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Abstract: Mobile technologies open up new ways of fostering reflection in teacher education. With the intention of tying reflection closer to the actions in the classroom, facilitating multimedia recordings, providing prompts for reflection and fostering discussions between pre-service teachers, experienced teachers and university mentors, we developed the “Metapholio” app and tested it in the context of teaching internships. This app supports pre-service teachers in collecting noteworthy moments in the classroom by providing functionalities for individual and collaborative note taking. Notes can be created in the form of written text, photography, audio recordings and video recordings. Each note can be commented on and discussed with invited peers, experienced teachers and university mentors, who can also record moments themselves. Furthermore, the app makes it possible to select notes and attach them to more general written or spoken reflections on teaching and learning. Theoretical frameworks and writing prompts that are part of the app serve as scaffolds for such reflections. Peers, teachers and mentors can be invited to join the conversation on reflections. With the help of this app, pre-service teachers can, moreover, create their own multimedia mobile portfolio, which acts as a hybrid space for professional development in teacher education.

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Metapholio: A Mobile App for Supporting Collaborative Note Taking and Reflection in Teacher Education

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Mobile technologies open up new ways of fostering reflection in teacher education. With the intention of tying reflection closer to the actions in the classroom, facilitating multimedia recordings, providing prompts for reflection and fostering discussions between pre-service teachers, experienced teachers and university mentors, we developed the “Metapholio” app and tested it in the context of teaching internships. This app supports student teachers in collecting noteworthy moments in the classroom by providing functionalities for individual and collaborative note taking. Notes can be created in the form of written text, photography, audio recordings and video recordings. Each note can be commented on and discussed with invited peers and mentors, who can also record moments. Furthermore, the app makes it possible to select notes and attach them to more general written or spoken reflections on teaching and learning. Theoretical frameworks and writing prompts that are part of the app serve as scaffolds for such reflections. Peers and mentors can be invited to join the conversation on reflections. With the help of this app, student teachers can moreover create their own multimedia mobile portfolio, which acts as a hybrid space for professional development in teacher education.

keywords: teacher education, mobile learning, reflection, microblogging, note taking

1 Introduction and Description of the Emerging Technology

In the past decades, reflection has been regarded as a core activity of teacher professional development. Teachers at all career stages are thus expected to reflect on classroom interactions and to attend to practical problems in a deliberate way. By doing so, they are not only meant to expand their expertise and but also to integrate theory and practice (Clarke and Hollingsworth 2002; Korthagen, Loughran and Russell 2006). Research has shown, however, that it is very challenging to design reflective activities in teacher education that live up to these high expectations (Beauchamp 2015; Zeichner and Liu 2010). Even with thorough scaffolding, reflection often remains shallow and does not yield the intended effects on teacher learning and practical classroom teaching. In view of these shortcomings, digital technologies have increasingly been explored in terms of how they might contribute to supporting reflective teacher training activities, especially with the help of digital video, portfolios, weblogs and, recently, mobile devices (Kori, Pedaste, Leijen and Mäeots 2014; Krutka, Bergman, Flores, Mason and Jack 2014). In particular, mobile note taking and microblogging apps have shown great promise (Baran 2014; Könings et al. 2016). While note taking and microblogging with mobile devices in general can be considered commonplace nowadays, these functionalities are yet emerging technologies in teacher preparation programs, especially in the context of teaching internships.

2 Relevance for Learning, Instruction, and Assessment

Although personal smartphones can serve as a tool for mobile note taking and reflection, usually by means of standard apps (e.g. the camera app or the note taking apps included in most operating systems), common note

taking apps (e.g. Microsoft Onenote, Evernote) or social media apps (e.g. Facebook, Whatsapp, Twitter, Instagram), there are still some aspects that point to the need for an integrated development of a specific app that is tailored to the purposes of teacher education. To combine and implement different features that have already shown potential in past studies, we developed the mobile app *Metapholio* (www.metapholio.ch), whose functions facilitate a) the collection of so-called “moments”, b) reflection on these moments and c) the sharing and discussion of both moments and reflections. The design of this app was strongly informed by insights of educational research:

- Noticing is an essential skill that pre-service teachers need to acquire if they are to develop “professional vision” (Goodwin 1994), which, in turn, is a core component of “reflection-in-action” (Schön 1983). With the intention of supporting professional noticing and accountable reflection-in-action, the app turns personal smartphones into a purpose-built note taking device and provides a fast and user-friendly interface for collecting noteworthy moments in the classroom.
- Learning to notice and developing professional vision usually consist in a collaborative rather than an individual effort. A note taking app can be useful for facilitating joint note taking, reflection and discussion because it contributes to establishing a “hybrid space” of discourse that includes student teachers, teaching professionals as well as university mentors (Zeichner 2010).
- While written reflective journaling has a long tradition in teacher education, mobile apps are particularly suitable for multimedia-based note taking in the form of pictures or audio and video recordings. These types of recordings document practical situations in a richer and at the same time more direct and authentic way than traditional written notes. Especially video-based recordings have proved to be very promising in terms of enhancing professional noticing (Sherin and van Es 2009; Star and Strickland 2008).
- The collected moments serve as starting points for fostering and extending professional “reflection on-action”. These reflections can be either documented in writing or recorded as a multimedia file. Since the results of studies on reflective journaling indicate that scaffolding prompts are essential to reach adequate levels of reflection (Hübner, Nückles and Renkl, 2010), the app includes a list of topics for reflection as well as specific prompts for guiding reflection.
- As the app provides functions for the exchange of comments between student teachers, practicing teachers and teacher educators, individual notes serve as a joint base for communication, the sharing of resources and engagement in co-constructive discussions. This opens up the full range of potentials and possibilities that are commonly associated with Computer-Supported Collaborative Learning (Jeong and Hmelo-Silver 2016).
- Recordings from classrooms consist of sensible data, which requires specific precautions for ensuring data and privacy protection. To this end, the data generated by this app are collected and securely stored on a university server.
- Owing to the integration of e-portfolio functionalities, this tool can be valuable not only in the context of internships but also over the entire span of a teacher’s professional development.

3 Emerging Technology in Practice

To sum up, the *Metapholio* app has been designed to support fast and easy note taking, both individually and collaboratively, to help student teachers write scaffolded reflections based on these notes, and to facilitate discussions on notes and reflections with others. When using the *Metapholio* app, users are supposed to go through the following course of action:

1. *Installing the app and creating an account.* After installing the app, users create an account that is linked to a valid e-mail address. During the registration process, they are asked to select their university from a list of participating institutions. This selection determines what kind of reflection framework and what prompts they see while they are writing a reflection. The app can be installed on several devices and run under the same username and password. In order to lower the barriers to making use of the software, users are not assigned specific roles, and school or university administration is not

involved in the registration process. Every individual user has the same rights, retains control and is responsible for providing other users with access to his or her own Metapholio.

2. *Inviting fellow student teachers and teacher educators (Fig. 1).* Users can open a dialog for inviting fellow student teachers, practicing teachers, teacher educators or other persons to get insight into their notes or reflections. The persons who are invited to a user's "moments" gain the right to view all notes, to add notes and to comment on notes. Almost the same applies to "reflections": users who have been invited to access another user's "reflections", can read all reflections and write comments themselves.
3. *Collecting noteworthy moments in the classroom by using the smartphone app for typing in short text notes, taking pictures, or recording audio and video files (Fig. 2, Fig. 3).* Note taking can be done both individually or collaboratively. After the selection of the "plus" button in the bottom right-hand corner of the screen, a short menu is displayed for selecting the kind of recording that is to be created. As simultaneous noticing and note taking in the classroom can be difficult for student teachers when they teach for the first time, moments can also be collected by other invited student teachers who are present as well or by professional teachers (see Step 2). All moments can be reviewed and supplemented with comments later on.
4. *Selecting several moments and writing or speaking an encompassing generalized reflection on these records (Fig. 4, Fig. 5).* For creating a reflection, student teachers switch to the reflections tab where previous reflections are displayed. Upon tapping on the plus-button at the bottom right-hand corner of the screen, a dialogue appears in which student teachers choose a topic to reflect on. Thereafter, they record their reflection either in written or in spoken form. This task is facilitated by pertinent prompts. These topical frameworks and reflective prompts can be customized to the purposes of each teacher preparation program that decided to work with this app.
5. *All notes and reflections can act as a starting point for comments and discussions (Fig. 6).* Invited users can comment on and discuss all moments and reflections.
6. *Exporting moments, reflections and interactions for creating an individual e-portfolio.* Like in an institutional e-portfolio, users have full administrator rights to their own recordings, which can also be exported and deleted.



