Coaching teachers using technology with cognitive apprenticeship

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Abstract

This paper shows the design of cognitive apprenticeship and professional learning communities which were part of a continued professional development program for secondary school teachers. Participants of all subjects have been coached in using digital media in classrooms, especially by implementing the flipped classroom and using wikis. The cognitive apprenticeship model was adapted for adult learners and connected with strengthening a professional learning community at school. These two concepts are supposed to provoke changes in self-efficacy and attitudes which are necessary for using technology in the classroom. The design patterns which were developed with the educational design research method will be presented in the materials market: design patterns of some professional development methods as well as patterns for using flipped classroom and wikis in class. Materials will be available online on http://flipyourclass.de/ and on http://educationaldesignresearch.de/. Another aspect of the materials market will be the presentation of first results of a study reconstructing the process of cognitive apprenticeship. Part of the related classroom project is already presented on http://projektwiki.zum.de/wiki/Mathe.forscher. The professional development material can be adapted for any STEM subject and combined with other concepts like inquiry based learning or problem solving.

1.   Coaching with cognitive apprenticeship in using technology in classroom

Teachers need continuing professional development to enhance technological pedagogical and content knowledge (TPACK; Koehler & Mishra, 2009; BITKOM, 2015), because the use of technology in classroom lacks variety and frequency. Cognitive apprenticeship focuses on changing teachers' personal characteristics such as skills, beliefs, attitudes and self-efficacy (Bandura, 1977), but also their instructional repertoires in using flipped classroom and wikis in their specific subject. The traditional flipped classroom is a method in which the teacher provides videos for homework. The advantage is that students can watch the videos at their own pace at home and the available time in the classroom will be used to coach the students (Bergmann & Sams, 2012; Spannagel, 2012). Using wikis in the classroom means that students write collaborative hypertexts and add multimedia. Work with wikis is based on constructivist ideas and prepares students for the information society (Döbeli Honneger & Notari, 2013). Cognitive apprenticeship (Brown, Collins & Duguid, 1989; Collins, Brown & Newman, 1989) and professional learning communities (DuFour & DuFour, 2012; Stoll, Bolam, McMahon, Wallace & Thomas, 2006) tend to be useful to enhance self-efficacy. Characteristics of efficient teachers' continuing professional development are not domain-specific and therefore have to be adapted to instruct teachers in using technology in classrooms. Cognitive Apprenticeship in combination with professional learning communities tends to meet quality features of continuing professional development according to studies like sufficient duration, focuses on content and modelling of teaching strategies, active learning with input, reflection, coherence, alignments with curricula, collaboration in professional learning communities, feedback, student achievement, teacher cognition and motivation (Yoon, Duncan, Lee, Scarloss & Shapley, 2007; Timperley, Wilson, Barrar, & Fung, 2007; Lipowsky, 2010). As basic concepts, cognitive apprenticeship and professional learning communities have been used in the intervention. The coach supports the teachers within the professional learning communities in planning lessons and teaching in the classroom. The teachers have domain-specific knowledge of the subject they teach, while the coach is an expert in integrating technology in classrooms. They develop the lessons together. For *modelling* the coach attends the class of the teacher and undertakes part of the instruction. This should be the only part, which the teacher is not supposed to do alone. The recommendation is to undertake only the parts of instruction which are supposed to be too difficult for the teachers. In the method flipped classroom concept this could be the instruction on technical aspects of the video production, and when using wikis in the classoom, this could be the necessary instruction on copyright, privacy, and data protection, and also the technical part of writing hypertext in a wiki. The other teachers of the professional learning community are supposed to see the modelling part of the coach, too. Then the *scaffolding* period starts. The coach attends only a short sequence of the classroom activity and supports the coachee who primarily carries out the instruction. In the period of *fading* the coach is available via telephone and email to answer questions, or the coach has a regular look on the wiki or the videos. At the end, the teachers try to continue independently in an interdisciplinary project. That gives them the opportunity to help each other with the same students. In that manner teachers with a lower level of self-efficacy and low skills in using digital media are encouraged to gain confidence for using technology in the classroom.

