DETERMINING THE ROLE OF MICRO-LEVEL STRATEGIES IN DEVELOPING STUDENT TEACHERS’ COMPETENCE FOR EDUCATIONAL TECHNOLOGY USE

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Abstract

Teacher training is in a key role to prepare student teachers to use ICT (Information and Communication Technology) and to create a technological supportive learning culture. Teaching practices offer an opportunity to strengthen the competence to use technology in learning. The theoretical framework of this study is based on the SQD-model (Synthesis of Qualitative Evidence) focusing on six micro-level strategies: role models, reflection, instructional design, collaboration, authentic experiences and feedback. The study was conducted with 26 student teachers in their first teaching practice period in Finnish teacher education in Kokkola and their five teacher tutors. The purpose of this paper is to present the quantitative findings relating to student teachers’ and teacher tutors’ perceptions of the importance of the micro-level strategies during the teaching practice. Data was collected during 2018 by Likert- scale questionnaire. The results indicate that there were differences in student teachers’ and teacher tutors’ opinions towards the appearance of the strategies. Mostly, teacher tutors’ perceptions were more positive than those of students. The study argues that these strategies play a major role to student teachers’ development in using technology supported learning. Also, there is a need for further development of teacher training related to pedagogical technology adaption in teaching practices.

Keywords: SQD-model, educational technology use, teaching practice.

1 INTRODUCTION

If we want to understand the future, we need to understand how technologies change it. This statement by Linturi & Kuusi [1] underlines the challenges of today's education; teacher and teacher educators should be able to understand what kind of work opportunities technologies bring, how professions and the skills they require change [1]. We already live in an ardent era for the development of artificial intelligence and it is already in everyday use through mobile devices of all ages.

We need to trust our existing knowledge and ensure that student teachers achieve sufficient technological-pedagogical skills to promote professional development. There is no doubt that digital competence play an important role in the future-oriented mapping of competence. Highly respected Finnish education lies entirely on highly educated teachers [2] and teacher training focuses on educating autonomous teachers who have deep theoretical and practical understanding about pedagogy and teaching methods [3] Technology oriented education has been part of Finnish teacher training for decades ([4], [5], [6], [7], [8]). In the 21st century, with the digital age, ICT skills, and in particular the pedagogical application of its use have become a major part of education (see [9]) Teacher Education has seen a significant role in the training of pedagogical expertise in Finland ([10]).

Our training systems need to be prepared and systemically be organized to educate future-minded, innovative-minded teachers, with the ability to build learning situations that develop problem-solving skills and creative thinking and critical reflection. These are considered as key skills for the future ([11], [2]). Learning new skills is not a simple nor easy process. Lonka ([2]) emphasizes that in order to solve the wicked problems of the modern world we need hybrid expertise that crosses the borders of discipline and are able to understand intelligent technology and the language needed to develop it. Student teachers need to have enough time and possibilities to develop these skills so they can become the teachers, who are at the forefront of how pupils can learn about technology at school and use it in a versatile and innovative way to learn ([12]). Teacher training has to provide student teachers with the ability to use technology pedagogically to enhance pupil's extensive knowledge and Tondeur ([13]) emphasized the integration of new technologies and teaching practices is an integral part of teacher training. Teacher trainings’ role to develop supportive environments that facilitate reflection about the role of new technologies in learning, is unquestioned ([14]). A number of recent Finnish
researches have focused on the ways in which teacher training promotes the technology skills of teacher students ([9], [15]).

