THE DIALOGICAL AUTHENTIC NETLEARNING ACTIVITY (DIANA) MODEL FOR COLLABORATIVE KNOWLEDGE CONSTRUCTION IN MOOC

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Abstract: The ways in which we work and learn are changing rapidly. These changes require research and competencies that are not only new, but which also respond to the requirements of the digital age. The extensive social phenomena and pressures that are a result of digitalisation also call for more careful consideration. Digitalisation requires us to renew educational structures. Massive open online courses (MOOC) and their associated pedagogical decisions can promote the development of digitalisation. Open online courses necessitate a stricter pedagogical structure that enables authentic learning and dialogue based on collaborative knowledge creation. This article presents a case study showing how the DIANA (Dialogical Authentic Netlearning Activity) pedagogical model was used to support collaborative knowledge construction in a micro open online course titled "Making learning personal". A questionnaire and interviews were used to collect data from fourteen participants, and qualitative content analysis was used to analyse the data. Various phenomena of MOOCs are evident in the results, however, the results also reveal the challenges of dialogical, authentic learning and collaborative knowledge creation in an open online course. The results indicate that sufficient guidance is required to gain a thorough understanding of a pedagogical model, and that collaborative knowledge creation requires time, shared learning objectives, and a substantial knowledge of dialogical participation.

INTRODUCTION

In recent years, ongoing digitalisation has required us to renew our educational structures and learning environments. Many e-learning courses are designed in a linear format, with the assumption that the students begin and finish a course at certain pre-defined points (Herrington et al., 2010). The developments in digitalisation have caused us to change our understanding regarding learning environments. However, these changes also create new possibilities. Massive open online courses (MOOC) and their pedagogical decisions can promote the development of digitalisation on both national and international levels. Open online courses necessitate a stricter pedagogical structure that enables authentic learning and dialogue based on collaboration. Laurillard (2009) states that digital technologies create new opportunities for change and support new ways of working. Digital technologies open a wide range of possibilities for education, but also create a need for a pedagogical framework. Online learning environments need to include more student-centred activity and collaboration, yet there are too many open online courses that are excessively technology driven.

According to Wheeler (2015), when we consider the digital learning of the future, pedagogy ought to come first and technology only second. To foster development, we need digital wisdom. It is said that information has become more democratic, and for learning it has become more open and communal. Wheeler suggests that blogging is one of the most effective ways of informal learning, especially when it includes some form of dialogic knowledge creation. Sangran and Wheeler (2013) view that every college ought to offer MOOCs and that new technologies are the key to the development of informal learning models. However, the possibilities of digital Open Educational Resources (OER) have not been properly utilised, nor have the quality criteria of open online courses been recorded. In addition, the content of such courses has not been evaluated from the perspective of learning. Learning is becoming more informal, and this change is enabled by MOOCs. In the modern world, MOOCs form an important way of learning and of acknowledging learning, and also serve to challenge our pedagogical thinking. Means et al. (2014, p. 69) argue that many MOOC designers have neglected to use the basic knowledge acquired by learning science, that is, how people actually learn.

According to Scanlon et al. (2015), the impact of technology on pedagogy (the manner or structure of teaching) is complex. Only a small amount of direct research exists on the ways that technological possibilities and their

associated pedagogical responses operate to benefit learners. They further point out that the area of formal learning is undergoing a period of rapid change, and that due to these changes, needs for alternative modes of delivery arise.

The Häme University of Applied Sciences (HAMK UAS), School of Professional Teacher Education (Finland) in cooperation with Coleg Cambria (United Kingdom) has created and implemented a mOOC that is based on dialogical, authentic learning and collaborative knowledge creation. The course was titled "Making Learning Personal: How to develop individualised approaches in Vocational Education and Training", and its value was 2 ECTS. This pedagogical pilot was developed in a Mapping project (Leonardo Da Vinci, Transfer of Innovation), and the Canvas Learning Management System was chosen as the learning environment. The key element in the course was formed by study groups and also the sense of a learning community that they perceive. Learning and knowledge were created collaboratively by focusing on a certain theme. The learning process was structured following the principles of the DIANA (Dialogical Authentic Netlearning Activity) pedagogical model (Aarnio & Enqvist, 2001), and in this context, implementation of the model requires a genuine dialogical learning community, a commitment on the part of learners and the teacher, and a solid presence on the net (Aarnio & Enqvist, 2001; 2002).

This article reports a case study for designing and implementing dialogical, authentic and collaborative knowledge creation based on a MOOC format, and investigates how the DIANA model construes the learning process. In addition, the article focuses on the realisation of a practical pedagogical process, and shows how the DIANA model supports collaborative knowledge construction in the mOOC context. The data for this study was collected by using an online questionnaire and in-depth online interviews, and analysed using a qualitative content analysis approach. This article is structured as follows: First, the topic is reviewed through theoretical concepts. Second, the study case and content analysis are described. Finally, the results are presented and discussed. The respondents' answers are presented verbatim in their original form. In those cases where participants answered in Finnish, the quotation has been translated and marked separately.

THE OVERALL COCEPT OF MOOCS

MOOCs (massive open online course) originate from American universities where the first course was launched in 2008. The words describing this new form of online courses have specific meanings. *Massive* means that the number of participants is unlimited, and *open* means that there are no entry requirements or tuition fees. Haber (2014, p.83) gave a concise interpretation that open means a free of cost or entrance requirement and with no barriers to entry and everything else are variant on eLearning. The courses function entirely as online courses and are structured in the form of goal-directed teaching (McAulay et al., 2010).

Massive open online courses are defined by various prefixes whose purpose is to describe the realisation methods or pedagogical approach of a particular course. One of the MOOC pedagogy branches is the cMOOC, and is based on collaborative and community oriented learning where learning is viewed as a social and collaborative learning event enabled by technology (Haavind & Sistek-Chandler, 2015; O´Toole, 2013). Siemens (2005) notes that connectivism as a learning theory is driven by the understanding that decisions are based on rapidly altering foundations, and that new information is continually being acquired. This concept has adapted to the digital age, an according to Grünewald et al. (2013), it describes learning as the creation of connections between information, and Web 2.0 functionalities lend support for this process. Connectivist knowledge and connectivism (Downes, 2012; Siemens, 2005) include insight of the cycle of knowledge development. In practice this means that individuals provide the community with knowledge, and also gain knowledge from the community. This kind of collaborative knowledge creation is seen as one aspect of the Web 2.0 philosophy. Means et al. (2014, p. 55) describe cMOOCs as endeavoring to generate online discussion and collaboration, through which the networked community of learners will build their knowledge and understanding. For example, on such courses the lectures and exercises are traditionally presented in the form of videos or text, but the learners are expected to create communities, to engage in discussions, and to give each other feedback on the exercises.

In addition to MOOCs, there are so-called micro open online courses (mOOC) which are based on the same principles as massive open online courses, but where the number of participants is limited. Instead of tens of thousands of participants, for example only 500 participants can enrol on the course. Amongst other things, the reason for this may be that the methods of discussion, guidance and feedback used are simply not feasible for a massive course. Additionally, the percentage of participants who pass the course tends to be higher when the number of learners is limited (Hiidenmaa, 2013).

According to some researchers, the MOOC pedagogy is based on the principle of learner centricity. In this, the learners decide, for instance, what, when and where they study, and to what extent they commit themselves to the learning community (Grünewald et al., 2013; McAulay et al., 2010). However, our experience shows that online learning that is based on collaborative knowledge creation requires carefully planned structures and a guiding process, i.e. the facilitation of learning. Only when a learning community has learned to learn together, can processes such as helping other learners, giving them advice and interacting in an online environment take place naturally.

DIALOGICAL, AUTHENTIC LEARNING AND COLLABORATIVE KNOWLEDGE CONSTRUCTION ONLINE

Aarnio and Enqvist (2001; 2002) emphasise that the key concept in online learning is dialogue. They further specify that in everyday speech, the term dialogue is used to refer to a discussion or conversation. Isaacs (1999) also notes that dialogue involves thinking together, although as a phenomenon, dialogue is altogether more extensive and complex. Dialogue requires equal participation, which is based on thinking together and familiarising oneself with a particular topic, matter or activity. According to Enqvist and Aarnio's (2004) definition, dialogue is based on an equal co-construction of understanding. They further point out that dialogue is seen as a tool for the co-construction of knowledge. Their offer that: "Dialogue is based on equal co-construction of understanding. It is shared thinking and getting well acquainted with a certain subject and activity." Herrington et al. (2010, p. 27–28) state that the opportunity for learners to collaborate is an important design element, especially when it comes to distance learning. Collaboration and collaborative knowledge creation are important elements of authentic online learning and can be encouraged though various tasks. Aarnio and Enqvist (2001, 19) note that dialogical participation consists of active and equal participation, engagement and reciprocal reaction, and the letting go of egocentricity.

