How Teachers Differ in Using Dashboards: the Classroom Observation App

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Abstract. This paper has two goals: first to introduce the reader to the classroom observation app that was developed to digitalize classroom observation. This app was designed for observations in classrooms where students work with adaptive educational technologies on tablet computers. This paper discusses the app, the observation categories and how the results of the observations are used for research and professional development purposes. An example of a research application is the examination of in-, middle- and experienced teachers use an adaptive educational technology in their classroom. An example of professional development usage is the application of the app by coaches to support teachers in their own classrooms with tips and track based on their current behavior. Future research directions are the inclusion of AET logs and location based information into the observation app.

Keywords: Educational technologies, primary education, dashboards, teachers

1 Introduction

This paper introduces the classroom observation app that was develop specifically to digitalize classroom observations when learners are continuously using tablets during learning. In the Netherlands, students often use adaptive educational technologies (AETs) on a daily basis in the classroom (Kennisnet, 2015). Students in primary education learn with these technologies on a daily basis in the classroom. During learning large amounts of data are generated which can be used to advance our understanding of students' behavior and performance and hence improve learning (Siemens et al. 2011). These advancement are expected to improve the adjustment of learning to the needs of students. However, even though these adaptive educational technologies (AETs) are expected to revolutionize education, our current understanding how these technologies affects the adaptivity of the learning environment is limited. In the learning theory a distinction is made between macro- and micro adaptivity (Corno, 2008). Marco adaptation typically aims to adjust instruction to a homogeneous group of learners based on assessments of learner characteristics before learning (Corno, 2008: Lee & Parker, 2008). Mirco-adaptation focuses on responding to changes in learners behavior and performance during learning (Lee & Parker; Shute, 2013). Especially on-task learner behavior and performance data from AETs is expected to improve micro-adaptivity.

Yet, this increase in micro-adaptivity is not only occurring at the technological level in the student-technology interaction with the AET, but also at the physical level in teacher-student interaction in the classroom. Teachers directly receive data about students' behavior and performance form the AET in dashboards and research indicates this influences their instruction and feedback (Molenaar & Knoop-van Campen, 2017). For example teacher respond information about a student making mistakes by providing additional instruction. However even though the AETs logs provide data on the technological level, important information from the physical level is missing. Therefore the observation app was developed to understand how continuous technology usage affects teacher behavior and consequently micro-adaptivity in the classroom. Currently, we analyze these two data sources, the logs and the observation data, separately, but ideally this information should be combined into one log.

In this paper, we discuss the app and the theoretical background of the observation categories. Next we discuss the application in research and teacher professionalization. Finally we elaborate on some first explorations to integrating multiple data streams such as location based service and the AETs' log data. Especially these future developments are related to the themes of this workshop "Multimodal Interactions Across Physical and Digital Spaces in Real World Learning Contexts".

1.1 The observation app

The classroom observation app was developed in collaboration between the first author and Artificial Intelligence students at the Radboud university Nijmegen. As decribed above the goal was to better understand how AETs contribute to mircro-

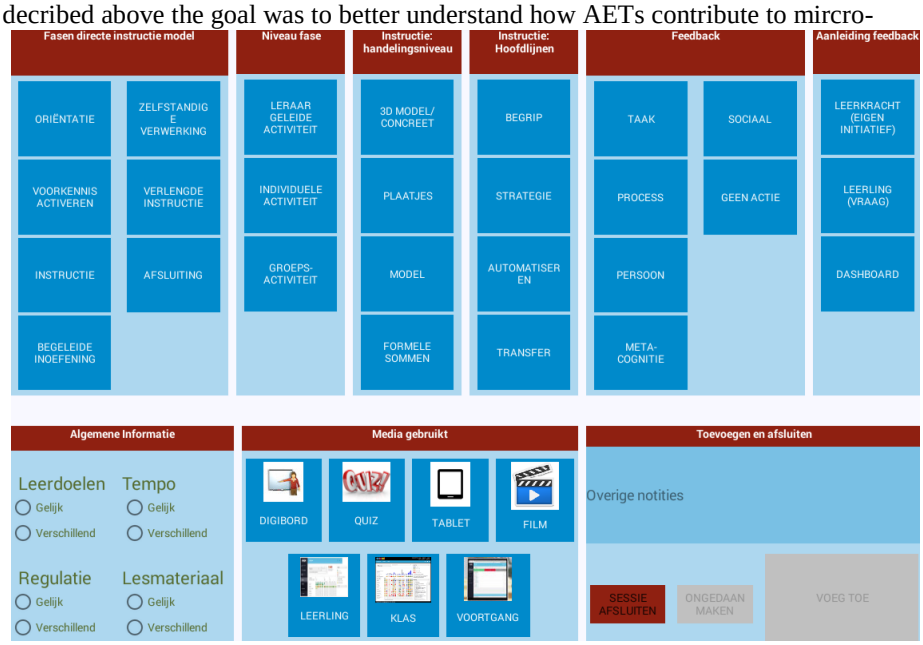

Figure 2. Screenshot of the observation-app

adaptivity in the classroom. The observers are instructed to coded all pedagogical actions of teachers engage in with a special focus on the teachers instruction and feedback.