To develop student teachers’ ICT competencies, there are different strategies for implementing this: educational technology courses, method courses and field experiences ([16]). The use of technology and understanding about its pedagogical application is integrated into teaching through the different disciplines and study modules in the teacher training at the Kokkola University Consortium Chydenius ([17], [18]). The goal of this integration is to promote the understanding about student teachers according to the TPACK-model ([19]). Teacher training ensures both students’ technological skills, pedagogical understanding and application of technological-pedagogical knowledge to content and context. By this, we seek to enhance student teachers’ understanding about technology supported learning. Combining theoretical and student's developing technology skill into practice takes place in teaching practice (see [20]). Meisalo et al ([8]) stresses that during their teaching practice, student teachers should learn to use ICT as a support to the theories of education, pedagogy and learning while analyzing and developing their own pedagogical approaches to teaching the subjects. Teaching practices have an important role to play in the professional development of the teacher student and in the refinement of learning and teaching skills (see [21]). Student teacher work together in small groups and get daily guidance from the teacher tutor. In this article, we define teacher tutor to represent teachers who carry responsibilities for supervising student teachers on teaching practice ([22]). According to the study of Lawson, Cakmak, Guenduez & Busher ([23]) student teacher benefit from the collaboration with teacher tutor, technology support and peer and tutor observation. Herewith, the student teachers can put their knowledge of theory into practice ([8]). The SQD-model ([14]) presents six micro-level strategies which have a positive association according to study of Tondeur et al, ([14]) for the development of student teachers ICT competencies: role models, reflection, instructional design, collaboration, authentic experiences and feedback. Tondeur ([13]) sees the key to the implementation of these six micro strategies as teacher design teams (TDT), which emphasizes collaborative ICT-rich curriculum design. TDT is defined as a group of teachers, student teachers and teacher educators.

In our previous research ([17], [18]), we have explored how training in the use of technology and the teaching of the pedagogical application of technology is integrated into our adult teacher training. We argue ([17]) that technology supported pedagogy is indeed an important educational element that needs to be part of teacher training. According to our earlier study ([18]) student teacher need to be challenged to use new technologies for transformative learning purposes. It is equality important for the student to develop their own technology competencies as to challenge them to integrate technology in authentic learning as situations during their teaching practice periods (see [8]). Teacher educators need to have skills needed to integrate technology into the curriculum they teach ([24]). Teacher training should be planned to address teaching and learning with technology throughout the curriculum. During their teacher training studies our student teachers are systemically guided to practice and deepen their pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK) and technological pedagogical content knowledge (TPACK). The aim of this is that they become to understand technology integration to teaching and learning as autonomous professionals on the basis of TPACK -model ([19], [15]). Student teachers are guided through their studies to understand how the authentic learning task can be bridged to challenge students to create learning tasks which integrate technology in transformative ways ([25]). Still only by combining theory and practice deep professional competence can be formed. Teaching practice should provide opportunities for the development of the student's pedagogical technology skills in relation to learning and the planning and implementation of learning.

The theoretical background to this study is SQD model to prepare pre-service teachers to integrate technology into their future classroom. The model consist of twelve key themes related to the preparation of preservice teachers that were found as a synthesis findings by Tondeur, van Braak, Sang, Voogt, Fisser & Ottenbreit-Leftwich ([26]). We focus on the six micro–level strategies of the SQD model during teaching practice: 1) using teacher educators as role models, 2) reflecting on the role of technology in education, 3) learning how to use technology by design, 4) collaboration with peers, 5) scaffolding authentic technology experiences and 6) continuous feedback ([26]). By following the role model (1), the student can observe ways to work in the classroom, but in order to transfer skills to his / her own teaching, he / she should discuss and reflect on (2) the integration of technology into learning contexts. Planning learning and teaching situations (3) on the basis of the curriculum is an important element in the student's ability to develop and group planning and working (4) to promote courage in the transformative use of technology and reduce the sense of uncertainty. Authentic learning contexts (5), which are proven in the practice of teaching, are important for the
implementation of the plan, and continuous formative feedback (6) utilizes the student's professional
growth in a proven way. ([26], [27].)

According to the recent study ([14]) the more student teachers perceive the occurrence of the
strategies during their teacher training, the higher their perceived competence to use ICT for learning
processes and to strengthen their instructional practice. Thus, the guidance and structure of teaching
practice can have a positive impact on the student's professional development by identifying the
strategic activities and control items presented by the SQD model under guidance. Tondeur et al ([14])
propose that research should stress the role of training institution and in this study the role of
institution is focused on teaching practice.