According to Resnick (1987), personal authenticity arises when an activity is seen as meaningful (cf. Keskitalo et al., 2011) and when the learning target is defined and interpreted from the point of view of the students. The concept of authenticity is extensive and complicated, and the term is generally used to refer to something which is real, true or genuine, or something that is not fake or a forgery. A learner's commitment and the feeling that they own their learning is strongly linked to how the feeling of authenticity is born and maintained during a learning process.

The definition of authentic learning by Herrington et al. (2010, p. 1) is that learners are engaged in an inventive and realistic task which provides opportunities for complex collaborative activities. Additionally, designing and implementing authentic learning requires teachers to take risks, so an authentic approach requires more effort than standard academic lectures. Authentic learning and its approaches are often based on open-ended and learner-centred constructivist learning. Authentic learning becomes deeply meaningful, inspiring and energising when the learners ask the questions and when the learning process is shared. In their study, Kim and Bonk (2006) predict that when it comes to teaching, then elements of authentic learning will gain more significance in the future. According to Herrington et al. (2010, p. 18), the nine elements of authentic learning are 1) authentic context that reflects the way knowledge is used in real life; 2) authentic tasks; 3) access to expert performances and the modelling of processes; 4) multiple roles and perspectives; 5) collaborative knowledge construction; 6) reflection to enable abstractions to be formed; 7) articulation to enable tacit knowledge to be made explicit; 8) coaching and scaffolding by the teacher at critical times, and 9) authentic assessment of learning with tasks. These elements require skills in both dialogical learning and collaborative knowledge creation.

Authentic, dialogical online learning and collaboratively constructed professional expertise can be described in a model which clarifies the components of learning and also the dynamics of the model. The DIANA (Dialogical Authentic Netlearning Activity) model is comprised of four cornerstones that promote authentic, dialogical and collaborative learning (Enqvist & Aarnio, 2004.) Authentic dialogical learning on the net and community-based, constructive professional expertise can be segmented into an operational model that makes it easy to discern the components of learning, as well as the dynamics of the model. The cornerstones of the DIANA model support authentic, dialogical learning. (Aarnio & Enqvist, 2001; 2002.) The developers of the model (Aarnio & Enqvist, 2001; 2002) refer to net-based teaching, but the model is equally well-suited to modern, flexible and mobile learning environments. In the model, peer learning groups have an important role. Moreover, there was a desire to link the dialogical learning process to collaborative thinking and knowledge creation (cf. Downes, 2012; Siemens, 2005).

Fig. 1. The DIANA model for learning on the net (Aarnio & Enqvist, 2001, p. 67).

According to Aarnio and Enqvist (2001), operations compliant with the four cornerstones (Fig. 1) organise and structure the learning process. Cornerstone A creates the common ground for collaborative and dialogical learning. Cornerstone B deepens the process of finding and formulating authentic questions that are connected to the learning objectives of the study module. Cornerstone C offers deep-oriented learning through dialogical actions which take place in conjunction with other students' work and create knowledge about the subject being studied. Cornerstone D links theory to practice. The students weave a collaborative synthesis and search for missing pieces (new questions) pertaining to the learning goals of the study module. Dialogical evaluation is another part of the final cornerstone, and enables dialogical reflections and develops new contextual understanding.

STUDY BACKGROUND AND CONTEXT

The starting point of the mOOC discussed in this paper was the pedagogical applicability of the course to a dialogical and authentic learning process, and the building of a collaborative learning community. The course was a combination of a mOOC and a cMOOC. The course was designed for vocational education and further education teachers who wished to deepen their knowledge of individualization and individual study plans (ISP). HAMK UAS, School of Professional Teacher Education in cooperation with Coleg Cambria created and implemented the "Making learning personal" course. This 2 ECTS course proceeded from one module to the next according to the course topics.

The seven-week course was carried out in the Canvas learning environment. This environment was also used as the course platform, but the study groups were free to choose among various social media platforms that foster dialogical and collaborative knowledge creation (e.g. Facebook, Google Drive, Padlet, Hackpad). According to Daniels (2012), a distributed environment is an essential element of cMOOCs in supporting autonomy, connectivity and interaction. Throughout the process, the facilitators and expert teachers could be contacted via the learning environment and at a Facebook clinic, so enabling learners to deepen their knowledge of dialogical guidance and scaffolding. Active, dialogical and collaborative participation was expected from the students. A

total of 155 participants enrolled on the course and were divided into 14 study groups of 8–10 people. The course consisted of four modules.

The first week of the course was used for bonding within study groups (creating common ground, cornerstone A). The topics of the modules were 1) Basics of individualisation, 2) Dialogical guidance and scaffolding, 3) Synthesis of ISP practices, and 4) Sharing new ideas and ways to embed them into practice. The pedagogical script was structured into modules on the basis of the learning objectives and the guidelines of the DIANA model.

The first two modules progressed according to the DIANA model (Figure 1). The first step included individual assignments where authentic questions were generated. After this, the authentic questions were gathered on the collaborative platform of each study group and arranged thematically (cornerstone B). This was followed by collaborative knowledge creation that focused on these themes. Studying and data acquisition centred on the learning materials handed out to the students. In addition, the studying and data acquisition process required learners to actively examine things in practice (cornerstone C). The answers students offered were used to create a synthesis of the topic in question by combining theory and practice (cornerstone D).

After the course, the Mozilla Open Badge Factory was used to acknowledge the acquired competence. A learner was able to apply for a digital badge whenever he/she knew how to demonstrate his/her competence as required in the criteria of the MOOC. In the application form, students were asked to demonstrate their competence by including a synthesis of the ISP model that their study group had created. In addition, the students had to add an explanation for using the model in practice. They were also asked to briefly describe their own dialogic participation and knowledge creation in their study group (cornerstone D).

Following completion of the course, a study was conducted to all of those enrolled on the course (n=155) received a request to complete the research questionnaire, but only 10 % responded. The participants in the study ($n = 14$) were teachers from seven different countries. The participants represent teachers interested in developing their individualisation and personalisation knowledge in a world-wide learning community. Participation in the study was voluntary.

Research questions and methods
The main research question was: How does the Dialogical Authentic Netlearning Activity (DIANA) model support collaborative knowledge construction in a mOOC?

The research question was divided into the following sub-questions:
1) What is the significance of group formation for a learning community in a learning process?
2) How did the participants experience the formulation of authentic questions?
3) How does dialogical participation work in an open online course?
4) Which factors facilitate collaborative learning and knowledge creation?
5) How does a pedagogical model structure learning on a micro open online course?

The study represents a single case study (Yin 2009, p. 46–47). The method used for collecting data was a semi-structured questionnaire with open and closed questions. In addition, semi-structured in-depth interviews were used to deepen the meaning structures (Salmons 2015, p. 9–10). This article presents the results of the online questionnaire ($n = 14$) and the semi-structured in-depth online interviews ($n = 4$) provided by the voluntary participants of the study. The data was collected at the end of the course in June 2015 and the in-depth online interviews were carried out in early September 2015. The analysis of the qualitative data began immediately after the second phase of the data collection. In this paper, only the answers which pertain to the research questions (outlined above) will be analysed.

The questionnaire was based on the background theory that supports the research questions, and consisted of open-ended questions about building a learning community, learning outcomes and dialogical participation. In addition, the questionnaire featured closed-ended questions concerning the participants' background, motivation, number of hours used for course work, group formation, use of collaborative tools, formulating authentic questions, organising authentic questions thematically, creating syntheses, online meetings, the dialogical attitude of the study group, creating an individual study plan and learning from each others' models/plans. The questionnaire was created in collaboration with the course designers. It was sent to all participants via the Canvas LMS news forum. Sixteen of the 155 enrolled participants completed the course, and fourteen (response rate 9.03 %) responded to the questionnaire. Low completion rates seem to be a regular phenomenon on MOOCs. Of the respondents, ten were women and four were men. The majority of the teachers who completed the questionnaire ($n= 6$) were from vocational schools. There were teachers from universities of applied sciences ($n= 4$), from adult/further education sector ($n= 2$) and from university level ($n= 2$).

