Social Microlearning Motivates Learners to Pursue Higher-Level Cognitive Objectives

Bernhard Göschlberger

Research Studios Austria FG, Linz, Austria
Johannes Kepler University, Linz, Austria
bernhard.goeschlberger@researchstudio.at

Abstract. With the advent of the smart phone, technology enhanced learning ultimately became mobile. The combination of small devices and ubiquitous availability promoted a certain type of informal learning called microlearning. Unfortunately, micro-learners tend to focus on the lower level cognitive objectives remembering and understanding. Social microlearning seeks to engage the learners in activities of higher cognitive levels – such as analyzing, evaluating and creating – by using successful strategies of social software. Early results confirm the assumption that learners' activities evolve towards higher cognitive levels over time spent on a particular subject in a social microlearning environment. Consequently, social micro-learners gain deeper insights by progressing through an upwards spiral of competence development.

Keywords: microlearning, social learning, question posing

1 Introduction

Microlearning focuses on short-term and informal learning activities using small, but self-explanatory learning resources [1] that are available on the Internet and often accessible through a single definitive URL or permalink [2]. Micro-learners are often driven by a particular knowledge gap they want to close immediately [3]. Therefore they tend to consume information on a factual level and solely for the sake of remembering. Microlearning implementations often use learning activities similar to flash cards (e.g. Mobler Cards [4, 5], KnowledgePulse [6]) as they provide a good format for compressed factual knowledge. In Bloom's revised taxonomy [7] the act of learning a flash card (in drill mode) is an act of remembering. To promote understanding - a higher-level learning objective - the aforementioned microlearning implementations advanced the traditional flash cards enriching them with explanation, insight and/or feedback. Further, they implement a variety of features aimed at engaging students in higher order cognitive tasks such as reflection, self-regulation, content evaluation and content creation. However, there is a significant gap between remembering factual knowledge and creating new knowledge. In order to evaluate and create learning content the learner already needs a good understanding of the subject. It is a challenge for microlearning systems to accompany a learner's progress throughout the different cognitive levels of educational objectives. The micro-learner's immediate need to fill a knowledge gap (cf. [3]) might be sufficiently served, the moment he or she remembers the specific facts. Therefore the system must be designed in a way to attract further interaction and ultimately leading to a deeper insight. Based on findings in related work described in section 2 and Baumgartner's learning model described in section 3 we will argue that characteristics and strategies of social software – described in section 4 – can attract micro-learners to pursue higher-level cognitive learning objectives. In section 5 we describe a first empirical evaluation and the results, before we conclude and outline intended future work.

2 Related Work

The pedagogical value of encouraging students to contribute educational resources via online systems has been demonstrated by many researchers. Several systems with a focus on online question posing or assessment item creation have been presented. Among the first systems was QSIA (Questions Sharing and Interactive Assignments) [8], which aimed to merge assessment and knowledge sharing (by recommendation). In experimental settings students had to take self-assessment followed by peer assessment and finally achievement assessment. Thus students should be led to reflection and deeper learning. The researchers found a statistical significant correlation between students' contribution quality and their exam grades.

Another approach was the QPPA (Question Posing and Peer Assessment) [9] system. It provided question-posing, peer-assessment, item-viewing, and drill-exercise capabilities. The research mainly focused on the difficulty of question posing for different subjects in higher grades of elementary school, but also showed that the task of posing questions promoted students' cognitive ability and motivation.

PeerWise is arguably the system providing the most empirical evidence on the effects of having students create and share their own assessment questions [10, 11]. The results of a study on 854 students during the academic year session 2011/12 across subjects showed a significant correlation between PeerWise activities and final exam grades. Although, providing evidence for the effectiveness of the pedagogical approach, it has to be noted, that PeerWise is designed for formal settings. Students log into a course specific space and are formally constrained to the topic.

All of the aforementioned systems have a narrow focus on multiple-choice questions and assessment items. Conversely Concerto II [12, 13] and Concerto III [14] allow additional types of questions. Their results support that students contributing questions perform better at exams and that the quality of the contributions is also positively correlated to exam scores. Another interesting finding is that students claim to be more motivated using the online question-posing system.

In recent work (unpublished) Karataev and Zadorozhny presented the SALT-framework [15]. Their work focuses on crowdsourcing of lesslets. A lesslet is a mini-lesson, constrained to a certain form and could well be considered as a certain type of micro-content. The focus on crowdsourcing by nature implies informal learning scenarios and therefore a close relation to our work. However, the research focus is clearly on crowdsourcing and scalability issues as (1) how to group/cluster students, (2) ideal learning pathways of individuals and groups, and (3) content recommendation using collaborative filtering.