This study has the potential to contribute to both theory and practice. Theoretically, the findings could
provide additional insights on the role of teacher education institutions to support teacher students to
plan and integrate technology in the classroom. Notably, necessary knowledge and skills needed to
model technology use for teacher students ([26]). In addition, this study shows that in practice, the
support and guidance given to teacher students play an essential role, and the teacher tutors should
be able to show and guide student teachers in the use of technology. The results of this study would
be useful to teacher educators, training schools and teacher students in empowering and improving
the practices and professional development. Teaching methods used in teacher training should be
based on research and the development of competencies required by the teacher's profession and the
working methods provided by the training should also be theoretically justified and researched ([25]. In
our teaching practices it has become notable that student teacher integrate technology in the planning
of the teaching quite seldom (see [28]). We were interested in studying, what might be the reasons for
lack of technology-based lessons during practices ([29]) in our teacher training. There is not much
evidence of transfer technology -pedagogical competence in teaching practices.

2 METHODOLOGY

The purpose of this paper is to present the quantitative findings relating to student teachers’ and
teacher tutors’ perceptions of the importance of the micro-level strategies during the teaching practice.
Systematic strategies have been proven to be in the important role of supporting student teachers to
integrate technology ([27]). The SQD-model presents the framework for such as analysis. This
research focuses on the contribution that SQD-model has on student teachers’ practice. The study
addresses the following research question: How much the six domains of micro-level strategies were
in use during the teaching practice?

The context of study was a Finnish teacher training at the Kokkola University Consortium Chydenius,
Finland. The teacher education curriculum of Master studies contains several practices during two
years long studies. After three months, coursework student teachers have the first teaching practice
(four weeks, 5 credits), which aims to encourage using ICT in learning and teaching. Student teachers' 
technological competencies has been taken into account in the teacher training as described earlier.
Student teachers work in small groups during practice in the same permanent class guided by teacher
tutor. Currently, the role of ICT is emphasized in the Core Curriculum for Basic Education where ICT is
one of the transversal competencies. Transversal competencies are always taught, studied and
assessed as part of the different subjects ([30]). Student teachers are expected to use ICT for
engaged learning with pupils in their learning process and learn technological knowledge about
effective integration. The training school is a new school building with open learning environments and
new technology. The school is profiled as a technology-oriented school and pupils have personal
devices at their disposal. Teacher tutors are involved in two broad programs of innovative pedagogy,
one of which is the international NPDL (New Pedagogies for Deep Learning) program ([31]). The other
one is the Development School Network Majakka ([32]), which is an extensive network of cooperation
at national level. The aim of both is to renew the school culture and pedagogy, which aims to prepare
pupils to act in a digitalizing world.

Participants in the study were teacher training student teachers (N=26) and teacher tutors (N=6) at the
primary school involved in teaching practices. Each teacher tutor had three or four student teachers in
his/her class during the practice. All participants were given an URL to access the online survey
questionnaire. The participants who completed the questionnaire gave implicit consent and they
completed the questionnaire anonymously. Participation in this study was voluntary. All the student
teachers involved the practice and six of nine teacher tutors responded to the questionnaire. Data was
collected by the online questionnaire after the four week long teacher practice period in the spring of
2018. The data sources included the SQD scale ([27]). The questionnaire used with teacher tutors
was adapted from SQD-model questionnaire to enable them to answer questions from their point of view. The SQD scale included six significant domains of the micro level with 24 statements, which were translated into Finnish. Respondents rate each statement on a six-point Likert scale: (1) totally disagree, (2) disagree, (3) slightly disagree, (4) slightly agree, (5) agree and (6) totally agree. Cronbach’s Alpha was used as to estimate for scale reliability. Each of six domains showed good reliabilities: Role model (α=0.884), Reflection (α=0.829) Instructional design (α=0.826), Collaboration (α=0.662), Authentic experiences (α=0.775) and Feedback (α=0.931). Quantitative data was analyzed via SPSS statistical analysis software. We ran an exploratory factor analysis (EFA) on the total sample. Using the scale in a new context and in another language should be proven ([33]). Each micro level strategy contains four statements whose functionality was tested by the principal component analysis included in the factor analysis. The test was made with the extraction method (not rotation varimax), because the statements of each domain correlated quite strongly (see table 1.).