The online interviews were semi-structured in-depth interviews. According to Salmon (2015, p. 18), an in-depth interview is a qualitative research technique which involves questioning a participant in order to elicit information, perspectives, insights or behaviours that cannot be observed. Four participants volunteered to take part in-depth interviews, and were teachers from Brazil, Mexico, Slovenia and Finland. Interviewees were given the five main questions in advance. The Webex video meeting program was used to conduct the online interviews, and ach interview was recorded and later transcribed.

Data analysis
The questionnaire answers were collected by two first authors, and the online interviews were carried out by first authors. Content analysis was used to analyse the data. According to Schreier (2012, p. 7), qualitative content analysis based on theory. The analysis process began by reading through the data to gain an overview of participant responses. In the second phase, the data was read through a second time and important sentences in the responses were underlined and roughly codified in relation to the research questions. After this, the data was interpreted and then compared to the cornerstones of the DIANA model (Aarnio & Enqvist, 2001; 2002).

When evaluating the reliability of a study, attention must be paid to the relationship that the researches have to their research topic (Yin, 2009). The first authors of this study were involved in designing and implementing the course, as well as in interpreting the data. Therefore, the researchers' assumptions and actions may have influenced the research process. However, the researchers have endeavoured to adopt a scientific research approach and to overlook their initial assumptions. Due to the small number of participants, the findings of this study are somewhat limited.

RESULTS
When the responses were analysed, the aim was to understand the point of view of the participants. It must be mentioned that all participants participated voluntary in this open in this mOOC as part of their professional development.

Group formation in a learning community
The first research question looked to pinpoint the participants' perspective on the significance of group formation for a learning community, during a learning process. The purpose of cornerstone A of the DIANA model (Figure 1) is to create a solid foundation for collaborative and dialogical learning. According to their responses, the respondents perceived the purpose of group formation as getting to know the other participants and making collaborative learning more interesting. "*It was very important at the beginning, helped us make much progress, and made everyone commit to working together*" (Teacher 3, translated). When asked to evaluate their success in group formation, none of the respondents rated their group formation as excellent. Those participants who rated their success as average or poor thought that the reason for this was unsuccessful timing that failed to support collaborative knowledge creation with unfamiliar participants: "*I had bad luck and ended up in an inactive group, and it took a couple of weeks before I was transferred into an active group*" (Teacher 4). Few of the participants encountered problems with understanding the learning environment and tools, although some expressed a wish that the students could have formed their study groups more freely: "*It would have been useful to form groups with teachers with a similar background*" (Teacher 2).

Therefore, according to the results of this study, group formation is seen as an important phase for the learning process. However, technical barriers, timing and the lack of active enrolled participants created challenges in many study groups.

Authentic learning
The second research question evaluated how participants experienced the formulation of authentic questions. Phase B of the learning process focussed on enabling authentic learning (Figure 1, cornerstone B). During this phase, each participant individually formulated authentic learning questions based on the module's learning objectives. According to the analysis, formulating authentic questions is not regarded as a clear and easy way to enable authenticity in learning: "*It took time to realize what an authentic question is and how I have to do this* [sic]" (Teacher 2). In a learning process based on the DIANA model, once authentic learning questions have been formulated, the learning community (study groups) then organises the questions thematically, thus creating themes to be studied. According to six participants, the authentic questions formulated in the first module were organised into themes by one member of the group. Almost half of the participants mentioned that the group had engaged in a dialogue concerning how the questions ought to be thematically arranged. Challenges for authentic activity sprang from the innovative nature of the model, the strict schedule, and the difficulties that online studies created for achieving an understanding of the concept of authenticity. It must be noted however that students

may experience difficulties with authentic online learning, especially at the beginning of the learning process. Formulating authentic learning questions was not experienced as being easy. Therefore, there is a need to enhance the pedagogical approach, and the learner-centred scaffolding and guidance.

Dialogical actions

The third question of this study evaluated how dialogical participation works in an open online course. Dialogical participation as a part of a learning process requires learners to become competent in collaborative knowledge creation and to adopt a dialogical approach (Figure 1, cornerstone C). Open-ended questions were used to identify how dialogical participation works in an open online course. The participants were asked to reflect on their dialogical activity and participation in their learning community during modules one and two of the course. Regarding the first module, three participants considered dialogical participation to be difficult because of the online environment and long distances. Almost half of the participants stated that they found the dialogical model inspiring, that the approach had opened their eyes, and they were consequently encouraged to work in a more dialogical manner in the future. When the same open-ended question was asked regarding the second module, the participants reflected less on their own actions and dialogical approach, and they concentrated more on explaining how their group had performed in their tasks. This was also apparent in the in-depth interviews: the participants had difficulties perceiving dialogical activity as a part of their community learning. *"Well, using Skype it was kind of difficult. I couldn't hear one person very well and everyone speaks English differently and I was wondering how dialogical it really was [...] and then, what with the time constrains of the conversation, well I mean to really proceed and to be heard [...]"* (Teacher 3, translated).

The results revealed that dialogical actions and dialogical participation were regarded as a difficult approach on this online course. However, the DIANA model was considered to be a motivating feature.

Collaborative knowledge creation

The fourth research question focused on the factors that facilitate collaborative learning and knowledge creation. Active participants understood that co-construction of knowledge is a key element of dialogical and authentic learning. According to six participants, every member of their study group participated in collaborative knowledge creation and weaving a synthesis, while two participants stated that one or two members of their group had created the syntheses on behalf of the entire group. The difficulties of collaborative knowledge creation were expressed along the following lines: *"I was not just being there - we have to learn and the facilitator had to guide us toward the right track and we have to take the right direction* [sic]*"* (Teacher 1). The entire group was needed in order to create shared knowledge about a given topic and the strict schedule made this process difficult: *"If you consider the DIANA model where you're supposed to create [knowledge] together, a terribly rushed schedule did not do much to foster collaborative knowledge creation"* (Teacher 4). Thus, among the respondents, the online environment, long distances and language barriers were considered to hinder collaborative knowledge creation.

The key factors for facilitating collaborative learning and knowledge creation are the engagement of each member of the study group, shared responsibilities and learning goals, time for shared thinking and knowledge building, as well as participants from similar backgrounds and time zones.

Pedagogical model in structuring learning

The fifth question of this study considered how participants felt the pedagogical model to structure the deep learning process of collaborative knowledge creation: *"The aspect of the model is quite helpful and promising to change ways of learning* [sic]*"* (Teacher 2). However, the DIANA model was also considered challenging to use on an open online course. A model such as this requires a learning environment that is coherent and comprehensible, functions well, and fosters collaborative learning. *"Teachers have to provide scaffolding and help students. DIANA is the key element to make effective learning* [sic]*"* (Teacher 1). It must be noted that nearly half of the participants stated that the pedagogical model of the course had opened their eyes and inspired them to act in a more dialogical manner in the future. The findings further suggest that a clear representation of a pedagogical model at the beginning of the learning process is important, for if the process remains unclear, it is difficult for course participants to understand the path of learning and collaborative knowledge creation. In addition, the model requires more active facilitation processes and should further support learning by using various channels of online tutoring.

The timing of the course was criticised and the Canvas learning environment was considered to be complex and confusing. Several participants mentioned that the course took place at a hectic time, and that teachers were busy as their semester was just about to end. Participants also stated that the topics covered in the course were too numerous considering the time that was available.

Ruhalahti: Redesigning a Pedagogical Model for Scaffolding…

Nearly all of the participants mentioned that the online environment chosen for the course was neither easy to use nor very well organised. Thus, a platform suited to dialogical and collaborative learning ought to be used to provide an appropriate learning environment. Familiarising oneself with the featured work environment was time-consuming, and therefore the remaining time was insufficient for collaboration and collaborative learning. The fact that participants lived in different time zones also presented a challenge, for example when arranging online meetings: *"It would be better to have national groups to help each other and communication would be more easier, the time zone was the problem"* (Teacher 3, translated). In addition, the participants wished for more facilitation, online tutoring and weekly online clinic meetings to support their study. McAulay et al. (2010) note that time zones can be concerns in MOOCs, if regular live sessions are planned. The number of topics covered in the course must be in proportion to the available time, and therefore the possibilities of synchronised studies across various time zones must be taken into account.

