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Cooperative Learning with Transparent Learning Outcomes using a Mobile App

Julian Dehne[1], Martin Kapp[1], Sven Strickroth[1] und Ulrike Lucke[1]

Abstract: Competence based learning and e-portfolios are integral parts of modern teaching repertoires. Implications of these techniques concerning cooperative learning and teaching are discussed. We developed a mobile application for cooperative learning using micro reflections that relies on the competence database COMPBASE as a backend for storing learning outcomes and peer reviewed reflections. COMPBASE[2] is a framework for saving and comparing learning goals and formulated competencies across systems. It includes badges as a formative assessment tool. The results are linked to the bigger picture of learning outcome oriented CSCL tools.

Keywords: micro-reflections, learning outcomes, database, group awareness

1 Introduction

Learning outcomes have been in the spotlight as a tool to make learning processes more manageable and easier to monitor. The same argument has been used against them blaming output-oriented pedagogies for the loss of in-depth reflective thinking. However, there is a third stand of thinking that argues that learning outcomes should not be seen as a way to quantify education but as a means of making learning process more transparent for everyone. The student can use them to communicate his or her interests to the teacher as well as the teacher explain the sequence of his lectures to the student. The government can use the learning outcomes to highlight some aspects the political system deemed necessary. Finally, European universities can use them to simplify mobility for students. From a technical point of view learning outcomes are valuable metadata that can be used to improve learning tools. If used with the right motivation they can be valuable to improve reflection processes and collaborative work.

In this paper we present the concept of 'micro reflections' which we use as a term for a number of sentences a learner writes about how he or she feels about his/her status or progress with regards to a learning goal. We use the term 'learning goal' as a short form for formulated learning outcome that adheres to a taxonomy or is semi-structured. It is also assumed that learning goals are not simply changes in disposition but can be partly demonstrated with an activity in a LMS (Learning Management System). Further, it is assumed that the combination of performing an activity and the comments of teachers or

[1] Institut für Informatik/Universität Potsdam, Lehrstuhl für Komplexe Multimediale Anwendungsarchitekturen, August Bebel Straße 19, 14482 Potsdam, vorname.nachname@uni-potsdam.de

[2] https://github.com/juliandehne/competence-database - access 19.07.2018

peers hereto suffices as an evidence that the learning goal has been reached. However, computer generated recommendations about learning goals are not the subject of this study.

The term 'transparent learning outcomes' is defined as learning outcomes that are visible to all the roles in the system such as the teacher, the student and the administrative body. The implemented system is based on an ontology and ensures consistency within the learning outcomes. It is also used as the backbone of the mobile application implemented. The mobile application is used to test the concept of micro reflections and their impact on collaborative learning.

2 Current State of Research

The Oxford Dictionary of Education defines competencies as "'The ability to perform to a specified standard" [Wa09]. In spite of its brevity this definition emphasizes the two aspects this paper relies on: The possibility to link a competence to a certain action being performed and the existence of a standardized curricula that can be leveraged as a framework. Action competence has been described in more detail in [We01, p. 3] and [Si09, p. 544]. In the context of e-learning the term 'competency' has several meanings which result in different modelling and implementation of competency aware systems: For instance, the industrial approach sees effective management of competencies as a way to foster human resources development [Hi10]. The main reason to deal with competencies or knowledge this way lies in the advantage of bridging knowledge gaps which in turn improves communication processes. Here the economic benefit is most visible. Competencies are then described according to the need to rate a person's ability to do a certain job. In consequence, they are modeled in a numerical fashion (e.g., 1-6, 0-100%). Another approach focuses on the idea that learning objects such as assignments or documents contain useful metadata [Lu03]. This knowledge is used to create a model of the user that has been in touch with the learning objects. Recommender systems are a logical consequence of this approach. More sophisticated teaching approaches based on the constructivist paradigm harness the additional information available [No04]. Here the competencies are modeled in a more complex fashion incorporating the metadata of the documents, the activities of the user that can be monitored in e-learning systems and the output generated by the learner.

If the learner is brought into focus there are two use cases. On the one hand the assessment based on competency [Il13] and on the other hand cooperative learning [Cr96]. A competence model of the students opens up the possibility of composing study groups based on similarities and dissimilarities in knowledge and learning styles. MoodlePeers [Ko16a] aims at group formation using discrete learning outcomes as a validation step. PeerLA [Ko16b] is a tool that is an editor for self-regulated learning goals. Both approaches have the idea in common that learning outcomes or goals can be utilized to foster self-regulation. Like the COMPBASE system they use Moodle plugins and could be integrated. Other related work focuses on presenting learning content depending on the context the learner is in [Mo14]. Different types of contexts such as natural context (weather, geoposition) or personal context (’User A is related to user X’) are defined. If integrated, the similarity of learning goals and corresponding groups could be used to enhance the user context.