All of the presented related research is driven by the intention to engage students in more metacognitive work and deeper and into a richer learning experience. Even though Bloom's cognitive domain model influenced all mentioned works, each one has a slightly different view on the learning process. The following section presents the educational model our social microlearning approach is based on.

3 Learning Model

The underlying learning model for this work is derived from Baumgartner's model of a micro-learner [16]. Whilst other authors (e.g. [6],[1]) focused on the use of micro-learning principles for formal learning and its didactics, Baumgartner's Model focusses on informal learning and the learners themselves. It has evolved from his earlier work on a teaching model that focuses on the students competence development in a certain subject or topic [17]. He argues that the role of the teacher transforms as the students competences develop. According to Baumgartner a teacher initially needs to transfer factual-knowledge (Teaching I). Subsequently students may apply the transferred knowledge and the teacher's role changes to tutoring (Teaching II). The teacher can continuously reduce guidance and the teaching process becomes an act of cooperation between students and teacher (Teaching III). In the context of microlearning Baumgartner adapts his model and describes the perspective of an informal learner. He argues that a student has to absorb basic knowledge about a topic or subject in a first step (Learning I), before being able to actively acquire knowledge about that topic in a self-determined manner (Learning II) and finally being able to construct knowledge in a third step (Learning III). With the learner continuing to learn more advanced concepts this process is repeated on a higher level (Learning I+) – leading to an upwards competence spiral. Baumgartner remarks relations between Learning I and behaviorism, Learning II and cognitivism, and Learning III and constructivism.

Whereas typical microlearning systems have proven valuable especially in the Learning I phase, the key challenge social microlearning tries to address is to motivate students to enter the following phases. Each phase demands different levels of guidance and requires the learning system to play a different role. The system needs to adapt accordingly and act like the teacher described in Baumgartner's earlier model. Learning I requires the software to provide strict guidance and reduce complexity by limiting the degree of freedom. In Learning II phase the learner takes control over his learning process. The system should enable the user to freely navigate through and choose learning resources. Guidance is reduced to recommendation. Learning III phase includes the construction of new knowledge. Therefore the system needs to support students to contribute, evaluate and discuss. The following section will focus on strategies and features of social software and derive a key set of functionality social microlearning systems need to address students' needs throughout all three phases, and therefore remains attractive to micro-learners beyond the objective to remember factual knowledge.

4 Social Software for Microlearning

The evolution of the Internet towards a space of more democratic information exchange has ultimately led to its society-changing success. The term social web has been coined to reflect the social nature of the process of creating and sharing information resources on the web. Accordingly the term social software describes software that enables groups to form and self-organize in a bottom-up manner and typical functionalities have been identified (cf. [18, 19]):

- Support for conversational interaction between individuals or groups
- Support for social feedback
- Support for social networks

Wikis and Weblogs were first popular types of social software and are still very commonplace. However, as of today social network sites (SNS) are the predominant form of social software on the web. Two success factors for SNS are the simplicity and immediate graspability of its content artifacts. Twitter – considering itself as micro-blogging service earlier – became more popular than any other blogging service as it restricted its content artifacts to 140 characters. This restriction reduced the cognitive load per artifact for both creators and consumers and lowers the barrier to initiate social interaction. On the other hand it also enables the consumers to quickly decide whether content is relevant to them. Similarly, Facebook only views the first view lines of a post in the timeline, forcing posters to indicate the essence of their post in the first lines in order to arouse a reader’s interest. Hence, micro-content artifacts as understood by microlearning are especially suited for SNS or social online learning environments.

A social microlearning system has to follow the premises for microlearning. It has to be available on the Web, optimized for mobile devices and should support the different phases of learning model. Therefore it has to at least enable learners to:

1. interact with and solve learning activities
2. tag, collect, evaluate, rate, comment and improve content
3. create and share content

4.1 Interact and Solve

Learners in Learning I phase try to remember and understand the factual knowledge they are provided with. They interact with the provided micro-content. In the case of multiple-choice questions, for example, this would mean to check and uncheck options. Once they decided on an answer they can submit and resolve. Learners in Learning I phase need to be able to repeat and practice a particular activity. Learners in Learning II or Learning III phase interact with and solve learning activities differently. Rather than repeating the activity to remember factual knowledge, they reflect, analyze and evaluate the activity and hence the content. They are more likely to tag, collect, evaluate, rate, comment and improve the content subsequently.

4.2 Tag, Collect, Evaluate, Rate and Comment

Learners in Learning II phase are able to organize content as they have the ability to understand the basic principles and structure inherent to the topic. To organize existing learning content relevant to them, they tag items or add them to their collections. In Learning II, learners are also able to compare and evaluate content and hence provide content ratings or express their thoughts on particular content items by commenting. As comments themselves are content it should be possible to rate them as well.