### Table 1. Factor scores.

<table>
<thead>
<tr>
<th>Domains</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role model</td>
<td>0.764</td>
<td>0.895</td>
</tr>
<tr>
<td>Reflection</td>
<td>0.534</td>
<td>0.834</td>
</tr>
<tr>
<td>Instructional design</td>
<td>0.731</td>
<td>0.913</td>
</tr>
<tr>
<td>Collaboration</td>
<td>0.525</td>
<td>0.822</td>
</tr>
<tr>
<td>Authentic experiences</td>
<td>0.704</td>
<td>0.847</td>
</tr>
<tr>
<td>Feedback</td>
<td>0.719</td>
<td>0.892</td>
</tr>
</tbody>
</table>

### 3 RESULTS

This section reports the results which cover participants’ perceptions towards SQD. Quantitative findings primarily highlight the results of descriptive statistics with mean values and correlation between subscales. Spearman’s Correlations relative to the whole data were very high in both questionnaires. The data of student teachers’ showed that the greatest significance was in feedback (=.884) and authentic experiences (= .774). In the data of the teacher tutors Spearman’s Correlations were the highest in feedback (=.949) and authentic experiences (=.975). Spearman’s Correlations were the lowest in collaboration in student teachers’ data (=.455) and in teacher tutors’ data on reflection (=.580). This differs from others, so the importance to the whole is less clear and straightforward. The responses of teacher tutors’ and student teachers’ were compared. The results are presented in tables and figures to show differences more clearly.

#### 3.1 Students Teachers’ and Teacher Tutors’ Perceptions toward

Descriptive analysis indicates participants’ different perceptions towards SQD. Table 2. shows that teacher tutors perceptions towards SQD were more positive than student teachers’ perceptions. Teacher tutors responded very high scores ($M=4.9$) in all six main domains and student teachers mean was much lower ($M=3.4$).

### Table 2. Mean ($M$) values of six main domains in SQD model.

<table>
<thead>
<tr>
<th>Domains</th>
<th>Student teachers</th>
<th>Teacher tutors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role model</td>
<td>3.1</td>
<td>4.7</td>
</tr>
<tr>
<td>Reflection</td>
<td>3.6</td>
<td>5.2</td>
</tr>
<tr>
<td>Instructional design</td>
<td>3.0</td>
<td>4.8</td>
</tr>
<tr>
<td>Collaboration</td>
<td>4.4</td>
<td>5.2</td>
</tr>
<tr>
<td>Authentic experiences</td>
<td>3.6</td>
<td>5.3</td>
</tr>
<tr>
<td>Feedback</td>
<td>2.8</td>
<td>4.1</td>
</tr>
<tr>
<td>Mean</td>
<td><strong>3.4</strong></td>
<td><strong>4.9</strong></td>
</tr>
</tbody>
</table>
In the responses of teacher tutors and student teachers, the differences between the means were high in all six domains. In teacher tutors’ responses, the mean was always over 4, whereas in the student teachers replies only collaboration mean over 4. The study relieved that authentic experiences, collaboration and reflection were the most commonly used strategies. In student teachers’ responses, collaboration became the most important strategy, while teacher tutors emphasized authentic experiences. Both groups of respondents felt the feedback to be the least common strategy.

