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Online tasks as a tool to promote teachers' expertise within the Technological Pedagogical Content Knowledge (TPACK)

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Abstract

In the Information Communication Technology (ICT) era, teachers will have to wisely use the online environment in order to realize a new pedagogy. We developed a digital indicator for examining the extent to which technological knowledge is integrated with pedagogical content knowledge (TPACK). This indicator is used to examine online tasks developed by teachers in different subjects over time. It enables quantitative measurement of the integration of technological knowledge with content knowledge and pedagogical content knowledge and thus affords a measure for the extent of integration. The digital indicator can be used to plan online tasks as well as for the teachers to test their own professional development in integrating technology in teaching. Use of the digital indicator can be implemented when training student teachers as well as in in-service training for teachers. Fifty-three online tasks developed by 14 high school teachers in different subjects were evaluated between 2001 and 2007. Evaluation of the online tasks was performed quantitatively using the digital evaluation instrument after it was validated and its reliability was examined. We examined the change and progress which took place in the integration of technological knowledge with pedagogical content knowledge over time as well as the contribution of guidance to the teachers' professional development for integration of technology in teaching. The findings indicate that the effect of time, which is expressed by the acquisition of experience, contributes to the integration of the technological knowledge with the teachers' pedagogical content knowledge. The findings also indicate that guidance plays a significant role in the implementation of the integration of technological knowledge with the teachers' pedagogical content knowledge. We recommend that correct integration of TPACK should be emphasized when planning professional development for teachers in the field of online tasks. We also recommend the development of models for teachers' professional development for integration of technology in teaching, with reference to the teachers' professional knowledge, i.e. their pedagogical content knowledge. The best ways for integrating the technological knowledge must be examined, such that the focus will not be on learning technological tools, but rather on the integration of pedagogy in technology. It is necessary to start from the field of knowledge and the teaching methods appropriate for this particular field of knowledge, and there to integrate technology. Optimal integration will lead to a change in teaching, to relevance for the students and to meaningful learning.

Keywords: Online tasks; online learning environment; technological pedagogical content knowledge (TPACK); digital indicator; professional development.

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1. Introduction

In the Information Communication Technology (ICT) era, teachers will have to wisely use the online environment in order to realize a new pedagogy. We developed a digital indicator for examining the extent to which technological knowledge is integrated with pedagogical content knowledge (TPACK). This indicator is used to examine online tasks developed by teachers in different subjects over time. It enables quantitative measurement of the integration of technological knowledge with content knowledge and pedagogical content knowledge and thus affords a measure for the extent of integration.

1.1. Online learning environments

According to Mishra and Koehler (2006) teachers who develop online learning environments must have technological knowledge as well as technological pedagogical knowledge. The online environment has the additional advantage of a high potential for learning and enrichment of the user also outside the school (Parsad et al. 2005).

Online teaching has the potential for supporting meaningful learning, in which the student is active and acquires high-order cognitive skills such as carrying out generalizations, asking questions, expressing a well-argued opinion, making comparisons or solving problems (Capper, 2003; Herrington et al. 2005; Linn et al. 2004). Salomon (2000) presents a vision in which use of technological tools will comprise a lever for the implementation of meaningful learning, where technology will be at the disposal of pedagogy and will help in its realization. The integration between a pedagogical rationale and technological tools enables the exposure of the student to rich and diverse information, enables dealing in complex contents that are relevant to the student and enables experience in constructing rich and original products based on the newly acquired knowledge. This is learning that encourages cooperation through a meaningful educational dialogue with the teacher and with peers, via the technological tools (Roschelle et al. 2000; Lehtinen et al. 1998). Technology also enables support of the learning process by means of intertwined evaluation that improves the process and directs the student's activity (Dori, 2003; Shepard 2000).

1.2. Knowledge attributes of teachers who integrate technology in teaching

The concept technological pedagogical content knowledge (TPACK) expresses the space created between the technological knowledge, the pedagogical knowledge and the content knowledge (Figure 1). This concept is based on Shulman's concept of PCK – pedagogical content knowledge. Shulman talks about the attributes of knowledge required of teachers who integrate technology in teaching, while referring to the complexity and the knowledge of the teachers in their field. Fig. 1 describes the complexity and the relations between content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK). The correct combination of technology in pedagogy in a particular subject must take into account the dynamic combination between the components and the intersections between them. A teacher who can navigate between these interrelations represents an expert who is different from an expert only in the disciplinary field of knowledge, only in the technology field of knowledge or only in the pedagogical field of knowledge (Mishra and Koehler 2006; 2009).