DISCUSSIONS AND IMPLICATIONS

The aim of this study was to investigate how the Dialogical Authentic Netlearning Activity (DIANA) model supports collaborative knowledge construction in an open online course. The results revealed that a clear representation of a pedagogical model at the beginning of the learning process is important to aid understanding of the path of dialogical and authentic learning, along with promoting collaborative knowledge creation. The results of this study correspond with the results of previous studies by Aarnio and Enqvist (2002) and Aarnio (2006), which indicate that particular skills and finesse are needed to create and understand collaborative, learner-centred learning processes. This study suggests that before a pedagogical model can be implemented, skilful pedagogical work and a sufficient command of technical online environments are required (cf. Grunwald et al., 2013). MOOCs are open, and voluntary, and participants engage in them selectively, for example by paying closer attention to topics that correspond to their needs. In this context, participants may not find the level of scaffolding and support they require in order to orient themselves because support structures are not formalized (McAulay et al., 2010).

The study groups needed a considerable amount of support and advice before they were able to start studying (cf. Aarnio & Enqvist, 2002, p. 255). The results of this study indicate that the group formation processes might have been more successful had the participants been given more freedom when forming the groups, and if the tutoring in online environments been timed more efficiently (cf. Keskitalo et al.2011). Based on the results of this study, it must be noted that students may experience difficulties with authentic online learning, especially at the beginning of the learning process (cf. Aarnio, 2006).This strongly suggests a need to enhance both the pedagogical approach and learner-centred scaffolding. Teräs and Myllylä (2011) stress that the principles of authentic learning have offered a useful framework for designing social online learning. One of the principles of authentic learning is formulating open questions pertaining to the learning objectives of the module. On the basis of the results of this study, it is recommended that the key factors in learning authenticity ought to be made more transparent in order for the students to understand the significance of authenticity at the very beginning of the learning process. As Aarnio (2006) states, the principles of dialogical and authentic learning require more efficient guidance at the beginning of the learning process. According to Teräs and Herrington´s (2014) study, authentic online learning differs in many ways from traditional educational approaches. Learners' authentic questions form a basis for dialogical knowledge creation (Aarnio & Enqvist, 2002), and at this point, a tutor has a significant role in ensuring that the learning process is based on authenticity (Herrington et al. 2010). In our study, challenges for authentic activity sprang from the innovative nature of the model, the strict schedule of the course, and the difficulties that online studies created for understanding the concept of authenticity.

It is a well-known fact that the pedagogical approach applied in MOOCs requires more extensive and deep oriented research by way of scientific discussion. Redefining MOOC pedagogy is a challenging task. Every online teacher has their own opinion, which is usually based on their own experience and the knowledge they have gained during their teaching careers, and the same applies to the new generation of online teachers. Even though a pedagogy based on collaborative learning was chosen, it did not motivate and encourage all of the students to study during the course. Collaborative knowledge creation entails problem solving and addressing meaningful issues, and the entire learning community must be involved. Scanlon et al. (2015, p. 7) point out that the greatest benefits of learning design, learning analytics and open education resources can be attained through an integrated approach where design, technology and pedagogy are combined. In our study, one of the first challenges was the discrepancy between the number of those who had enrolled on the course, and those who actually started their studies. Even though it was believed that a sufficient number of participants had been assigned to each study group, only two thirds of the study groups started their studies according to the syllabus. The course completion rate was about ten percent (10, 3%). When offering MOOCs in the future, the demand for such courses ought to be taken into account, and according to Onah et al. (2014), it is important to pay closer attention to the completion rates of MOOCs. Although thousands of participants enrol on MOOCs, the completion rate for most courses is below 13 %, and this was the case in the course examined in this study.

Amongst the reasons for these considerable drop-out percentages, Onah et al. (2014) list a lack of motivation or time, difficult course topics, lack of support, lack of (online) learning skills, unpleasant experiences, expectations that differ from reality, starting the course late, and also peer evaluation.

Since the number of participants in our featured study was rather small, no wider or general conclusions can be drawn on the basis of the study results. The data remained rather scant due to the significant number of drop-outs, and the course in question was a micro open online course, not a massive open online course. Therefore, the results of this study should be deciphered and applied with care. Although a need for continuing pedagogical development, piloting and research can be seen in this area, our extensive experience as online teachers has revealed one indisputable fact: the learning results and the degree to which the studies are considered as meaningful are connected to the issues of collaborative work and knowledge creation.

CONCLUSION

The results of this study show that dialogical, authentic learning and collaborative knowledge creation require more practical scaffolding, guidance and tutoring. Structuring a learning process based on the DIANA model is challenging, because it is precisely the authentic, dialogical and collaborative knowledge creation that is in danger of being lost in the process if the required activities and support structures remain insufficient. The results of this study clearly revealed these critical issues. The pedagogical model itself provided no solutions to the main problem typical of MOOCs, namely the substantial drop-out percentage. The key question is one of the underlying pedagogy, which will inevitably affect the learning experience and the learning itself. In the future, a stronger pedagogic approach is needed to develop MOOCs and to ensure their quality of teaching. When choosing a pedagogical model, one must take into account the learning objectives, the number of participants, the learning environment, and also the way the course is implemented. As promising as they are, MOOCs are only as strong as their design. Therefore MOOC designers need to consider the balance between course completion and deep-oriented learning.

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Authentic, Dialogical Knowledge Construction: a Blended and Mobile Teacher Education Programme

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Abstract:

Background: Knowledge construction and technology have been identified as critical for an understanding of the future of teacher education. Knowledge is discovered, applied and created collaboratively from authentic starting points. Today's new mobile and blended learning environments create increased opportunities for such processes, including learner-centred approaches, authenticity and dialogical knowledge construction. However, teaching still requires appropriate learning design and structuring. The presented study explored, and was designed and implemented, using the 'DIANA' (Dialogical Authentic Netlearning Activity) pedagogical model, which is seen as one of the learning designing models for existing digital, open and mobile learning environments.

Purpose: The purpose of this study was to identify the challenges and opportunities inherent in the adoption of the DIANA model and to examine student teachers' reflections concerning authentic and dialogical knowledge construction. The focus is on the learning process.

Sample: Participants were 63 student teachers who were following the study module 'Networks in Vocational Education' at the School of Professional Teacher Education, in Hämeenlinna, Finland.

Design and methods: This qualitative study uses a deductive content analysis to discern relationships between the data and the existing theory. The data for this study was drawn from an online questionnaire and participants' self-reflective accounts.

Findings: The results indicate that achieving deep-oriented learning through dialogical actions is the most challenging part of using the DIANA model. Some of the students had difficulty understanding the concept of 'authenticity'.

Conclusions: The findings of this study suggest enhancing learner-centred scaffolding and guidance, particularly at the outset of the learning process. In addition, methods that develop dialogical skills and competences ought to be integrated into teacher education as extensively as possible, in order to make collaborative work and problem-solving genuinely dialogical and equal.

Introduction

Teacher training, together with higher education in general, faces the challenge of bridging education and work. Teacher education programmes address this issue by adopting learner-centred and collaborative pedagogical approaches. Such routes include inquiry learning, problem-based learning, and project-based learning, all of which capitalize on authentic professional practice and related phenomena, problems, and situations (e.g., Brush and Saye 2014; Hunt 2015). Teacher education is also required to bring itself up-to-date by responding to the current digital, mobile and interactive communication and content creation practices, preferences, and cultures of student teachers, as well as their present and future students.

