deep reflection) the pre- and post-test showed exactly the same results.

The main reason for only one principle being significantly different between the pre- and post-test can be attributed to the fact that the pre-test, which was given before the course, already indicated a readiness to use constructivism. The scores which were given to the principles were unexpectedly high for the pre-test items. Six principles out of eight: authentic learning context, complex task, original construction of knowledge, multi-faceted conversation, deep reflection, formative evaluation were rated with seven and above (out of ten).

3.3.3. Teachers' feedback on the course

In order to gain the teachers' feedback of the course, a questionnaire with 21 items was designed. 19 structured questions were to be evaluated on a five point Likert scale and 2 open-ended questions to be filled in. In the following table (Table 3) the mean scores of the results on 19 structured questions are presented on a five point Likert scale.

Table 3: Frequencies among utility and usability.

Item	Mean (standard deviation)
1. Were the goals of the course clearly presented?	4.5 (0.5)
2. Was the scheduling of the course sufficient with respect to the planned contents and tasks?	4.3 (1.4)
3. Was the workload well spread over the course?	4.1 (0.6)
4. How would you rate the value of descriptions of constructivism principles?	4.9 (0.4)
5. How would you rate the value of examples of constructivism principles?	3.9 (1.5)
6. How would you rate the value of discussions of constructivism principles?	4 (1.0)
7. How would you rate the value of practical activities in the IVA course management system?	5
8. Is the course in general good and relevant to the teaching practice?	4.8 (0.5)
9. Were the individual and group work well balanced during the course?	4.5 (0.5)
10. Was the course sufficiently practically oriented?	4.8 (0.5)
11. Was there enough technical equipment for the course?	4.9 (0.4)
12. To what extent do you think this course can help the instructor making a constructivist course?	4.3 (0.7)
13. To what extent do you think this course will help the instructor to use IVA course management system in the future?	4.8 (0.5)
14. Have your goals been met after the course?	4.5 (0.4)
15. Was it easy to follow the trainer's explanation?	4.9 (0.4)
16. Was it interesting to follow the trainer's explanations?	4.5 (0.5)
17. How would you rate the approach used for the course?	4.5 (0.5)
18. How difficult or easy was it to work with support materials (handouts)?	4.5 (0.4)
19. What is your opinion about the support materials (handouts)?	4.5 (0.4)
Overall average of the questions	**4.5 (0.3)**

Note: All the structured questions were rated using a five point scale, where 1 represents very low and 5 very high.

The highest score of questions was given to the role of practical assignments in the course (Question 7). This item received the total maximum mean score 5.0. This indicates, that the design aspect: to use practical assignments throughout the course, achieved very positive responses from all the participants. Only one question was rated below four, and the rest of the questions were rated four and above.

As mentioned above, the questionnaire also consisted of 2 open-ended questions. The first open-ended question was aiming to find out, what kinds of additional activities the participants would like to see added to the course. The main suggestion which was given concerned practical issues. Participants suggested adding more practical assignments on how to work with the course management system in the workshops. Suggestions were also given to leave more time for group discussions and provide teachers with additional materials about constructivist teaching.

The second open ended question, was aiming to find out what personal goals the participants had for this course. Most of the participants set as their personal aims for the workshops to learn about the IVA learning management system and its applications for their teaching. Two participants had more general aims; they entered the course in order to make decisions about implementing IVA on a larger scale, for one participant the larger scale was the whole school and for another the department.

In brief, both structured and unstructured questions indicate that the most valuable aspect of the course for the participants was its practical orientation and mainly for learning how to use the IVA learning management system. This was also shown by the unstructured question about the personal aims for attending the course. All the participants' answers were related to learning how to use the IVA learning management system.

As indicated, constructivist teaching also achieved high rating but still lower than using the IVA learning management system. This could have been influenced by the fact that teachers were actually quite familiar with constructivist teaching. This could have made them less interested in the examples of how to use constructivist teaching.

3.3.4. Learning task and impact evaluation

The learning task for the participants was to create a web based version of a course. In order to evaluate these courses in terms of using constructivist principles, an impact evaluation was used. The impact evaluation indicates which constructivist principles are used in these courses created by the participants. The impact evaluation was carried out by three educational experts who are familiar with methods of constructivism in education.

In order to carry out the impact evaluation, an expert-review checklist was created. The checklist evaluated the presence of constructivist principles in the courses that were made by the teachers taking part of the course. All the evaluators were asked to rate the presence of the principles on a three point scale, where zero indicates that the principle is not used, one indicates that principle is used to some extend, and two indicates that principle is used.

Due to the fact that not all the participants had time to finish their actual courses in IVA, three courses (which were to be developed by the participants) out of eight were not evaluated. The final target group for the impact evaluation consisted of five teachers. Their courses in IVA were evaluated by three educational experts.

 In three courses (Religious Studies, History of Textile Technology, and Presentation Culture) out of five, which were evaluated, all the measured constructivist principles were present or to some extend present according to all evaluators. The most constructivist course was History

of Textile Technology. The least constructive course according to the evaluators was History of Latvia and Lithuania.

In order to indicate, which principles were used most and which least, the average of all the measured principles were calculated. Most often, a preference to the principle of using the mother tongue was given; it obtained a mean score 2. The second highest rated principle was that of collaboration. The least used principle, indicated by the evaluators, was the principle of genuine response.