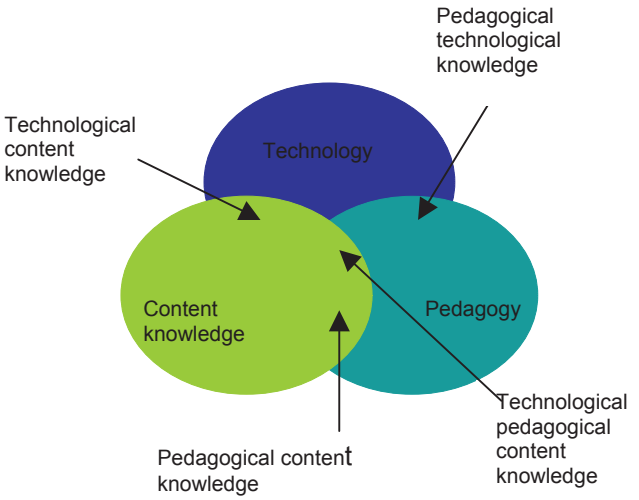

Figure 1. TPACK – the space created between the TK, the PK and the CK (Mishra & Koehler, 2006; 2009)

Alonso (2007) states that there is some consensus that PCK develops largely through teaching experience. However, pre-service and in-service experiences also influence PCK (van Driel, et al. 2004) and are potentially important leverage points for impacting teacher knowledge. Multiple research efforts have been directed at preparing teachers to teach with technologies and substantial qualitative differences in their TPACK have been identified.

1.3. Indicator for evaluating improvement of the online tasks

Because we did not find a dynamic and digital indicator for evaluating the quality of online tasks which encompasses all of the aspects which in our opinion should be expressed in an indicator, such as PK, PCK, TK and TPACK, which is actually the space expected to be expressed in an online task, we developed a digital indicator that evaluates the quality of online tasks. The indicator was constructed based on the megalithic instrument for characterization and evaluation of online tasks (Rotem 2006). Each criterion has three levels of performance standards: 1 – low; 2 – medium; 3 – high. The indicator enables focusing on the different fields of knowledge as well as on the identification of weak and strong points in these fields.

Other instruments that have been used to measure TPACK did it via respondents' self-report (Archambault & Crippen, 2009; Schmidt et al., 2009) while this indicator measures trough teachers' product - online tasks.

Table 1: Characteristics of the indicator, built by the authors, for evaluating the quality of an online task (Klieger & Oster-Levinz,In press)

	Measures
Pedagogical Knowledge (PK)	adaptation to the students adaptation of sources to which the task refers affording a solution for the heterogeneity of the students in the learning process the readability and clarity of the language in the texts of the task or to which the tas refers meaningful learning encouraging creativity/originality of the learner the interactivity of the task and the development of IT skills congruity with the curriculum
Pedagogical Content Knowledge (PCK)	ways for representing the information that are appropriate to the field of knowledge and the subject of the task designing the task in a digital format
Technological Knowledge (TK)	orientation and clarity of navigation organization of the information in the digital format and meeting the rules of ethics on the internet added value of the digital text and online environment
Technological Pedagogical	diverse means of illustration and expression

Content Knowledge (TPACK)	adaptation to learning in additional contexts and resources for performing the task

1.4. The research

Fifty-three online tasks developed by 14 high school teachers in different subjects were evaluated between 2001 and 2007. Evaluation of the online tasks was performed quantitatively using the digital evaluation instrument after it was validated and its reliability was examined. We examined the change and progress which took place in the integration of technological knowledge with pedagogical content knowledge over time as well as the contribution of guidance to the teachers' Professional Development (PD) for integration of technology in teaching.

2. Findings

The findings indicate that the effect of time, which is expressed by the acquisition of experience, contributes to the integration of the technological knowledge with the teachers' pedagogical content knowledge (Figure 2). The findings also indicate that guidance plays a significant role in the implementation of the integration of technological knowledge with the teachers' pedagogical content knowledge (Figure 3).

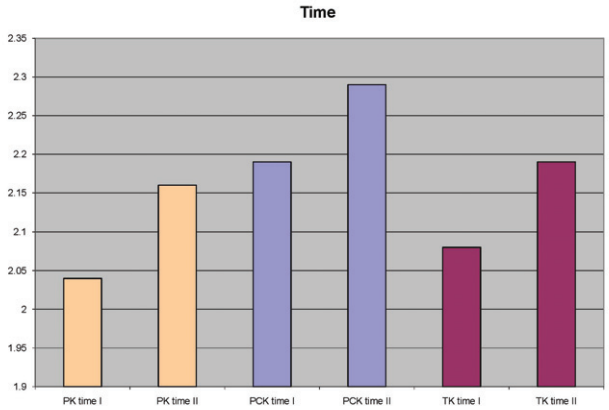

Figure 2. *Mean scores of PK, PCK and TK obtained for the online tasks developed by teachers over time. Time I: (2001-2004), Time II: (2005-2007).*