In this article, we will present a study based on a blended and mobile teacher education study module provided by the Häme University of Applied Sciences, School of Professional Teacher Education, Finland. The purpose of the study is to gain insights that can be used to develop teacher education programmes that better support students' dialogical and equal collaboration and problem-solving with the help of mobile devices. The two primary authors of this article both work as teachers in this programme, which aims to address both of the aforementioned challenges through the use of the DIANA (Dialogical Authentic Netlearning Activity) model

in the design of the learning activities. The creators of the model, Helena Aarnio and Jouni Enqvist (2002) point out that taking a dialogical leap is a precondition for deep-oriented and efficient learning in the digital age. Previous studies (Enqvist and Aarnio 2004; Aarnio 2006) have indicated that authentic dialogical learning is difficult in online settings and that the construction of such knowledge should be structured more deeply in the learning processes of teacher education. The DIANA model combines the key factors of learning and teaching in the digital age in an inquiry-oriented practice-based tool and learning framework. At the present time, in many educational settings and systems, becoming a teacher and practising as a teacher require one to work with processes which are, by nature, more communal than ever before: teachers must operate in various learning communities and communities where knowledge is constructed. Dialogical skills are necessary, so that efforts toward authentic, integrative and interdisciplinary knowledge construction can be successful (Aarnio and Enqvist 2016).

Knowledge and technology have together been identified as critical for an understanding of the future of teacher education. Royle, Stager, and Traxler (2014) challenged the relevance of the existing programmes that fail to make major adaptations as a result of emerging innovations and, in particular, the increased mobility arising from learning that uses mobile technologies. Knowledge is discovered, applied, and created collaboratively, from authentic starting points. The new mobile environments create increased opportunities for such a process, including learner-centred approaches, authenticity, and dialogical collaborative work. However, teaching still requires appropriate learning design and structuring. In addition, the integration of technology into learner-centred and collaborative approaches, such as problem-based, project-based, and inquiry-oriented learning, is challenging for pre-service and practising teachers alike (e.g., Brush and Saye 2014).

According to Glahn's (2016) definition of mobile learning, teacher education should be developed in the direction of "technology-supported learning processes and practices that take advantage of mobility of people and consider learning opportunities that are created by contexts as well as relations and transitions between those contexts" (180). Traxler and Kukulska-Hulme (2016) argued that the next generation of learners in the mobile age is becoming context-aware and that the design of learning will play a significant role in its education. The focal points of the desired type of design are the achievement of a more individualized and flexible style of learning and the enablement of the use of informal learning strategies and environments, situated learning, collaborative knowledge construction, context-aware learning, and learning as a conversation (Bachmair and Pachler 2015).

This paper presents a study that investigated, through qualitative and deductive content analyses, the learning experiences of student teachers who participated in a 'Networks in Vocational Education' study module between 2014 and 2015.

The study module was designed using the DIANA model. The following sections introduce the concepts of authentic and dialogical knowledge construction and blended and mobile learning, which form the theoretical basis of our study. Thereafter, the context of the research is presented, together with the research questions and methods. Finally, the results are discussed and suggestions for learning design and future research are presented.

Theoretical background

Authentic and dialogical knowledge construction
In discussions of authentic online learning, many researchers agree that it derives from situated learning (Teräs 2016; Herrington et al. 2009; Aarnio 2006). Most recent studies have indicated that students have difficulty understanding the concept of authenticity, and it is therefore necessary to enhance the pedagogical approach, as well as to improve student-centered scaffolding and guidance (Aarnio 2006; Teräs 2016; Ruhalahti, Korhonen, & Ruokamo 2016).

Designing learning settings that use authentic activities as anchoring assignments can be a difficult process if the previous design was based on a teacher-centred approach (Oliver, Herrington, and Reeves 2006). Shaffer and Resnick (1999) argued that more comprehensive views of authenticity combine learning environments with all aspects of authentic learning; they are personally authentic for the learners, real-world related, provide an opportunity to think in an authentic mode of a particular discipline and assessments include authentic reflections on the learning process itself. Sources and materials are authentic when they are required to understand a topic stemming from a practical approach to solving a problem or creating a product or artefact. This is the case when considered from either individual or group perspectives. According to Aarnio and Enqvist (2016), the idea of authentic learning is viewed too narrowly and the process of finding and creating authentic knowledge by integrating theory into practice has often been designed and implemented without sufficient care.

According to many researchers, learning demands social interaction and knowledge creation is fundamentally a social process (e.g., Vygotsky 1978; Wenger 1998). This is primarily linked to participation and action in communities of practice (Wenger 1998). During the learning process, peers depend on others with more experience, which increases the need for joint participation in learning (Lave and Wenger, 1991). From the perspective of collaborative learning, group members share a goal and contribute new knowledge in order to create a common understanding through interaction. This is achieved by asking questions, evaluating knowledge, and modifying the collaborative approach (see also Dillenbourg 2002). For such activities and interactions to succeed, one must not only be understood,

but also understand the viewpoints of others and pay attention to them in order to find a deeper meaning in the dialogue.

Bohm (2004) pointed out that in genuine dialogue, active participation is required. This involves two meanings: i.e. taking part both 'of' and 'in'. Dialogue does not simply mean talking or having a conversation (Bohm 2004; Isaacs 1999); according to Isaacs (1999), dialogue enables a person's attitudes and self-knowledge to undergo changes, while it also improves our ability to listen and familiarize ourselves with others' points of view. When collaborating through dialogical actions, it is essential to be equally and consciously present, engaged, listening, participating, and suspending (Bohm 2004).

The research literature on dialogicality in blended and online teacher education and higher education has focused predominantly on dialogical discourse, interaction, and teaching (e.g., Ligorio, Loperfido, and Sansone 2013; Cramp et al. 2015; Sedova, Sedlacek, and Svaricek 2016). However the focus of the present study is on authentic and dialogical knowledge construction specifically on the part of the learning community. In this line of research, several studies have focused on the applicability of pedagogical models that structure the dialogical knowledge construction process online. The results clearly demonstrate that dialogical knowledge construction does not happen by itself, but requires pedagogical modelling and structuring. According to Enqvist and Aarnio (2003), dialogical knowledge construction means that learning is a social process where students, though participation and collaboration, build a shared understanding. This requires the skills of inquiring and questioning, so that the generation of new ideas and knowledge is possible. For example, Bound (2010) developed and instigated the "Map of Dialogic Inquiry" model to improve online dialogue in the context of adult and vocational education. The results of the case study showed that the model supported and facilitated dialogical inquiry. In British Columbia, Canada, a dialogic learning community model, which emphasized dialogue focusing on real-world problems, was used to instruct adult learners. For the dialogue to be successful, the researchers argue that its characteristics must be featured in the learning model (Guilar and Loring 2008).

Authentic, dialogical online learning and collaboratively constructed professional expertise can be described in a pedagogical model that clarifies the components of learning activities. The study module that the present study explored was designed and implemented using the DIANA model, whose purpose is to create a general view of authentic and dialogical knowledge construction. Table 1 provides an overview of the pedagogical design of the model. The developers of the model (Aarnio and Enqvist, 2016) refer to blended learning and teaching, but the model is equally well-suited to existing digital, open, and mobile learning environments.

Table 1. An overview of the pedagogical design of the DIANA model Adapted by the authors of the current study from Aarnio & Enqvist 2016, 41 – 46. Adapted and reproduced with permission.

Cornerstones of the DIANA model	Operative dimensions
A. Creating common ground for the collaborative learning	A1. The idea of dialogical and authentic learning A2. Preparing for dialogical participation in the learning community A3. Structuring and starting collective work
B. Enabling the authenticity in learning	B1. Deriving authentic learning tasks (starting problems) learner-centredly from real life and work situations, formulating problems using language used by students, the starting point being their everyday conceptions B2. Using authentic sources and materials/data to create content and products
C. Increasing deep-oriented learning through dialogical actions	C1. Solving problems and constructing knowledge through dialogical actions C2. Working as equals, participating reciprocally and symmetrically, listening to others, open and constructive inquiry and weaving syntheses C3. The focus is on open, inquiring questions that are used to find solutions and create content
D. Integrating theory and practice in learning situations	D1. Alternating theory and practice, weaving a synthesis, finding gaps in thinking and actions, formulating new problems on the basis of those gaps D2. Continuous reflection and evaluation throughout the learning process – individually and collectively

The revised DIANA model starts from cornerstone A, which creates a common ground for learning collaboratively and dialogically in the learning community. The objective of cornerstone B is to establish authenticity in learning by using problems related to real life and formulating authentic learning questions or assessments. These are connected to the learning objectives of the study module. The teacher's role is to offer scaffolding and guide the students' learning in the right direction. Deep-oriented learning, through specific dialogical actions and collaborative knowledge construction, is at the heart of cornerstone C. In practice, this entails seeking answers to learning questions set earlier, providing individual contributions, clarifying and questioning the meaning of utterances, continuing the utterances of others and participating in the construction of a shared understanding. Cornerstone D integrates theory with practice and requires the students to weave a collaborative synthesis, create shared artefacts and to search collaboratively for new learning questions pertaining to the learning goals of the study module (Aarnio and Enqvist 2016).