4.3 Create, Share and Improve

Learners in Learning III phase create and share micro learning content. They synthesize their acquired knowledge into new variations of that knowledge. If challenged, they will justify their point of view through commenting. They will engage in debates and edit and improve shared content. As in most social software a version history should be provided to document the evolution of content.

5 Experimental Setting and Results

Based on the criteria outlined above a social microlearning platform has been implemented (described in [20]). To verify the underlying educational model a cohort of 100 students was asked to use the system accompanying a specific university course. The course consisted of five distinct topics covered during the semester. The topics were covered sequentially in the course.

Our hypotheses were that (1) students would progress through the learning phases (Learning I, Learning II, and Learning III) for each topic, and that (2) in each learning phase students prefer the associated type of activity. The students were not instructed how they were expected to use the system, but were able to earn bonus points for their final exam for actively using the system. Activity was assigned to the course topics and students were able to earn up to three bonus points per topic. The exam itself totaled 100 points. The actions outlined in the previous section were logged using xAPI and analyzed for patterns of evolution in the students' types of activities over time per topic. To provide content students could interact with, the instructor created initial learning cards at the beginning of the experiment.

The data was investigated in two ways: (a) by thorough statistical analysis of the tracked interaction data and (b) by analyzing the textual content items and comments. The statistical analysis so far supports the learning model presented in section 3 as we found the following patterns:

– most students started with activities associated with Learning I (interacting with existing content)
– first movers contributed content for new topics right away
– after about two weeks of interaction, other students contributed content themselves
– although the bonus points were already awarded, the highest activity was tracked in the last days before the exam

Fig. 1 illustrates the found patterns. It highlights the timespan of two weeks between contributions of first movers and other students for the modules “mediatype text” and “multimedia systems”.

The analysis of the textual content showed that students were demonstrating clear signs of critical analysis and reflection, such as discussions on the correctness of content or inquiries about content improvement directed at the content creator. Linking these findings with the statistical data we found that especially students who had interacted with content of the specific module prior showed these signs of higher order cognitive thinking.

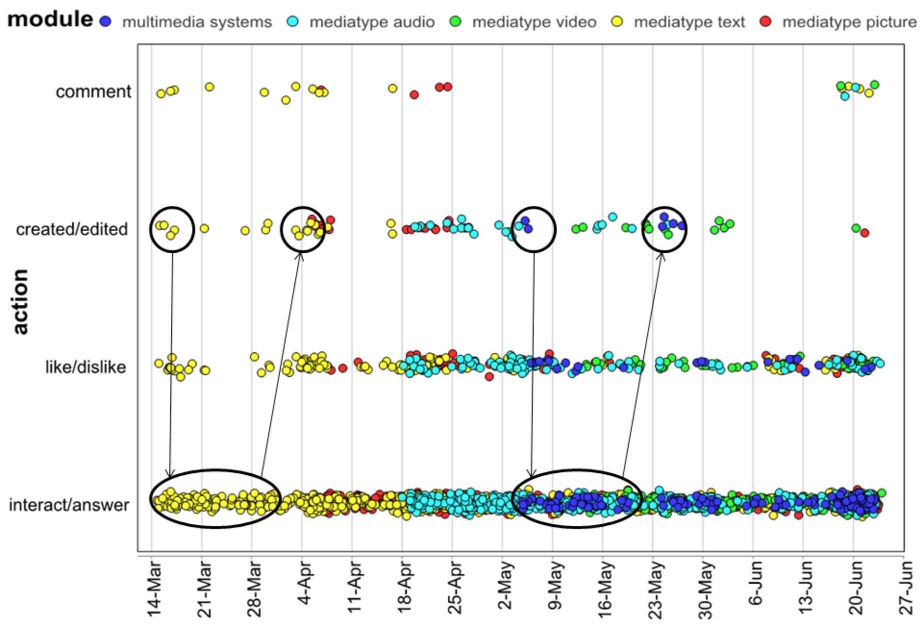

Fig. 1. Student activities. Reoccurring pattern: First movers create content. Majority of students consumes content for two weeks before contributing content themselves.

6 Conclusions and Future Work

The experiment demonstrated that patterns of the competence development spiral can be identified throughout all topics. The results of our analysis supports our hypotheses, as clear signs of Learning III appeared towards the end of each topic and were preceded by tasks that are related to Learning I. However, the current prototype provided no appropriate way to organize content. The tagging-feature was hardly used and therefore Learning II could not be observed as desired.