3 Collaborative Learning/Teaching and Learning Outcomes

Cooperative learning can be viewed from an e-learning perspective from different angles: computer supported creation of good learning groups [Ch07], fnding good patterns for group formations [KD11] or assisted self-regulated group formation. Self-regulated learning [BC06] includes creating groups based on personal learning preferences and other factors. Group awareness raises the motivation and the sense of responsibility and ownership. This way self-regulated learning can be controlled by a different factor than the individuals’ motivation [Bu11]. Another factor for successful cooperative learning other than the group composition are the learning goals the group shares. One possibility is that the teacher has set the learning goals for the class. If this is the case, these learning goals can be very different from the learning goals of the individuals in question resulting in unintended learning outcomes. Moreover, formulating learning outcomes that match the teacher’s expectations can be problematic, too [HS02]. Learning goals serve to standardize cooperative learning processes. In informal settings they can be used to mainstream the efforts invested. However, it is not possible at the moment to compare formulated learning goals automatically. Nature language processing is needed to segment formulated learning goals and allow reasoners to compare learning goal aggregates. For this reason, an automatic group composition algorithm using learning goals does not exist yet to the knowledge of the authors.

Therefore, we focused group awareness and reflection processes instead of group composition. Computer supported collaborative teaching can be viewed from different angles: Distance learning that includes more than one teacher is regarded as ICT supported collaborative learning. Usually, the support is limited to providing a communication platform with video chat and file exchange. Having teachers reflect on their colleagues practice, however, is less common. Learning goals offer the possibility to plan activities more consistently and reflect on them collaboratively. A study at our institution [DN17] has shown that more than 30 per cent of students regard their study experience as inconsistent complaining about redundancy or conflicting information given in different classes. The margin is even higher if more than one faculty is involved in the study program. The most notable group of e-learning tools that enhance reflection are e-portfolio systems. Making use of an e-portfolio system as a reflection tool in an institutional manner conflicts with the learner’s priority to pass exams, which usually focusses on knowledge (of facts or procedures), rather than in-depth analytical thinking and reflective depth. Mobile learning can resolve this issue if used in combination with micro reflections. Small time frames like when sitting in public transport or between lessons can be used effectively by the students to reflect upon their progress, plan their next steps or comment the progress of their peers. Assessment of micro reflections can be difficult. It is possible to ask students to merge their micro reflection into a bigger essay. If grades are required, this may be the only viable option. However, we suggest that the micro reflections should be used additionally. If this is the case, assessment using the Open Badges standard[3] is suitable. Badge systems can be complementary to traditional performance assessments such as certificates and diplomas. Open Badges is the term for an open standard for the creation, allocation, display and storage of digital badges. The concept comes from the Mozilla Foundation in 2011. This standard stipulates that every institution issues digital badges. As an implementation for the badges the Moodle competency framework is used. However, using a more sophisticated process of baking the competency badges is deemed suitable barring that the Mozilla framework allows different identity management system to hook into its baking mechanism. The concepts would then relate in the following way: The competencies are represented by set of learning outcomes and they count as attained when there is a badge that links the learning outcomes to user evidences in form of activities. The activities may contain reflective practices.

Taking all the above shown into consideration the learning outcomes fulfill four purposes:

1. They provide a framework for the micro reflections making it easier for the students whose learning style is not adapted to keeping a diary.
2. They enable collaborative teaching by making learning goals transparent between the contexts of different courses or individuals.
3. They enable peer reflection processes. The peers have a framework which to judge their fellow students' progress by.
4. They enable informal formative assessment using the Open Badges standard.

4 Implementierung

The developed mobile app gives an overview of the course goals from the user's Moodle courses. The learning goals are separated into views of those reached and not reached. There is a view for the user's digital badges and for the creation of his own learning goals. Inside the learning goal menu the user can self assess the progress and the time he spent, enter his or her micro-reflections by answering reflective questions, give peer feedback to activities, and look at the same information from other students. The interface for the teacher is implemented as a Moodle plugin, where he or she can create learning goals for the given course context and link Moodle activities to them. It is possible to link reflective questions the teacher created for the course, too.