In brief, the courses which were made by the participants made use of most of the constructivist principles, especially language and collaboration. The constructivist principles that were least presented in the courses was related to evaluation. It could have been influenced by the design of the course management system. In the IVA learning management system evaluation tools are integrated in different sections. Tools for evaluation: Quizzes and homework assignment can be created in the management section. Created quizzes and homework assignments are placed in different sections in IVA (WebTop and Workshops). This could lead to a situation where teachers will loose their attention applying these principles. The principles presented by most participants are simply applied in the course management system, such as language selection, workshop section with tools for collaboration and group work, and adding materials for authentic learning.

3.5. Discussion

The first research question of this study aims to identify the ICT competences of teachers. Literature review showed that needed ICT competences for teachers are directly linked with the pedagogical context in accord with the teaching and learning methods. In the current study, the pedagogical context was constructivist teaching and therefore ICT competences were identified as supportive applications in the IVA learning management system, which advocate constructivist teaching. The principles of constructivism set high requirements for the learning subject, objects, context and process. Necessary conditions for carrying out this kind of teaching and learning might not be present in each learning situation. For example, teachers might have large courses, containing 60-100 students, by these conditions; it can be difficult to use formative evaluation and to provide genuine response to all participants. This argument should be taken into consideration when making a decision about using constructivist teaching for a certain topic. This means that constructivist teaching may not be suitable in all learning situations, and as ICT competences for teachers should be related to the teaching context, the concrete ICT competences can be different than identified in this study.

The second research question was aiming to identify the setup of the learning session for teaching how to apply constructivist teaching with the use of the IVA learning management system. The learning sessions were organised according to four clusters of constructivist principles. In each session principles of a cluster were introduced to teachers and showed how these principles can be applied with the help of the IVA learning management system. According to teachers' feedback, the most valuable aspect of the course was its practical orientation. However, the other items in the questionnaire, which aimed to receive feedback on the course, were also rated with relatively high scores. This sets doubts on the method, which was used to receive feedback. The results of rating items on the Likert scale did not show remarkable differences between items. It can be suggested that the values of the scales were not clearly defined and that the respondents tended to give higher values to the items rather than lower, due to a personal relationship with the evaluator, not wanting to disappoint

the trainer of the course. Considering the size of the target group it should be suggested to use a qualitative method to evaluate the course setup and content of the course in similar studies.

The third research question was aiming to identify the impact of the learning session to teachers' ICT competences. As stated above, constructivist teaching was chosen for the pedagogical context of the ICT competences. Therefore the preliminary test to evaluate the use of ICT competences was measuring the teachers' readiness to use the principles of constructivist teaching. Testing had a pre and post test design, to identify the differences in ideas of constructivism before and after the course. The results showed that there was only one statistically significant difference. The main reason for this can be the fact that the learning sessions took place in four consecutive days, which is too short a time to change attitudes. Another reason for this finding can be that the theoretical model, which was used for creating the questionnaire, does not provide suitable bases for this evaluation. Readiness evaluation should not concentrate only testing the general ideas, but also on the behavioural aspects and implications of ideas of respondents.

The actual impact on teachers' ICT competences was evaluated in terms of how the constructivist principles, which were discussed in the course, were applied to the courses, which participants created in the IVA learning management system. Modest evidence showed that compared to the use of other principles of constructivism, relatively less use of the principles was made, which fall under the defined evaluation cluster. My interpretation of this finding is related to the design of IVA learning management system, where for all the other clusters there is a concrete section, where these principles can be applied. These principles, which are related to evaluation, need to be applied in different sections in IVA. This fact could cause the loss of attention, while implementing the principles related to evaluation. This finding needs however further research because of the following problems with impact evaluation. As mentioned above, the learning session took place in four consecutive days, teachers were working on their courses in these days with the help of the trainers of the course and had two extra weeks to finish the courses by themselves in their own time and place. The fact that only five teachers out of eight finished their courses in IVA indicates that the work load of the course was not sufficiently divided. Another problem with the impact evaluation appeared with the evaluation method, three experts indicated the use of constructivist principles differently, in some cases experts did not agree, is the principle applied or not. This makes it impossible to trust the method, which was used for impact evaluation.

3.6. Conclusion

The first research question of this study was to identify the ICT competences for teachers at Viljandi Culture Academy. As a result of the literature review it was identified that the teachers' ICT competences are directly related to the pedagogical context and methods for teaching and learning. In this study the pedagogical context was constructivist teaching and learning. The ICT competences were identified as the use of applications in the IVA learning management system to facilitate the constructivist teaching and learning.

The second research questions aimed to identify the suitable setup of the learning session for teaching how to apply constructivist teaching using the IVA learning management system. In this study each session introduced a cluster of constructivist teaching and learning principles. The finding indicated that learning sessions should not take place in consecutive days. There should be more time between the sessions in order for students to familiarize themselves how to apply the teaching principles with the use of a learning management system.

The third research questions aimed to evaluate the impact of the course to the teachers' ICT competences. As a main finding it appeared that principles related to evaluation were applied

relatively less than other principles of constructivist teaching and learning. Further research is needed to test this evidence and its reasons.

Many evaluation methods, which were used in this study, did not function as their set purpose, this evidence can be used as suggestions for further research to avoid problems with evaluation, which appeared in this current study.

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