Student teachers' changing and enduring perceptions on teachers' knowledge

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Abstract

This article investigates how technology becomes part of a teacher's overall pedagogical content knowledge across the curriculum. It is shown that though previous technology knowledge predisposes student teachers to more favourable perceptions of technology as part of what good teachers should know, an enhancement in the frequency of use of technology does not always lead to revision of the one's conceptions of the role of a teacher. An enhancement in the perception of the command of ICT significantly favours the inclusion of technology as a component of good teachers' knowledge. It is argued that student teachers' educators should explicitly guide student teachers in the revision of their perceptions of what a good teacher knows and does so student teachers develop a technology pedagogical content knowledge framework.
Keywords: teacher education, TPACK, technology literacy, professional beliefs, teachers' knowledge

Concepțiile superficiale şi permanente ale viitorilor dascăli asupra cunoştințelor unui dascăl

Rezumat

Articolul analizează felul în care tehnologia devine parte integrantă din corpul cunoştințelor pedagogice ale unui dascăl. S-a demonstrat că, deşi cunoştințele tehnologice anterioare predispun viitorii dascăli spre o opinie favorabilă despre tehnologie, utilizarea cât mai frecventă a acesteia nu rezultă în revizuirea concepțiilor referitoare la rolul dascălului. Optimizarea felului în care viitorii dascăli percep propriile abilități tehnologice favorizează semnificativ includerea tehnologiei ca parte a practicii şi cunoştințelor unui dascăl. Se susține că mentorii viitorilor dascăli ar trebui să îi încurajeze pe aceştia din urmă în revizuirea concepțiilor lor despre ceea ce un bun dascăl cunoaşte şi face pentru a dezvolta un cadru de cunoştințe favorabil unui conținut pedagogic tehnologic.
Cuvinte cheie: educația pedagogică, TPACK, cunoştințe tehnologice, concepte profesionale, cunoştințele dascălilor.

1. INTRODUCTION

Student teachers enrolled in a pre-service teacher education program have certainly spent a significant time of their lives in classrooms at school and university. They have memories, assumptions and beliefs of what good and bad teachers are and do (Kane & Russell, 2005). It is not unexpected or problematic that student-teachers' beliefs and preconceptions are formed as a result of their socialization as students (Kane, 2002). What should raise concern among teacher educators is the „enduring nature of student-teachers' beliefs and preconceptions, formed predominantly without understanding of pedagogical principles and theories". (Kane & Russell, 2005: 350).

The main objective of the present paper is to inquiry into how technology becomes part of a teacher's overall pedagogical content knowledge across the curriculum. We investigate the relationship between pre-service teachers' beliefs regarding what a good teacher should know and their perceived technological literacy. It is arguable if self-reported literacy corresponds or not to actual literacy, but the central point here is how student teachers' perception of their own technology skills influences their understanding of what a good teacher should know and do. In this present paper, we observe how changes in student teachers' perception of their own abilities – perception of themselves in relation to technology – influence what they consider to be a good educator.

2. LITERATURE REVIEW

Teacher perceived technology literacy has been identified as a condition for teachers to use technology (Zhao & Cziko, 2001) and the lack of such perceived abilities has been described as an obstacle to the introduction of ICT in schools (Ely, 1993; Pelgrum, 2001; Smeets et al, 2001). Resistance to change, teachers' attitudes, training, time, access and cost are major issues identified in the literature as barriers for the implementation and integration of technologies in classrooms (Fabry & Higgs, 19997). Notwithstanding, it is now undeniable technologies are here to stay (Mishra & Koehler, 2006). Teacher educators should then support their student teachers in the development of technology literacy, as they develop a sense of how such technological knowledge integrates content and pedagogical knowledge bases. The desired outcome is that student teachers develop a deeper understanding of the complex web of relationships between content, pedagogy and technology, and the contexts within which they function (Mishra & Koehler, 2006).

In the Technological Pedagogical Content Knowledge (TPCK) framework, Mishra and Koehler (2006) emphasize the connections, interrelations, affordances and constraints between knowledge of content, technology and pedagogy. Figure 1, elaborated by Mishra and Koehler, presents the three pivotal areas of teacher knowledge: Content (C); Pedagogy (P), and Technology (T). Three overlapping areas are created in the interrelation among them: Technological Content Knowledge (TCK), that refers to knowledge of the manner in which the subject matter can be changed by the application of technology; Pedagogical Content Knowledge (PCK), that is the type of knowledge that allows teachers to select most appropriate approaches and techniques for specific aspects of the subject matter and to identify which of the latter need more pedagogical attention; and Technological Pedagogical Knowledge (TPK), which involves the necessary skills to change and/or adapt in creative ways both technologies and traditional pedagogical practices. Finally, in the central area that organically integrates all areas of teacher knowledge, Technological Pedagogical Content Knowledge (TPCK), all types of knowledge considered above are interwoven. Professionals who develop this type of knowledge see both teaching and learning in different ways content, pedagogy and technology experts usually do.