Based on previous research (Molenaar et al., 2017) the coding schema was developed over the last 2 years. Seven categories were defined as main coding sections (see Figure 2). The first category consisted of the seven phases of the direct instruction model, namely orientation, activation of prior knowledge, instruction, guided practice, independent practice, additional instruction and closure (Veenman, 1992; Verloop & Lowyck, 2009; Molenaar et al, 2017). The second category indicated the acting level of the teacher. This could be a teacher-guided activity, a group activity or an individual activity (Land et al., 2012; Molenaar, Van Schaik, & Denessen, 2015). Third, the quality of the instruction was observed in two caterogries, action levels and main goals. The action levels distinguished are concrete actions, concrete, abstract, and formal representations. The main goals, indicate the aim of the instruction: understanding, strategy, automation and transfer. Fourth, feedback was divided into five types: task, process, metacognition, person, and social feedback (Hattie & Timperley, 2007; Keuvelaar-Van den Bergh, 2013).

Figure 3. output pages with results of the observation

In addition, when the teacher consulted the dashboard and did not engage in an pedagogical action directly after, the "no action" category was checked. In the fifth category, the initiator of the feedback was indicated. The initiators were own initiative of the teacher, the student or the dashboard consultation. In addition, the consulted dashboard could be indicated. The sixth category specified the extent to which the

teacher differentiates between students in the learning outcomes, teaching materials, pace, and regulation. In the seventh and last category, the usage of media by the teacher was entered: teacher usage of the smartboard, quiz, student tablets and the dashboard with the lesson overview, class overview, and the progress dashboard.

After the lesson is over the observer ends the session. All information is immediately progressed into different visualizations showing the summary of the lesson. Figure 3 provides an example of the output page showing time spend in different lesson stages.

2 Applications of the classroom observation app

2.1 Research application

An example of a research application of the observation app was our study in which we investigated if experienced teachers differed in their usage of the dashboard form inexperienced teachers. 65 classroom observation were used and the results indicated differences in dashboard usage. Inexperienced teacher only used the dashboard in 7% of the instance they provide feedback, whereas experienced teachers use the dashboard in 24% of the instances they provide feedback.

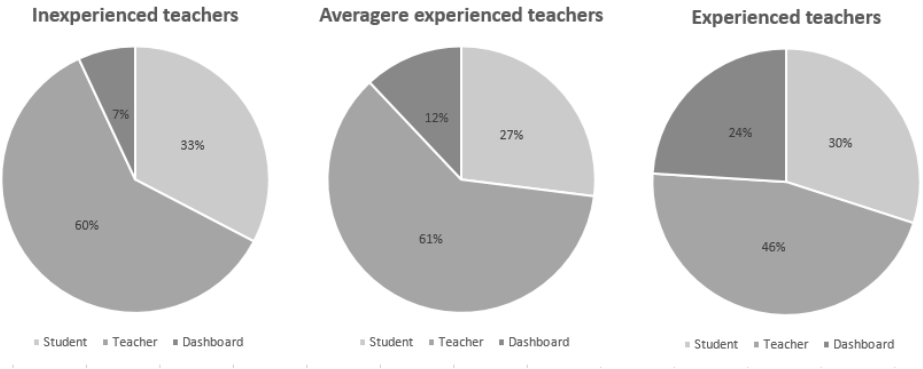

Figure 1. *Relative Measures of Reason of Providing Feedback per Group in Percentage*

2.2 Professional development

Two school boards implemented a new coaching program to support teacher professionalization. Each school was linked to a 'AET coach' which is a teacher that has shown advanced use of the technology in his classroom and also received additional training. This coach offers professional training to schools and consults with teachers that need support in their usage of adaptive teaching technology in their classroom. In

total 10 coaches were trained to use the classroom observation app during school year 2016-2017. They did the observations as part of their classroom consultations with teachers. First the teacher was observed during the lesson and after the lesson the coach discussed the observation with the teacher. During this session the visualizations in the app were used to illustrate how the teacher uses the AET in their teaching and point towards possible improvements. Overall the Snappet coaches performed over 70 observations using the app. At the end of the school year, they all intended to use the app again for teacher consultations next year.

3 New directions

3.1 Integration of location based services

We explored the opportunities for predicting classroom observations by using the location of the teacher throughout the lesson. During an observation we placed four Nearables in the corners of the classroom to track the location of the teacher. A location based app was installed on the teacher's tablet. The teacher was instructed to his tablet with him during the lesson. He could walk around in the classroom freely and his workflow was not influenced by the data collection. In total, we collected 67 observation data points and 2560 location data points. An number of different classifiers were tried and we selected the best classifier and calculated the accuracy on the test set. The following table shows the accuracy of each of the classes, using the best classifiers compared to chance. The performance of the AI component on the dataset is quite reasonable, given the small size of the dataset.

31 Class	Classifier	Accuracy	Chance
Phase	RBF SVM	85%	0,14%
Level	Nearest Neighbors	63%	33%
Mainaction	Random Forest	48%	20%
Subaction	RBF SVM	26%	0,09%

The best results were found for the accuracy of the AI component predicting the phase of the direct instruction model from the location and time data at 85%. The DI model has seven different phases that often linearly succeed each other. That is why the accuracy would already be reasonably high by just using the timestamp, but location data could add to this information. For instance when the teacher is in front of the class he or she will mostly likely either be starting or wrapping up the lesson. Likewise, a teacher that moves around the class will most likely be answering questions or checking on students while students are working individually.

Further research has to show exactly how accurate and which classes we can predict from the location and time data, using more data from different observation session

CONCLUSION

This paper introduced the observation app and showed how it was used for research and professional development in tablet classrooms. We would love to discuss further details at the workshop and also elaborate on the integration more data streams into the app, such as location based data or the logs from the adaptive educational technology.

4 Acknowledgements

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