3.1.1 Role model

Analysis of using teacher educators as role models indicates some differences between student teachers’ and teacher tutors’ perceptions (see Fig. 1). When looking at the means, the student teachers responded that they saw the role model quite a bit (M=3.1), when the teacher tutors thought that they were acting as a role model abundantly (M=4.7). The student teachers (M=2.9) think that they had not seen many examples of ICT use in an educational setting (ROL1), but the teacher tutors felt they had shown them (M=4.5). The parallel difference was at the statement (ROL3) where, according to the student teachers’ answers, they had not seen the good examples of ICT practice that inspired them to use ICT in their classrooms (M = 3) when the teacher tutors replied that they had shown these examples (M = 4.7). There was also a big difference in the responses related to statement “The potential of ICT use in education was demonstrated concretely”, where student teachers’ mean was 3.0 and teacher tutors’ mean was 5.2.

![Role model](role_model.png)

**Figure 1. Role model.**

3.1.2 Reflection

Figure 2 shows that according to student teachers there was less reflection on the role of technology in education than teacher tutors thought. At least both respondents think that they had the opportunity to reflect on the role of ICT in education (REF1). The biggest differences were the opportunities to discuss the challenges of integrating ICT into education (REF2). The student teachers had discussed them a bit (M = 3.3) when teacher tutors responded more positively (M = 5.3). Teacher tutors (M = 5.7) felt much more likely to have opportunities to discuss general attitudes towards ICT in education (REF4) than student teachers (M = 3.7).
3.1.3 Instructional design

There were (see Fig.3) considerable differences between the respondents in using this strategy. Teacher tutors (M = 4.8) think that they had provided support for the designing lessons that integrated ICT (DES1) when students felt they had received it less (M = 3.0). Particularly, in guidance how to integrate ICT into lessons (DES2) showed great differences: student teachers’ mean was 2.6 and teacher tutors’ mean 4.8. The significant difference was in the statement related to developing ICT-rich lesson (DES4).

3.1.4 Collaboration

The perceptions of collaboration with peers were similar, even teacher tutors were more positive also in this strategy. For this strategy, student teachers’ respond to be above mean 4 in all statements. Student teachers (M=4,4) and teacher tutors (M=5,2) thought that ICT in education was used together with peers (COL1). Student teachers helped each other to use it (COL3) and shared experiences.
3.1.5 Authentic experiences

As shown in Figure 4, student teachers’ perceptions on scaffolding authentic technology experiences differed quite much from teacher tutors’ views. The student teachers did not think they had enough opportunities to test different ways of using ICT in the classroom (AUT1) and the student teachers’ experiences differed (M = 3.6) from the views of the teacher tutors’ (M = 5.3). Student teachers strongly believed that they had not learned to use ICT in the classroom (AUT2) during the practice (M = 3.3), while the teacher tutors responded that had happened (M = 4.8). Most positively, both respondent groups saw encouragement to use ICT in an educational setting (AUT4) with the means of 4.0 and 5.5.

![Figure 4. Authentic experiences](image)

3.1.6 Feedback

The differences between student teachers and teacher tutors are highlighted in Figure 5. Feedback strategy was attributed the lowest scores of all six strategies by student teachers (M=2.8) and teacher tutors (M=4.1). The teacher tutors (M = 4.5) were, in their opinion, giving enough feedback to the use of ICT in lessons (FEE1), but student teachers did not respond to received sufficient feedback. The student teachers did not think that they had received feedback on the use of ICT (M = 3.3). Similarly, the feedback on the development of their own ICT competencies (FEE3) was more needed by the student teachers (M = 2.6), when the teacher tutors think that they had given it (M = 4.2).