2. Methodological background

According to the main research question "How coaching of teachers in integrating technology in classrooms has to be designed?" we carried out educational design research (Plomb & Nieveen, 2013; see also Gravemeijer, 1994; Edelson, 2002; Reinmann, 2014). The professional development programme consists of prototyping and assessment. These characteristics are typically covered by Educational design research (Plomp, 2013).

The research activity was realized with a mixed methods design. For the evaluation of the technological pedagogical and content knowledge, pre- and post-questionnaires were carried out (Schmidt, Baran, Thompson, Koehler, Mishra, & Shin, 2009; Chai, Ng, Li, Hong, & Koh, 2013; Cramer, 2015) as well as a technology related self-efficacy scale (Cassidy & Eachus, 2002; Spannagel & Bescherer, 2009; Dinse de Salas, Spannagel, & Rohlfs, unpublished) and attitudes towards technologies scale (Richter, Naumann, & Horz, 2010). Also questionnaires and interviews have been used to develop the intervention in collaboration between researchers and practitioners. The results were combined once more with a literature review and an external audit of experts aimed to improve and refine the coaching intervention.

3. Conclusions

The continuous improvement of the coaching intervention by educational design research changed the used methods. The formative and summative evaluation of the first three cycles yielded the following needs for optimization of cognitive apprenticeship and professional learning communities in the coaching concept:

• It is of great importance to build a coaching relationship before it is possible to do cognitive apprenticeship. Coachees have to gain confidence that the coach will not evaluate their classroom activity, but only help to implement technology.

• Furthermore the coaching has to reinforce the creation of a professional learning community even more. This can be done by creating positive experiences within the group by giving them group tasks (like spending more time in planning and recording videos together or do the cognitive apprenticeship together).

• The professional learning community has to be a group of teachers who like to work together. Some communities prefer to have the same level of TPACK. For example, building a group of novice teachers in the field of technology in the classroom is beneficial for the teachers' confidence to ask even very simple questions.

• The professional learning community helps in the process of fading in cognitive apprenticeship, because the teachers can help each other and doesn`t need the coach.

Acknowledgements

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ProfiL
Professionalisierung im Lehrberuf
Research Group investigating TPD

Theoretical Background

- Germany has got an index of ICT use at school far below OECD average. (OECD, 2015)
- Teachers need TPD to enhance technological, pedagogical and content knowledge (TPACK; Koehler & Mishra, 2009)
- TPD needs also to focus on changing teachers' personal characteristics: skills, beliefs, attitudes and self-efficacy (e.g. Petko, 2012)
- Characteristics of effective TPD:
  - long-term nature
  - focuses on content
  - modelling of teaching strategies
  - active learning with input/reflection
  - school collaboration
  - feedback

  (e.g. Yoon, Duncan, Lee, Scarloss & Shapley, 2007)
- ➡ can be adapted with cognitive apprenticeship and in professional learning communities (PLC)
- TPD with digital media is not investigated yet (OECD, 2015)

AIM: Design teachers' professional development (TPD) to enhance quality and frequency of technology use in classroom

Selected research question

How coaching of teachers in integrating technology in classrooms has to be designed?

Methods

Educational Design Research (e.g. Plomp & Nieveen, 2013)
Qualitative data: participant observation and audio recordings, interviews, follow-up interviews, extern audit
→ Qualitative Text Analysis (Kuckartz, 2014)
→ Design Pattern (e.g. Wedekind, 2015)
Quantitativ data: questionaire (tpack, beliefs, self-efficacy)
intervention group: n = 20 (14 females)
high school teachers (26-67 years)

Design Pattern for TPD

Cognitive Apprenticeship and PLC
- Learning by doing
- Setting goals
- Best practice sharing
- Planning next steps

Wikis
- Collaborative writing and composing

Flipped Classroom
- Students produce videos
- Students analyse videos
- Students explain
- Students don't watch the videos

Online: http://educationaldesignresearch.de/   Online: http://flipyourclass.de/

Conclusions

The continuous improvement of the coaching intervention by the first three cycles of educational design research yielded the following needs for optimization of cognitive apprenticeship and professional learning communities:
- The coaching relationship is necessary for cognitive apprenticeship
- The professional learning community
  - likes to work together
  - has the same level of TPACK
  - helps in the fading process
- reinforce the creation of a professional learning community by creating positive experiences with group tasks

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