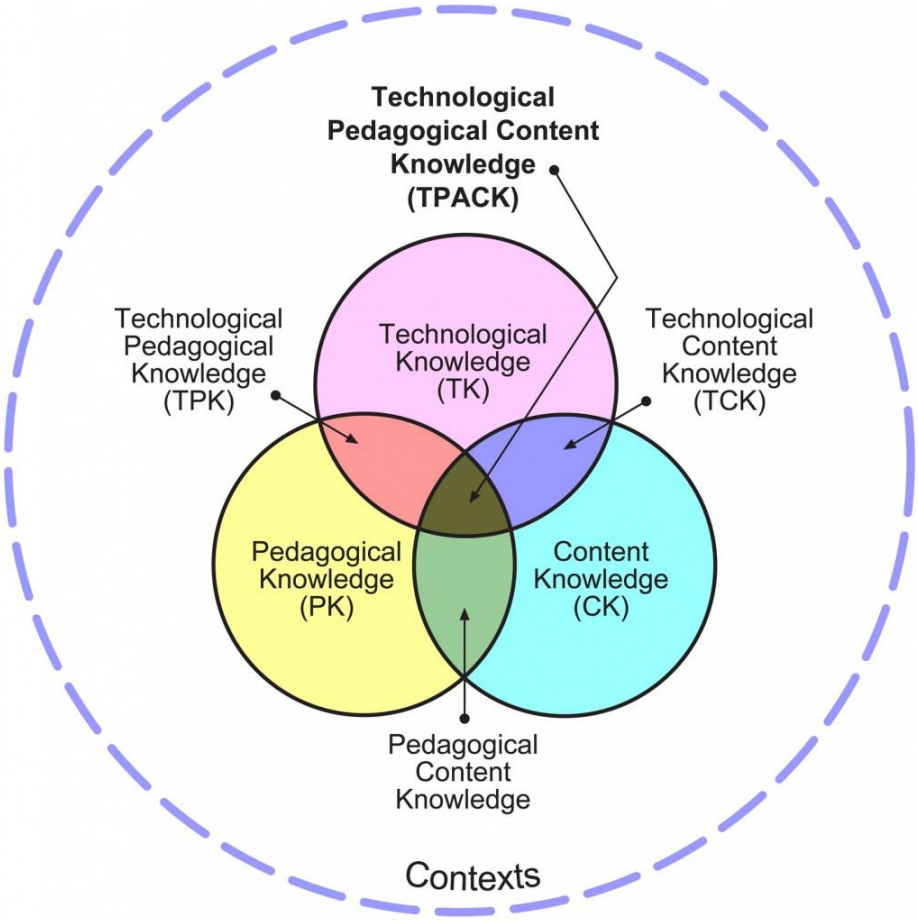

Figure 1: Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge framework (image available at http://www.tpack.org).

Reconceptualization of 'literacy' in the digital age reshapes the values, attitudes and beliefs that underpin teachers' notions of professional identity (Mc Dougall, 2009). Teachers' attitudes and beliefs toward technology are of great importance in their decisions to adopt and frequently use technology in the classroom (Russell et al., 2003; Niess, 2005). Hammond et al (2009) found that student teachers who made good use of ICT made a clear association between the use of ICT and the idea of a good lesson. One of the conclusions of the study was that the key factor influencing student teachers' decisions to use ICT was a belief that such use made a difference to their lessons and that pupils would respond positively to it.

A favorable perception of technology as a teaching component, however, does not translate unequivocally in the introduction of technology in the classrooms. In a study developed by Smeets (2005), most teachers valued the potential contribution of ICT to the learning environment as quite large, but employed limited methods to adapt education to the need and abilities of individual students.

3. METHOD

3.1 Context

This study was carried out among student teachers taking part in a three year teacher initial training program. More specifically, participants were enrolled in the course New Technologies Applied to Education, which stands in the final semester of the training program curriculum. The course was taught by one of the authors of this paper. It counted with an active enrollment of 164 students, who participated in theoretical seminars in two separate groups and were split into 8 groups for practical work in the Education Faculty's technology laboratories. The course lasted 15 weeks and a complete account of it, including syllabus and evaluation procedures, can be found in de Oliveira et al. (2009).