[3] https://openbadges.org/ - access 19.07.2018

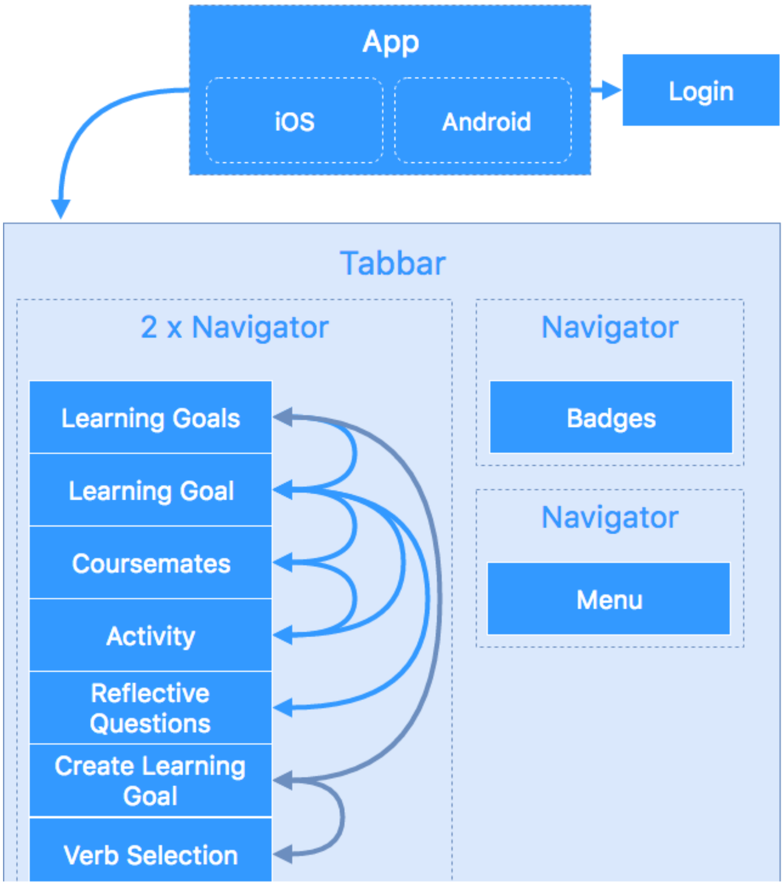

Figure 1: App navigation structure

The app was implemented for Android and iOS using React Native[4]. As shown in the figure above the app consists of two basic UI views depending on the user's login state: Login or Tabbar layout. The tab bar contains tabs with the unreached learning goals, the reached learning goals, the badges and a menu, where the user can log out. Each tab contains a navigator to make it possible to navigate back and forth. In order to formulate personal learning goals the user needs to select a verb that describes an observable behavior. Inside the app all learning goals are displayed in the form: 'I + [verb] + [free wording]'. A formal grammar has been published previously [DL15]. This makes it

[4] https://facebook.github.io/react-native/ - access 19.07.2018

easier for the learner to understand and create learning goals and at the same time forces the use of a consistent format.

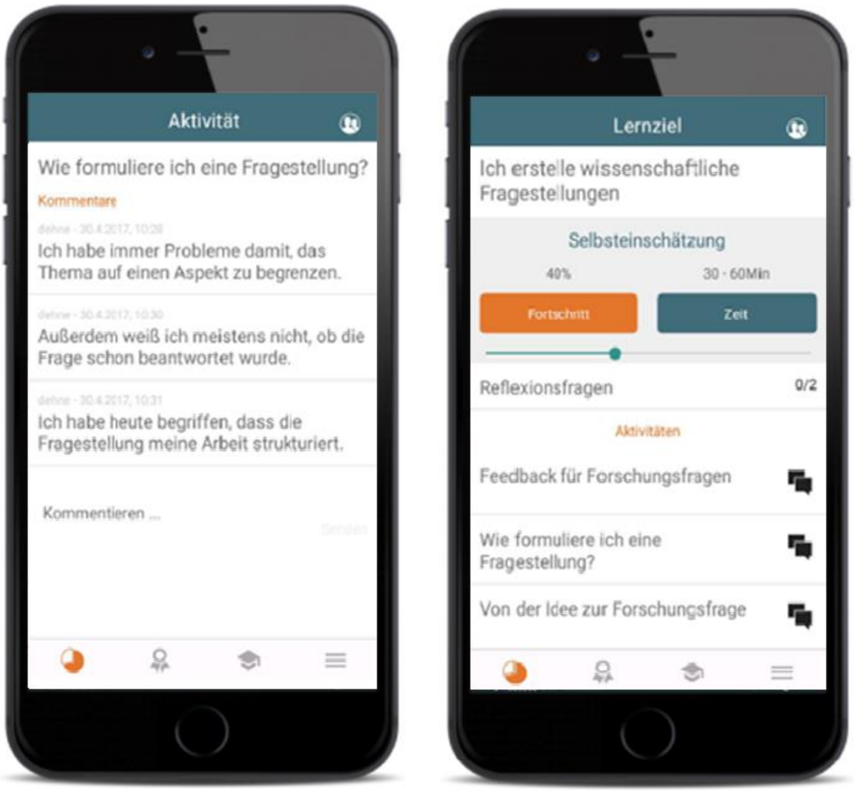

Figure 2: Screenshot of the Lernreflex Application. Because of privacy reasons, we did not take screenshots during the evaluation at the school. The above screenshots show the implemented app used in the context of inquiry based learning.