Blended and mobile learning in teacher education

As a concept, blended learning is currently being used in learning settings that combine face-to-face and online instruction (Graham 2006; Wagner 2006; Kennedy and Archambault 2012). Blended learning processes combine face-to-face instruction and computer-mediated instruction. Blended learning is seen as one of the more effective pedagogical practices (Graham 2006) and encompasses active learning, peer learning, and student-centered strategies (Morgan 2002). Many researchers agree that technology is not the central concept when it comes to defining mobile learning (cf. Glahn 2016; Sharples, Taylor, and Vavoula 2005; Traxler 2007). Bachmair and Pachler (2015) indicated that mobile learning is morphing into a new state as a result of the accepted use of tablet devices in schools and the growing amount of practical experience of their application. Mobile learning is a wide-ranging concept which, at its simplest, refers to learning and teaching with the help of mobile devices.

Herrington, Herrington, and Mantei (2009) listed some characteristics that they recommended were incorporated into mobile learning. In their view, the use of mobile learning should be linked to authentic contexts and situations wherein learners are able to be mobile. Time is needed for the exploration of mobile technologies and the blending of mobile and non-mobile approaches. It should be possible to apply mobile learning spontaneously, at any time, and in both individual and collaborative learning. A teacher should employ the students' own mobile devices and use mobile learning to mediate knowledge construction. Mobile technologies have been one of the key facilitators of change.

A key element of mobile learning is openness, meaning that its learning environments are inclusive, easily accessible, and portable. Educational openness also refers to open educational technologies and software, content, and knowledge sharing and construction (Iiyoshi and Kumar 2008). Open social software enables people to collaborate, interact, and create online communities with ease (Özkan and McKenzie 2008). Accordingly, the study presented in this article offers the suggestion of how to combine blended learning design and open content with open educational technology.

In the context of teacher education, blended and mobile teaching and learning approaches, drawing on inquiry-based learning, have become more common and are attracting a growing level of interest from researchers (see Tomas et al. 2015; Hunt 2015). For example, Hunt (2015) studied a group of 55 pre-service student teachers in New Zealand, who participated in a two-month professional inquiry course that adopted a blended learning approach. She concluded that the inquiry process was "an empowering group experience that models the effective teamwork expected of student teachers in their future employment" (57). Hunt also noted the significant reciprocal learning and peer support experienced by the students. Meanwhile, in Australia, Tomas et al. (2015) investigated whether and how a blended learning

design promoted the development of substantive knowledge in science and sustainability education and engaged first-year online pre-service student teachers in active, experiential, and praxis-oriented learning experiences. Interestingly, their findings indicated that "a powerful blended learning design can be achieved by using online affordances to facilitate students' learning in their physical environment" (101). An example of this is experiential activities that students online can undertake themselves, in their local environment, and share through, for example, video blogs, which themselves can become shared artefacts for learning.

Purpose of this study

The purpose of this study was to identify the challenges inherent in the adoption of the DIANA model (Aarnio and Enqvist 2016) and to examine student teachers' reflections concerning authentic and dialogical knowledge construction. The focus is on the learning process. This study has two main research questions:

RQ1) What are the challenges and opportunities of the adoption of the DIANA model for blended and mobile learning, from the perspective of student teachers?

RQ2) How do student teachers reflect on and evaluate authentic and dialogical knowledge construction, based on their mobile learning experiences?

Context and methods

Context of the study
The setting of this research was the study module "Networks in Vocational Education" 4 ECTS credit (European Credit Transfer System) in the Professional Teacher Education programme (duration of 1 to 1–and a half years, 60 ECTS credit) of Häme University of Applied Science, School of Professional Teacher Education. The aim of the module is that the students will be able (1) to build and utilize different national cooperative networks in the field of vocational education and training, (2) to function in international networks, (3) to understand the administration, financing, and management of an institution of vocational education, and (4) to apply in his or her work plans and documents guiding the activities of such organizations.

The study module design is based on the idea of integrating four elements: authentic learning, dialogical collaboration and collaborative knowledge construction through mobile applications. The contribution of mobile learning to teacher education is that it responds to the current mobile communication practices of student teachers, and to the practices of their present and future students. In addition, mobile learning is in line with authentic professional practices that capitalise on collaboration and networking beyond organisational boundaries.

Application of the DIANA model to the study module

The study module was designed and implemented using the DIANA model. The two primary authors were co-facilitators of the four implementations of the module explored by this study. The main components of the learning environment provided by the facilitators were an open course blog, containing freely accessible educational resources, and open blogs for the study circles. The module was designed so that each collaborative learning application could be accessed via mobile devices. Three of the four module implementations included contact teaching, while the remaining course was solely based on online and mobile learning environments.

As we outlined in the previous section on the theoretical background, the DIANA model is based on four cornerstones and activities therein that promote authentic dialogical learning and collaborative knowledge construction (Aarnio and Enqvist 2016). The model does not follow a step-by-step structure; instead, the various issues summarized in the cornerstones are presented simultaneously (Aarnio 2006, 14).

In the six-week study module, based on blended and mobile learning, the learning process started from Cornerstone A, in which students created a common ground for authentic and dialogical learning (Aarnio and Enqvist 2016). The learners were introduced to the idea of authentic dialogical learning, the learning process, and mobile applications. Both video and face-to-face lectures were used as learning materials. The participants were divided into study circles and expected to create a shared blog to document their learning process. However, the study circles were free to decide on the digital applications they wanted to use to support their dialogical collaborative knowledge construction. The facilitator's role was to ensure that students were progressing in their learning journey and to provide scaffolding with the help of the blog and various other mobile applications.

Cornerstone B deepened the individual and group processes of finding and formulating authentic questions that were connected to the learning objectives of the study module (Aarnio and Enqvist, 2016). Each student individually devised their own authentic question concerning the learning goals of this study module – for example, what are the benefits of a teacher practising networking, from the perspectives of both teacher and student? Thereafter, the students formulated shared authentic questions and categorized them into themes. Both the questions and the themes were published on the blog so that they could direct the work during the following activity. In addition, the students decided on the kind of artefact they would produce during the learning process. The facilitator's role was to offer scaffolding and guide the learning in the right direction. Cornerstone C offers deep-oriented learning through dialogical actions which take place in conjunction with other students' work and construct knowledge about the subject being studied.

Cornerstone D artefacts included, for example, a self-evaluation questionnaire concerning professional networks. Dialogical evaluation was another aspect of the

final cornerstone, which enabled dialogical reflections and helps the development of a new contextual understanding (Aarnio and Enqvist 2016).

Ethical considerations

Ethical approval for the study was governed by The Finnish Advisory Board on Research Integrity (2012) guidelines for educational research. The research followed principles that have been endorsed by the research community, that is, integrity, meticulousness and accuracy in conducting research, and in recording, presenting and evaluating the research results. All data were gathered by the two lead authors, who were familiar with all student teachers and who participated and were well-immersed in the study's setting as long-standing members of staff. Study participants were informed that their data would be used in this study and that participation was entirely voluntary. The anonymity of all individuals participating in the research was ensured and explained on the questionnaire form. All communication related to the study was conducted with honesty and transparency. The research organisation also adheres to good working practices and takes into account all data protection legislation.