As a self-study that aims to contribute to broader understanding of the pedagogies of teacher education, the present research should address the dual role of the author/teacher in her relationship with the students (Grossman, 2005). All students enrolled in the course New Technologies Applied to Education 2008/2009 were invited to take part in the survey. They were informed participation would bear no relationship with their grades and their data would be treated with confidentially. Volunteers completed the survey online, in their personal time, that is, no class time was used to that aim. Out of the 164 student teachers invited to participate, we finally had 65 participants, a response rate of 39.6%. Though 137 students answered the questionnaire at least once, only those students who took both the initial and the final questionnaires and completed both of them thoroughly were accounted as participants in the study.

3.2 Participants

3.2.1 Demographic profile

There were 54 female and 11 (65 participants) male student teachers who chose to take part in the survey. The gender imbalance is not surprising given that, historically, teacher training programs in the Education Faculty of our university are predominantly taken by women. 36,4% of participants were aged 20 years, 48,4% were aged 21–25 years, 10,5% were aged 26-30 years and 4,7% were over 30 years of age.

3.2.2 Teaching experience

69,9% of student teachers reported having some teaching experience apart from their curriculum practices and 30,1% reported not having it.

3.2.3 Use of ICT

Most of the participants had full access to ICT: 00% reported having access to a computer in their studying spaces in and out of the university and 94,5% reported having regular access to the Internet. 83,6% of the respondents had had a computer for more than 2 years and 67% also had had access to the Internet for more than 2 years.

3.3 Design

The study used a quantitative method to the collection of data using web based self administered questionnaires. We then proceeded the qualitative coding of answers to the one open question in the instrument using the TCPK framework for labeling answers. Such a design entailed analysis of student teachers' self-reported literacy in relation to TCPK framework both at the beginning and at the end of the course New Technologies Applied to Education.

3.4 Procedure

3.4.1 The instrument

A validated questionnaire used by Romero (2008) was adapted for the present research. The resulting questionnaire collected participants general information – such as student teachers' gender, age, years of teaching experience, etc. – and consisted of 45 Lickert scale items (valued in a 1 to 6 scale) presenting students with different technology literacy indicators and frequency of Information and Communication Technology use.

Participants completed surveys twice, once at the beginning of the course and once at the end. The surveys were stored in the course's Moodle space in university the virtual campus. Moodle is an open source free course management system which can be used to help educators create effective online learning communities. In the case of the course New Technologies Applied to Education, apart from the storage of this study's survey, Moodle was used to maintain links to the bibliography students should read, to make available web links where students could find extra online information, to keep constant communication both between teacher-students and students-students, to manage organizational aspects in general (task delivery, examination calendar, etc), to centralize information (on evaluation performance indicators, for example), to continue discussions initiated in class (forums) and to organize online databases fed by the students (online educational videogames, Web pages and blogs of interest).

3.4.2 Coding the student's answers to the open question

We initially used the TPCK framework for coding students responses to the open question „In your opinion, what should a good teacher know?". All responses, both in the initial and in the final questionnaire, were analyzed and then categorized into three categories: content (C), pedagogy (P), and technology (T). Coding categories were not mutually exclusive. Responses could receive a combination of these codes, for example, if the response was about technology and pedagogy (TP), or about technology, pedagogy and content (TPC), and so on.

In a second stage, we contrasted students initial responses with their final ones and classified them in four groups: in the first group (G1), we found students whose perception of what a good teacher should know was unchanged and unrelated to technological knowledge; in the second group (G2), we grouped students whose perception of what a teacher should know changed, but technological knowledge was still not a part of that process; in the third group (G3), we found students whose initial perception of what teachers should know did not include the knowledge of technology, but that in their final response address technological knowledge; finally, in the fourth group (G4), we found students who both in the initial and in the final questionnaires perceived technological knowledge as part of what a good teacher should know. No student reported the development of negative perception toward the integration of technology in education.

4. RESULTS AND DISCUSSION

The main objective of the present paper is to inquiry into how technology becomes part of a teacher's overall pedagogical content knowledge across the curriculum. We will now address the research questions that motivated the present research.

4.1 Is technology part of student teachers preconceptions of what a good teacher should know?

Table 1 shows data analysis of the questionnaire's open question performed as described above. It shows that at the beginning of the course, 16.9% of the student teachers perceive technology as part of the knowledge good teachers should have. Toward the end of the course, these students were joined by those students who, though not initially mentioning technology, did mention it in the final questionnaire as part of the knowledge base of a good teacher. Once students had finished the

course, therefore, those who perceived technology as part of what a good teacher should know accounted for 52.2% of the course enrollment.