These connections between learning goals and other entities are stored in the COMPBASE. It is connected to Moodle using a plugin and by extending Moodle’s web services. The app never accesses Moodle directly. All the data it needs comes from the COMPBASE and is, if not stored already, synchronized from Moodle. The Information flow and general component structure is shown in the figure 3.

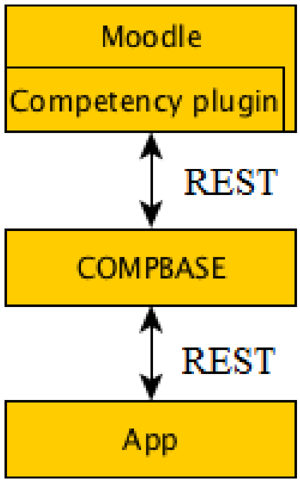

Figure 3: System architecture overview

When having opened the app users can view their learning goals ordered by course or learning template, which is a method of grouping learning goals according to a specific topic. It is possible for them to give feedback to all other students in the course they participate in and view their self-assessment and the answers they have given to reflective questions. If a student is given feedback for an activity connected to a learning goal, the activity is marked as finished and the learning goal is considered as reached. In an earlier prototype the teacher had to approve every single activity of the learning outcome to be marked as reached. This slowed down the process significantly, which is why this new method was chosen.

5 Evaluation

In order to evaluate the app, it was tested with 15-25 students in a preliminary study with 9th and 11th graders during a 90 minutes computer science class in each grade. The students were introduced to the app and explained their functionalities. It was also mentioned that everything connected to a learning goal could be seen by the other app users. The students were then anonymously given credentials to log into the app. They were instructed to work on tasks in groups of two. The groups would then share their user names in order to collaborate. This way anonymity was achieved between different groups of students but collaboration facilitated within single groups. Before starting the work they were told to answer all the reflective questions in the corresponding learning goal for the task. There were two learning goals set up for each course. The goals were set to fit the teacher’s planned class content, so that the test would just be part of a usual lesson. After some time the students were told to assess their progress and the time needed to reach the learning goal and to give their partner feedback inside the app for the activity.

Item	**Grd.9**	**Grd.11**
Were you happy about the feedback you were given?	0,4*	0,75
Would it be better if the teacher gave the feedback rather than your classmates?	0,2	0,375
How difficult was it to give feedback using the app? (1 = easy, 5 = difficult)	1,5	2,6
Did you enjoy giving feedback to your classmates?	0,6	1
Was using the app hindering to your work? (1 = not at all, 5 = very much)	1,667	2
Did you reach the learning goals listed in the app?	0,8	0,25
Would you use the app to track your progress outside of class?	0,6	1
How often do you think about your learning outcomes outside of class? (1 = rarely 5 = a lot) *	3	4,143
How difficult was it judge your own progress? (1 = easy, 5 = difficult)	1,75	3
Did the questions match the learning outcome precisely? (1 = precisely, 5 = not precise)	2,2	2,875
Would you use your own name instead of the pseudonym when using the app?	0	0,5
How much did it influence your answers that others could read them? (1 = a lot, 5 = not much)	1,25	2,375
Could you come up spontaneously with other learning goals for yourself?	0,4	0,25
Did you adjust your progress when using the app besides the times the teacher asked you to?	0,2	0,5
How difficult were the tasks to you? (1 = easy 5 = very difficult) *	2,2	2,375
How much knowledge did you gain by reading the answers the others gave?	0,2	0,5
Did you gain insights because of the feedbacks your peers gave to you?	0,4	0,5

*In percent normalized between 0 and 1, or between 1 and 5 if scale is given

Figure 4: Result table. The source is the master thesis of Martin Kapp

The interactions show that the app stimulates awareness and some metacognitive activities. However, further evaluation is needed to come to conclusions concerning learning effects. It should be considered using the app at the university level, too.

6 Discussion and Future Work

The app has been evaluated in a school classroom setting. However, results have been biased by the students' preferences. Thus, the real impact of the app for cooperative learning still needs empirical validation. Using the app at university level is promising as students are more likely to take part in self-regulated learning activities that can be supported by micro reflections. Group composition based on perceived learning progress using this app is possible but not evaluated yet. Different patterns have been suggested during the tests. These are: group composition based on similar competency patterns, groups with different time management and groups based on perceived progress. Another area that needs further experiments are the collaborative teaching aspects. During our tests we used the app with two teachers (the regular teacher and our staff member). It remains an open question whether the system scales with the number of teachers who use the app to communicate learning goals with their intersection of students.

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