Fig. 1 Menu for inviting others to access one's own moments and reflections

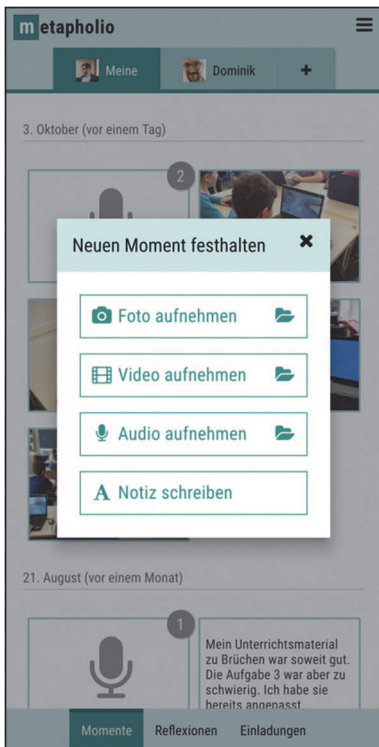


Fig. 2 Menu for documenting a new noteworthy moment

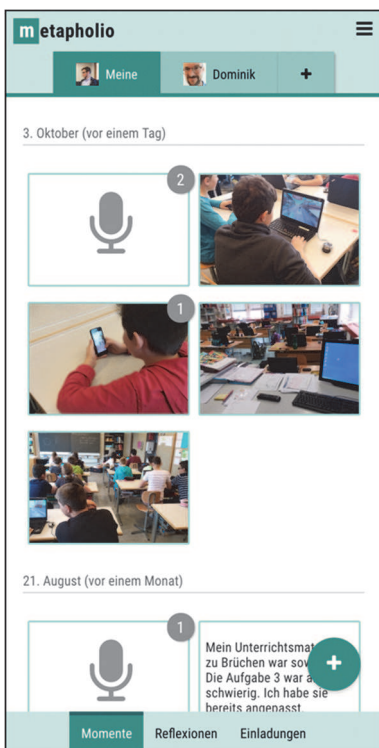


Fig. 3 Overview of collected noteworthy moments



Fig. 4 Menu for writing or speaking a reflection

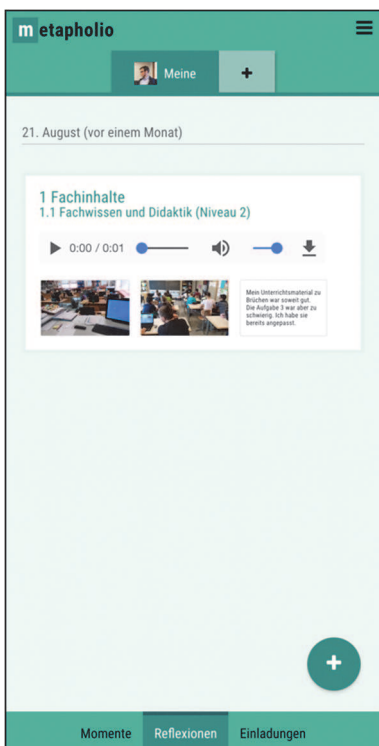


Fig. 5 Overview of written or spoken reflections



Fig. 6 Menu for commenting on a moment/a reflection

4 Significant Challenges and Conclusions

In order to foster professional noticing and reflection, the use of the Metapholio app must be embedded in the overall context of a teacher preparation program and carefully scaffolded by teacher educators. Controlled studies will need to show how these processes ought to be orchestrated so that the app can effectively contribute to achieving measurable progress in reflective skills, teaching quality and, ultimately, pupil learning. In particular, we will have to address questions concerning the frequency with which moments should be collected (incident-based vs. at regular intervals), the mode of the collection of the moments (text-based vs. multimedia), and the focus of the note taking activities (open vs. focused on predefined aspects). With regard to reflections, it remains to be analyzed whether their quality varies according to their mode (written vs. spoken) and depending on the support by different types of scaffolds (specific vs. generic prompts). As the app facilitates social interaction and enables collaborative noticing and reflection, we also need to clarify who should participate in the creation of a hybrid space of discourse (e.g. university mentors, mentor teachers, student teachers, possibly also pupils and parents). Establishing a culture of discourse and reflection that is based on both individual and joint noticing is a challenge that goes far beyond the simple functionality of any specific app.

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