Table 1 Student teachers categorization according to their perception of what good teachers should know

Category group	Participants (%)
G1 - Students whose perception of what a good teacher should know was unchanged or alien to technological knowledge	6 (9.2%)
G2 - Students whose perception of what a teacher should know changed, but technological knowledge was still alien to that process	25 (38.4%)
G3 - Students whose initial perception of what teachers should know did not include the knowledge of technology, but that in their final response address technological knowledge	23 (35.3%)
G4 - Students who both in the initial and in the final questionnaires perceived technological knowledge as part of what a good teacher should know	11 (16.9%)

4.2 Among students who perceive technology as part of what good teachers should know, how does this technological knowledge relate to content and pedagogical knowledge bases?

Students in G3 (n=23) and students in G4 (n=11) perceived technology as part of what good teachers should know. Table 2 presents their responses analysis regarding the type of intersection, if they perceive one, between technology, content and pedagogy. For G3 we only have data for their final answers. We see that 65,1% of the students end the course considering Pedagogy as a knowledge basis that should be integrated to technology. Only 30,4% of the participants see Pedagogy, Technology and Content should be integrated. In G4 we see how the initial dispersion changes into a perception of Technology as a knowledge basis which should be integrated to Pedagogy and/or Content. As G4 students already considered technology as part of what good teachers should know, during the course they had the opportunity to think it over under richer grounds and develop more integrated perceptions of the educational potential of technology.

Table 2 Student teachers' perceived intersection between technology, content and pedagogy

	Group 3 (n=23)	Group 4 (n=11)	
	Final Questionnaire	Initial Questionnaire	Final Questionnaire
TK	7 (30.4%)	4 (36.3%)	-
TCK	1 (4.3%)	2 (18.1%)	-
TPK	8 (34.7%)	3 (27.2%)	3 (27.2%)
TPCK	7 (30.4%)	2 (18.1%)	8 (72.7%)

4.3 How do student teachers' preconceptions change, if they do at all, in relation to the enhancement of technology literacy?

Tables 3 and 4 present students' perception of their ICT literacy at the beginning and at the end of the course, grouped according to their perception of what good teachers should know. Table 3 shows students' answers when asked to value their general command of the computer and Table 4, how frequently they used ICT in their professional and academic lives.

Table 3 Students' answers when asked to value their general command of the computer at the beginning and at the end of the course, grouped according to perception of what good teachers should know

	G1		G2		G3		G4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Initial questionnaire (I)	3,33	0,5	3,63	0,9	3,5 (mode 4)	1	4,13	0,6
Final questionnaire (F)	3,83	0,75	4,21	0,77	4,4	0,5	4,43	0,5
Difference between I and F	0,50		0,58		0,9		0,3	

Mean= Arithmetic average. SD= Standard deviation. Mode= the value that occurs the most frequently in a data set

Table 4 Students' answers when asked how frequently they used ICT in their professional and academic lives, grouped according to perception of what good teachers should know

	G1		G2		G3		G4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Initial questionnaire	3,83 (mode 6)	2,4	4,74	1,1	4,83	1,1	5,13	0,75
Final questionnaire	4,83	0,75	5,33	0,7	5,25	0,9	5,53	0,6
Difference between I and F	1,0		0,59		0,42		0,40	

Mean= Arithmetic average. SD= Standard deviation. Mode= the value that occurs the most frequently in a data set

Students in G4, who report the lowest enhancement of frequency of use of ICT (0,3 difference between initial and final questionnaire in Table 3 and 0,4 in Table 4) were those who initially most frequently used technology and had the highest command of the computer both initially and at the end of the course. In other words, students in G4 present only modest enhancement of perceived technological literacy and frequency of ICT use. They are those who both initially and once they had finished the course considered technological knowledge as a component of good teachers' knowledge.

Students in G1, who increased the most the frequency of ICT use as a professional and academic tool (1,0 difference between initial and final questionnaire in Table 4) are not those who report the highest enhancement in their learning. Students who report the highest enhancement of their command of the computer belong to G3 (0,9 difference between initial and final questionnaire in Table 3).