![Figure 5. Feedback](image)
4 CONCLUSIONS

Returning to the question posed at the beginning of this study, it is possible to state that the six domains of micro-level strategies during the teaching practice were used much more from teacher tutors’ point of view. However, these results were not very encouraging. Student teachers’ and teacher tutors’ perceptions of SQD-model strategies do not meet. As we have argued, student teachers will receive new and up-to-date information and skills during their teacher training on the use of TPACK technology and integration for learning and teaching ([17], [18]). Teacher tutors’ competencies, on the other hand, are based on their own professional skills, their school's ICT operating culture and possible continuing education. A possible explanation for these results may be the lack of the adequate knowledge and coherent practices of ICT pedagogical integration into learning. The study shows that the teacher tutors need to be familiarized with the student teachers' ICT skills and with the TPACK model in order to support the student teachers' skills to integrate technology into teaching which is based on the TPACK model ([19]).

This study examined the impact of student teachers’ and teacher tutors perceptions toward the SQD model strategies in teaching practice. The study relieved that authentic experiences, collaboration and reflection were the most commonly used strategies. Giving student teachers the opportunity to receive authentic experiences is an important way in which they can be trained to use technology ([29], [27]). In the real classroom with pupils’ student teachers can experience effective technology use, but they also need teacher tutors to show them how technology can be used in an innovative pedagogical way. Observing a teacher tutor using technology with pupils is an important motivator for student teachers to integrate technology into their own practices ([34]). Perception of student teachers indicated that collaboration with peers is very important strategy, which was possible because of working in small groups. Learning how to use technology by design, the results showed great differences. A possible explanation for lack of using technology in practice, might be that according to student teachers, the support for planning teaching and learning was inadequate. These findings seem to be consistent with ICT-rich lessons planning according to the TDT-model ([13]) TDT-model could be the solution to reduce the gap between student teachers and teacher tutors. This finding may help us to understand that student teachers benefit by observing peers, sharing experiences using ICT and helping each other to use ICT in an educational context. One of the issues that emerge from this finding is the importance of peer groups. Strong views about collaborative learning tend to have high correlation to the willingness to develop and reflect their own pedagogical practices ([27]).

Feedback was the least common strategy although the difference between the respondents was high. This result agrees with the findings of other studies (see [35]), in which feedback strategy was attributed the lowest scores. This finding is not unexpected even though it is showed by many studies that feedback has an important role in the professional growth of student teachers ([27], [13]). So the study leads to reflect how to promote feedback that supports the student teachers’ ability to integrate ICT. There should be a seamless continuum between teacher training and teaching practice in order to achieve the goal of educating teachers with transversal competencies ([20]). Examining teacher tutors’ and student teachers’ perceptions of SQD-model, this study showed a substantial gap. To reduce the gap, the strategies included in the SQD-model should be known highly in the teacher training ([35]). That means that teacher tutors need to be educated to master these strategies particularly during student teachers’ practices. The influence depends on how these strategies are implemented not only in teacher training regarding teacher students, but also in teacher tutors’ training to systematically support their ability to guide teacher students to integrate ICT in learning situations. The relevance of the important role of teacher tutors is clearly supported by the current findings. The involvement and influence of the teacher tutor are relevant factors.

This study has shown that that design did not take sufficient account of the integration of technology into teaching as well as the organization of authentic learning experiences. It is therefore understandable that there has not been much feedback discussion about it. The high use of these strategies by teacher tutors in their responses is a remarkable result. The contradiction between the results leads us to consider what teacher tutors consider good and sufficient as a technology integration. This study has been unable to explain reasons for the extent of the differences. The further study with more focus on the reasons is therefore suggested. The results of this study may not be generalizable because of the limited sample. However, modelling a common instrument to measure the strategies both from teacher tutors’ and student teachers’ point of view is valuable. The study has gone some way towards enhancing our understanding about the strategies that teacher training needs to take into account regarding the development of teacher students’ ICT competencies supported by the teacher tutors during teaching practices. Teaching practices, which are organized by
teacher educators, are integral part of teacher training. The ICT competencies of teacher educators plays an important role. Thus, it is significant that teacher educators are aware of twelve competencies (TETCs) that comprise the knowledge, skills and attitudes all teacher educators need in order to best support student teachers in thinking about the integration of technology ([31]) and educate teacher tutors to become familiar with these competencies.

REFERENCES


3693