Data collection and analysis

The participants of the study were 63 student teachers (43 females and 20 males) in the age range of over 25 years and under 60, who were following the four implementations of the study module "Networks in Vocational Education" between 2014 and 2015 (see Table 2). The data for this study was drawn from an online questionnaire (n = 63). The questionnaire was designed in the light of background theories that illuminate the research questions. These were used to form questions to inquire about phenomena, understanding and experiences during the learning process. The survey included three multiple-choice questions about participants' use of mobile devices and applications, as well as their experiences related to such use. In addition, three open-ended questions were used to inquire into the challenges experienced by the students during the learning process. The students were asked to comment on what cornerstones were most taxing from the point of view of both the study circle as a whole and individually. In addition, the research data included the self-reflective accounts (n = 15) of students enrolled in the third implementation of the study module. For the accounts, the students were asked to answer eight open questions regarding their roles in and contributions to the authentic and dialogically constructed knowledge creation processes. During the final face-to-face meeting of the study module, students were asked to write a self-reflective evaluation of their learning activities and outcomes. Please see the Appendix for details of the online questionnaire and the guidelines for the self-reflective account.

Table 2. Summary of the module implementation and data collection methods.

Module implementations and timeframes	Implementation 1 03-04/2014	Implementation 2 08-09/2014	Implementation 3 03-04/2015	Implementation 4 09-11/2015
Survey participants (N)	16	16	16	15
Blended learning design	2 x 4 hours of classroom learning, 1 hour of online coaching, independent mobile/online learning	3 x 2 hours of online coaching, independent mobile/online learning	2 x 4 hours of classroom learning, 1 hour of online coaching, independent mobile/online learning	2 x 4 hours of classroom learning, 1 hour of online coaching, independent mobile/online learning
Data collection methods	Online questionnaire	Online questionnaire	Online questionnaire Self-reflective accounts	Online questionnaire

A qualitative and deductive content analysis (Schreier, 2012) was used to discern relationships between the data, the existing theory, and the elements of the DIANA model. The main categories of this analysis were derived from the DIANA model and agreed upon by the two primary authors prior to its commencement. The subcategories were formed on the basis of the research data. The content analysis proceeded with the following steps: (a) reducing the data, (b) regrouping the data, and (c) interpreting and identifying units of meaning and forming conclusions on the basis of the data.

First, the two primary authors read the data independently to obtain an overall picture of the participants' responses. Second, the self-reflective accounts were again read independently several times and important passages in the responses were underlined and coded with respect to the research questions. The data were divided into separate themes and reorganized according to the theoretical arguments regarding the theory and elements of the DIANA model (see Table 3). Words, phrases, and sentences were used when coding the data; the themes were generated deductively as the codes were grouped, sorted, regrouped, and resorted. After completing the individual analyses, the first two authors of this article compared and discussed the coding and arrived at an agreement. The whole study was conducted in Finnish. To be precise, the data collection and the data analysis were conducted in Finnish, and the results were translated in to English by a first language translator.

Results

The findings of the data analysis are described below, and key themes are discussed, with quotations from the data used illustratively. These quotations have been translated from the original language of the data collection (Finnish) into English. Special attention was given to understanding the real meanings of quotations.

In their responses to the online questionnaire, the participants (n = 63) reported that they used smartphones (n = 53) and tablets (n = 36) to communicate and collaborate with their peers. They also stated that they used the following digital applications on a mobile basis: Blogger (n = 35), Facebook (n = 53), Google Drive (n = 38), and WhatsApp (n = 59).

Table 3. Summary of the results of the data analysis, with examples from the data.

DIANA Cornerstones and associated activities (see Table 1)	RQ1: Categories indicating challenges of adoption of the DIANA model (The most challenging cornerstone for a student/ study circle)	RQ2: Coding categories indicating authentic and dialogical knowledge construction for Cornerstones B and C (Number of items)	Examples from the data (RQ2)
A. 'Creating a common ground for collaborative learning'	Beginning the learning process (5/5) Understanding the integration of the entire process (4/0) Incoherence (1/1)		

B. 'Enabling authenticity in learning' B1. Finding competence problems from working life B2. Using sources and creating content	Formulating authentic questions and synthesis (2/7) Lack of time (1/0) Group work (1/1) Understanding the task (1/0)	Basics found through the objectives of the study module (1) From personal perspective (4) Knowledge and needs of a professional education teacher (3) Through one's experiences, skills, and knowledge (5) Constructing shared knowledge (6) Making inquiries and wondering collaboratively (6) Contributing with one's own skills and knowledge (3) Participation (3) Improving information literacy skills (2)	*We formed authentic questions by thinking about them together on the basis of the description of the study module.* *Stemmed from practical questions; that is, what does a professional education teacher need to know about a given topic?* *We read all of your starting material and every student was inspired by the issues they found personally meaningful.* *We constructed knowledge with the help of practical experiences as well as various information sources.* *I continued from the answers of the other members and contributed with my own skills and knowledge.* *As a member of the group, I participated in searching for information.* *Information literacy skills were improved and we learned to distinguish important information from irrelevant information.*
C. 'Increasing deep-oriented learning through dialogical actions' C1. Dialogical problem-solving in a learning community C2. Dialogical help and support in a learning community	Dialogical approach (5/6) Lack of time (3/5) Dialogical problem-solving (working on a task) (1/3)	Inquiry (3) Dialogue made the learning deep-oriented (4) Together we are more (8) An integrated whole was constructed collaboratively (8) New perspectives (2) Time constraints (1) Listening (2) Symmetrical actions (5) Maintaining dialogue (3) Using open inquiry (8) Listening (3) Active participation (5)	*I asked open questions and weaved syntheses, which made it easier to understand the big picture.* *We gained perspectives from various educational levels and generated good discussions and new information.* *We had no time to examine the topic deeply.* *I listened while others talked about their thoughts.* *We worked very equally and rather symmetrically.* *…to give others a turn. I also focused on listening.*
D. 'Integrating theory and practice in learning situations'	Artefact (7/3) Evaluation (2/1) Other (1/1)		

Challenges of adoption of the DIANA model

The online questionnaire asked the student teachers about the most challenging Cornerstone, both from their personal point of view and that of the study circle as a whole (see Table 3). From both perspectives, the most challenging cornerstone was Cornerstone A, during which students formed an overview of the learning process and orientated themselves to the performance of collaborative and dialogical work. For some students, the instructions provided were inadequate: 'I couldn't quite comprehend the instructions and therefore didn't know what I was supposed to do and how...' From the point of view of individual students, perceiving and understanding the learning process as an integrated whole was considered challenging, while this was never mentioned when considering the matter from the perspective of the study circles. Some of the students reported having had difficulties in achieving an understanding of the concept of authenticity (see also Ruhalahti et al. 2016; Teräs 2016).

For most of the students, Cornerstone B, which aimed to enable authenticity in learning, was the most uncomplicated part of the entire learning process. However, the formulation of authentic questions and weaving a synthesis of the study circle on the basis of those questions was considered difficult on the collective level, while from the individual point of view, authentic questions were formed relatively easily: 'very naturally and easily. The study circle included people who, in one way or another, had encountered the topic in their work.'

A large proportion of coding units were related to Cornerstone C, which included collaborative learning, knowledge construction, and learning through dialogical actions using mobile applications. From the perspectives of both individual students and study circles, dialogical work and operating as equals, reciprocally and symmetrically, were considered particularly problematic by a few students during this stage. On an individual level, knowledge construction based on authenticity was considered straightforward, while on the collaborative plane it was considered difficult to create a shared overview from an authentic starting point. This emphasizes the skills and competences required in dialogical thinking.

With regards to the final Cornerstone, D, the most challenging activity from the individual point of view was the collaborative creation of an artefact: a process wherein theory and practice intertwine. This aspect, however, was not as strongly represented when considered from the perspective of the study circle. This activity is a significant part of the learning process, as its goal is to make learning deep-oriented (Aarnio and Enqvist 2016). However, the students experienced different challenges as individuals and as a part of learning communities. Some participants mentioned that self-evaluation and finding gaps in their thinking were challenging.

Reflections and self-evaluations on authentic and dialogical knowledge construction
The aim of the second research question was to deepen our knowledge of how student teachers reflect on and self-evaluate their authentic and dialogical knowledge construction in a mobile learning process (Cornerstones B and C). The data consisted of the answers to the online questionnaire and students' self-evaluations.

Students formulated authentic learning tasks (B1) on the basis of their personal work-related experiences and competences. In other words, the learning tasks originated from problems brought by real life and work situations, as this quotation indicates:

> 'First, everyone thought up some questions from their own point of view and then we considered the questions together. The synthesis was influenced by the knowledge and ideas of the members of the study circle and the information we had gathered.'