However students in G1 perceive their computer command as the lowest (3,33 in Table 3) and report using ICT less frequently than the other groups (3,83 in Table 4), they are those who increment the most the frequency of use of ICT (1,0 difference between initial and final questionnaire in Table 4), probably to cope with the course assignments making up for low technological literacy. Thus, G1 students work the hardest, but they still do not see technology more transcendentally, as part of good teachers' knowledge. In other words, at the end of the course, G1 students perceive their technological literacy as more developed than at the beginning, but they still

are not able to revise their perception of what educators do or know. It was possible to break G1 students in technology, but their enduring perceptions on pedagogical content knowledge persist.
G3 students are those who report a highest increase in their perception of computer command (0,9 difference between initial and final questionnaire in Table 3). These students initially do not identify technology knowledge as part of what good teachers should know, but they do it once they have finished the course. It is worth mentioning these students almost reached the perception of same level of computer command as students in G4, even though G3 students perceived themselves as having much less previous technological knowledge. G3 students were not only able to improve their perceived technology literacy, but also to change their perceptions on what good teachers know and do.
G2 students are those who present the second most important enhancement of computer command and frequency of ICT use (0,58 difference between initial and final questionnaire in Table 3 and 0,59 in Table 4). However, like G1 students, they still do not identify technology as part of what good teachers should know once they finish the course.

4.4 Do student teachers with higher technology literacy perceived gains develop more favorable beliefs toward technological knowledge as a component of good teaching than student teachers with lower technology literacy perceived gains?

Yes. Student teachers with higher technology literacy perceived gains develop more favorable beliefs toward technological knowledge as a component of good teaching than their colleagues with lower technology literacy perceived gains. G3 students are those with highest technology literacy perceived gains. G1 students, on the other hand, are those with the lowest ones. Students in both groups initially ignored technology knowledge as a component of what good teachers should know. Once they have finished the course, however, G3 students incorporate technology as part of the knowledge good teachers should bear, while G1 students still are unable to think of technology knowledge as integrated to pedagogical content knowledge basis.

5. CONCLUSIONS

This current research investigated how technology becomes part of a teacher's overall pedagogical content knowledge across the curriculum. We observed the relationship between pre-service teachers' beliefs regarding what a good teacher should know and their perceived technological literacy. Previous research has demonstrated that a favorable perception of technology as a teaching component does not translate unequivocally in the introduction of technology in the classrooms. This present study aimed at digging further. Beyond a favorable perception of technology as a teaching component, it is relevant to find out whether an improvement in student teachers' technology literacy can favor changes in their pedagogical content knowledge basis. So that teachers introduce technology in classroom, we believe, it is important they do something beyond improving their technology literacy or see it as beneficial for learning. So that teachers use technology in classroom, they should be able to revise and change their perceptions on what being a teacher means. Their new perceptions should include technology knowledge where most frequently there is only room for pedagogical content knowledge.
A major conclusion which can be drawn out of the data presented here is that many student teachers may go through pedagogical technological courses, perceive an enhancement of their technology literacy and of their frequency of technology use without experiencing any revision of their perceptions of what a good teacher knows or does. This is something courses aimed at preparing student teachers to make pedagogical use of technology should explicitly address. Developing technology literacy and/or incrementing the frequency of technology use is not enough to change student teachers enduring perceptions of the role of a teacher. Student teachers should be guided in

elaborating new appreciations of the role of teachers and the purposes of education as they are prepared to educate the citizens of the digital age.

The present research shows that an enhancement in the frequency of *use* of technology does not always translate in student teachers revision of their beliefs and conceptions of the role of teacher. In other words, breaking student teachers in technology does not naturally lead to the inclusion of technology knowledge in the educators' pedagogical content knowledge basis. On the other hand, an enhancement in student teachers' perceived *command* of ICT significantly favors the inclusion of technology as a component of good teachers' knowledge and, therefore, may favor their bringing of new experiences to the elaborations of conceptions and beliefs of what teachers are and do.

It became evident from the data analyzed that previous technology knowledge predisposes student teachers to more favorable perceptions of technology as part of what good teachers should know. Actually, students who already considered technology as part of what good teachers should know could think it over under richer grounds and develop more integrated perceptions of the educational potential of technology. An abrupt enhancement in the frequency of technology use, as we have seen, does not immediately impact in students perceptions of the role of teacher. However, one could expect student teachers who still do not see technology as a component of the role of a teacher but take courses which help them enhance their technology literacy and frequency of use, will be more open to revision of their professional perceptions in the future.

When student teachers finish courses with a technological pedagogical knowledge orientation they are more or less open to revise their beliefs and perceptions of what a teacher is and does, depending on whether their enhancement in the frequency of technology use comes accompanied by a perceived enhancement of technology literacy or not. Once student teachers become in-service teachers, they receive the influence of many aspects which may favor or hinder the pedagogical use of technology. Schools may have more or less technological resources, such as laboratories, computers and digital boards; more experienced colleagues may be more or less open to the use of technology; the students may have more or less access to technology at home, etc. If teachers do not bring in their perceptions and beliefs the understanding of technological knowledge as a component of their role, it is much less likely technology will ever become a working tool for them.

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