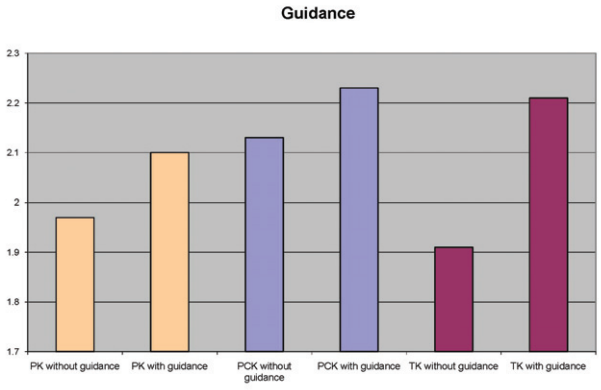

Figure 3. Mean scores of the PK, PCK and TK obtained for the online tasks developed by teachers who received guidance compared to teachers who did not receive guidance.

3. Conclusion and Recommendation

The digital indicator can be used to plan online tasks as well as for the teachers to test their own (PD) in integrating technology in teaching. Use of the digital indicator can be implemented when training student teachers as well as in in-service training for teachers. The digital indicator enables immediate evaluation of online tasks and can show improvement in the tasks over time in different fields: CK, PK, PCK and TPCK. The indicator also enables teachers to construct better online tasks by identifying foci of difficulty prominently and immediately.

We recommend that correct integration of TPACK should be emphasized when planning PD for teachers in the field of online tasks. We also recommend the development of models for teachers' PD for integration of technology in teaching, with reference to the teachers' professional knowledge, i.e. their pedagogical content knowledge. The best ways for integrating the technological knowledge must be examined, such that the focus will not be on learning technological tools, but rather on the integration of pedagogy in technology. It is necessary to start from the field of knowledge and the teaching methods appropriate for this particular field of knowledge, and there to integrate technology. Optimal integration will lead to a change in teaching, to relevance for the students and to meaningful learning.

References

Alonzo, A. C. (2007). Challenges of simultaneously defining and measuring knowledge for teaching. *Measurement*, 5(2–3), 131– 208.

Capper, J. (2003). Complexities and challenges of integrating technology into the curriculum. *TechKnowLogia*, *5*(1), 60-63.

Dori, Y.J. (2003). From nationwide standardized testing to school-based alternative embedded assessment in Israel: Students' performance in the matriculation 2000 project. Journal of Research in Science Teaching, 40, 34-52.

Herrington, J., Reeves, T. C., & Oliver, R. (2005). Online learning and information delivery: Digital myopia. *Journal of Interactive Learning Research*, *16*(4), 353-367.

Klieger, A., Oster-Levinz, A. (In Press). How Online Tasks Promote the Expertise of Teachers within the Technological Pedagogical Content Knowledge (TPCK). In Yuzer, V., T. & Kurubacak, G. (Editors). *Transformative Learning and Online Education: Aesthetics, Dimensions and Concepts.* IGI Global.

Lehtinen, E., Hakkaainen, K., & Muukkonen, H. (1998). *Computer supported collaborative learning: A review*. University of Turku, University of Helsinki. Retrieved May 15, 2009, from http://etu.utu.fi/papers/clnet/clnetreport.html.

Linn, M.C., Davis, E.A., & Bell, P. (2004). *Internet environments for science education*. Mahwah, NJ: Lawrence Erlbaum Associates.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A new framework for teacher knowledge. *Teachers College Record*, *108(*6), 1017-1054.

Mishra, P., & Koehler, M. J. (2009). TPCK - Technological Pedagogical Content Knowledge. Retrieved November 11, 2009, from http://tpck.org

Parsad, B., Jones, J., & Greene, B. (2005). *Internet access in U.S. public schools and classrooms: 1994-2003*. US Department of Education: ED Pubs.

Roschelle, J. M., Pea, R. D., Hoadley, C. M., Gordin, D. N., & Means, B. M. (2000). Changing how and what children learn in school with computer-based technologies. *Children and Computer Technology*, *10*(2). Retrieved October 8, 2008, from http://www.futureofchildren.org/usr_doc/vol10no2Art4%2Epdf.

Rotem, A. (2006). Megalithic model for characterizing and evaluating an online learning task. Retrieved December 25, 2006 (Hebrew), from http://avrumrotem.com/avrum-S/megalit/

Salomon, C. (2000). *Technology and education in the age of science*. Haifa: Haifa University and Zmora Bitan (Hebrew).

Shepard, L.A. (2000). The role of assessment in a learning culture. Educational Researcher, 29, 4.

van Driel, J. H., de Jong, O., & Verloop, V. (2004). The development of preservice chemistry teachers' pedagogical content knowledge. *Science Education*, 86, 572–590.