Most of the students considered it easy to formulate open questions on the basis of the study module's learning goals, as the following quotation indicates: 'Information and questions were constructed as if using building blocks. First everyone provided information about a particular section, then the others asked questions about it.' In addition, the competence requirements of professional teachers were mentioned as items used to formulate open questions.

The next activity of the DIANA model (B2) focused on using authentic sources in the creation of artefacts and content. Drawing on one's own experiences, skills and knowledge was considered important for authentic learning by the participants. When they searched for, used and shared authentic information sources on the blog, a sense of community was widely felt and the participants felt that their knowledge and perspectives expanded. What makes collaborative learning meaningful is the community that, through the skills, knowledge, and responsibility of its members, aims to achieve a certain goal (cf. Lave and Wenger 1991; Wenger 1998).

Most of the students considered that the role of mobile devices and applications in their learning process was crucial. They also reported that such applications were inspiring and user-friendly; in addition, some stated that their information literacy skills had improved considerably through using them effectively. The results revealed that mobile applications brought new, enriching, and empowering aspects to collaborative knowledge construction: 'Despite geographical locations, intimacy and presence were strengthened as we worked together in mobile environments. Communication and dialogue (were) effortless and seamless during the study module, more frequently than normally.' The concept of openness in learning was seen as a crucial component (Özkan and McKenzie 2008; Iyosi and Kumar 2008). The teacher's open blog was clearly seen as a supportive and inclusive element in the students' learning.

Dialogical problem-solving and knowledge construction in a learning community (C1) helped to create a shared and integrated whole through collective understanding. Dialogical approaches and attitudes were regarded by students as factors that deepened the learning process, and learning in study circles was considered to strengthen this tendency. The skills and competences gained by making inquiries were regarded as the most rewarding part of the dialogical actions. Most of the students also felt that they gained new perspectives, thanks to the various skills and pieces of knowledge shared by the participants of the study circle. As one student reported:

> 'Through dialogue, one learned to think of the topic from different angles that might never have opened up to one otherwise. The knowledge and experiences of the group helped one realise how to use the content in practice when teaching.'

Students constructed knowledge through concrete dialogical activities and thereby engaged in the dialogical progress of work (C2). The core activities were: listening, acting reciprocally, participating symmetrically, and wondering about issues in a constructive way. These are deep dialogical actions (cf. Bohm 2004; Isaacs 1999) and can be interpreted to mean that dialogical skills and competences may be developed through participation in learning communities.

Cornerstone C included dialogical inquiry as a means of problem-solving and content creation (Aarnio & Enqvist 2016). Formulating open questions, active participation, and listening were considered significant sub-skills by the participants (C3). The study circle, where people knew each other and felt safe, created the preconditions for a dialogical approach. As one student reported: 'Fortunately, our study circle has worked together before, so we're not afraid to speak our minds and together we find appropriate solutions. No one needs to feel left out of something.'

Discussion and implications

This study focused on a study module in teacher education that creates opportunities for authentic, dialogical, and collaborative learning experiences while integrating mobile learning technologies with a structured learning design. The results indicate that some of the students had difficulties in achieving an understanding of the concept of authenticity and, therefore, it is important to enhance learner-centred scaffolding and guidance, particularly at the outset of the learning process (see also Aarnio and Enqvist 2016; Ruhalahti et al. 2016; Teräs 2016). In addition, deep-oriented learning through dialogical actions was the most challenging part of using the DIANA model (see also Enqvist and Aarnio 2003). Therefore, methods that

develop dialogical skills and competences should, we suggest, be integrated (e.g., Aarnio 2012) into teacher education as extensively as possible, in order to make collaborative work and problem-solving genuinely dialogical and equal.

Sharing one's experiences, skills, and knowledge within the learning community was considered important for authentic learning and expanding one's perspectives by the participants of this study. It is clear that mobile applications brought new and enriching aspects to collaborative knowledge construction. As a pedagogical model, DIANA proved to be demanding for students; a problem that is closely connected to a lack of dialogical competence (Aarnio & Enqvist 2016). Although dialogical work is challenging, when done effectively, we believe, it helps learners to create a shared whole through shared understanding. Inquiry skills were shown to be the most important dialogical skills and competences, but listening, reciprocity, and symmetrical participation were also considered key.

The piloted study model provides an example of educational openness (Iiyoshi and Kumar 2008) for professional teachers who wish to design, teach, and integrate new open technologies into education, use open content, and transparently construct their knowledge. The results of this study are in line with Aarnio's (2006) findings, which indicated that the learning process requires skilful structuring. In addition, when working with the principles of the DIANA model, teaching in open digital learning environments should be skilfully structured.

Collaborative learning requires a community which, through the skills, knowledge, and responsibility of its members, aims to achieve a certain goal (Lave and Wenger 1991; Wenger 1998). The outcome of the learning process is presented as an artefact and a synthesis of the course themes that have been collaboratively created by the study circle. The results of this study indicate that a sense of community is crucial for the delivery of a shared outcome.

Inevitably, this study does have some limitations related to the researcher's positioning and its potential impact on the research (see Yin 2009). The two primary authors of this study were involved in the design and implementation of the module as well as in the data analysis. Therefore, their assumptions and actions may have influenced the research process, and the results may not be generalizable to other contexts of implementation wherein the researchers did not influence the proceedings so directly (Barab and Squire 2004). The reliability of the study could be enhanced by having someone independent of the study - that is, not working as a course instructor - to analyse the data. In addition, using the students' answers to the questionnaires as a starting point for the collection of further data, through face-to-face or online interviews, would have benefitted this study (see Williams 2005).

The present study deepened our understanding of student teachers' experiences concerning authenticity and dialogical knowledge construction in a learning process. Based on our analysis of the data, this paper argues that such students need to be competent in dialogical activities. Therefore, the sub-skills of such dialogical

activities (e.g. Aarnio 2012) should be integrated more deeply into the processes of teacher training, so that they become deep-oriented skills.

Our next step will be to study how to combine the DIANA model as a learning design and scaffolding model when students are using open learning environments during their learning process and where teachers' scaffolding is needed. We agree that the role of teachers is central in promoting a dialogical knowledge construction and learning culture. In the future, members of the teaching profession will increasingly need more flexible information and skills related to the use of information and communication technology, combined with pedagogical knowledge.

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Appendix

Source: created by the authors.
Original instruments in Finnish; translated into English for publication purposes.

The online questionnaire:
1. Which devices did you use during the study module?
__ PC __ Tablet __ Smartphone __ Other
2. It was not only possible to participate in the course solely on a mobile device, but also on a traditional computer. Which apps did you use on your mobile device?
__ Blogger __ WhatsApp __ Google Drive __ Facebook
3. How did the study circle create authentic questions? How did you use those questions to weave the syntheses?
4. Which were the most demanding cornerstones from an individual point of view?
5. Which were the most demanding cornerstones from the study circle point of view?

Guidelines for the self-reflective account:

How do teacher students reflect on and self-evaluate the accomplishment of authentic and dialogical knowledge construction?

- How did I contribute to the work of my study circle?
- What kind of knowledge and skills did I contribute?
- From the perspective of knowledge creation and knowledge construction, how did I encourage dialogical work in the study circle?
- How could I have improved my actions and behaviours to help us achieve our goals?
- How dialogical was the work of the study circle?
- How would I describe the knowledge constructed collaboratively, compared to the authentic learning questions?

The online learning process and scaffolding in student teachers' personal learning environments

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ABSTRACT

Personal Learning Environments (PLEs) enable lifelong learning and make competences visible in education and professional life. This paper illuminates how to design an online learning process that enables deep learning through PLEs based upon our study of a scaffolding process supported by Web 2.0 tools. Professional student teachers developed their own blogs as PLEs, and we collected data from five student teacher groups. We employed the DIANA pedagogical model to design a dialogical, collaborative, and authentic learning process before comparing its activities against the activities of the five-stage model for scaffolding designed for online learning processes. The results indicate that the DIANA model includes the elements of the five-stage model, and it appears that teacher scaffolding is particularly important in student PLEs. These findings provide insights to other practitioners seeking to design and implement online learning processes that are based on collaborative knowledge construction utilizing students' Personal Learning Environments.

Keywords: online learning; personal learning environment; scaffolding; pedagogy; web 2.0 tools