We plan to report on the students' exam performances in relation to this experiment in future work. As related research suggests we expect that (1) students using the system will outperform students not using the system, and that (2) students that showed signs of Learning II and Learning III will outperform other students.

Future work will have to incorporate further strategies of social software such as reputation management, recommendation or information filtering. The Concerto II-research showed that students' motivation to use a system and the amount of contribution can be improved enormously by considering user feedback. Therefore we will survey students about their experience and potential improvements and adjust our development priorities accordingly.

Acknowledgements. This research is part of a PhD project, funded by the Austrian Funding Agency (FFG) as part of the Industrial PhD Programme. The project started in July 2015 and will be completed by December 2017.

References

1. Hug, T., Micro learning and narration: exploring possibilities of utilization of narrations and storytelling for the design of" micro units" and didactical micro-learning arrangements. Proc. Media in Transition, 2005.
2. Buchem, I. and H. Hamelmann, Microlearning: a strategy for ongoing professional development. eLearning Papers, 2010. 21(7).
3. Kovachev, D., et al., Learn-as-you-go: new ways of cloud-based micro-learning for the mobile web, in Advances in Web-Based Learning-ICWL 20112011, Springer. p. 51-61.
4. Glahn, C., Supporting Learner Mobility in SCORM-Compliant Learning Environments with ISN Mobler Cards. Connections: The Quarterly Journal, 2012. 12(1).
5. Glahn, C. Using the adl experience api for mobile learning, sensing, informing, encouraging, orchestrating. in Next Generation Mobile Apps, Services and Technologies (NGMAST), 2013 Seventh International Conference on. 2013. IEEE.
6. Bruck, P.A., L. Motiwalla, and F. Foerster, Mobile learning with micro-content: a framework and evaluation. Bled eConference, 25th Bled eConference eDependability: Reliable and Trustworthy eStructures, eProcesses, eOperations and eServices for the Future, 2012: p. 17-20.
7. Anderson, L.W., D.R. Krathwohl, and B.S. Bloom, A taxonomy for learning, teaching, and assessing: a revision of Bloom's taxonomy of educational objectives2001: Longman.
8. Barak, M. and S. Rafaeli, On-line question-posing and peer-assessment as means for web-based knowledge sharing in learning. International Journal of Human-Computer Studies, 2004. 61(1): p. 84-103.
9. Yu, F.Y., Y.H. Liu, and T.W. Chan, A web- based learning system for question- posing and peer assessment. Innovations in Education and Teaching International, 2005. 42(4): p. 337-348.

10. Denny, P., A. Luxton-Reilly, and J. Hamer. The PeerWise system of student contributed assessment questions. in Proceedings of the tenth conference on Australasian computing education-Volume 78. 2008. Australian Computer Society, Inc.
11. Hardy, J., et al., Student-generated content: Enhancing learning through sharing multiple-choice questions. International Journal of Science Education, 2014. 36(13): p. 2180-2194.
12. Hazeyama, A. and Y. Hirai, Concerto II: A collaborative learning support system based on question posing. 2009.
13. Hazeyama, A. and Y. Hirai. Concerto ii: A learning community support system based on question-posing. in Advanced Learning Technologies, 2007. ICALT 2007. Seventh IEEE International Conference on. 2007. IEEE.
14. Hirai, Y., A. Hazeyama, and T. Inoue, Assessment of learning in concerto III: a collaborative learning support system based on question-posing. Proceedings of Computers and Advanced Technology in Education. Calgary, Canada: ACTA Press, 2009: p. 36-43.
15. Karataev, E. and V. Zadorozhny, Adaptive Social Learning Based On Crowdsourcing. IEEE Transactions on Learning Technologies, 2016. PP(99): p. 1-1.
16. Baumgartner, P. Educational dimensions of microlearning–towards a taxonomy for microlearning. in Designing microlearning experiences–building up knowledge in organisations and companies. 2013. Innsbruck: Innsbruck University Press.
17. Baumgartner, P. The Zen Art of Teaching-Communication and Interactions in eEducation. in Proceedings of the International Workshop ICL2004, Villach/Austria. 2004.
18. Ziovas, S., M. Grigoriadou, and M. Samarakou, Supporting learning in online communities with social software: An overview of community driven technologies2009: INTECH Open Access Publisher.
19. Boyd, S., Are You Ready for Social Software? Darwin Magazine, 2003.
20. Göschlberger, B., A Platform for Social Microlearning, in Adaptive and Adaptable Learning: 11th European Conference on Technology Enhanced Learning, EC-TEL 2016, Lyon, France, September 13-16, 2016, Proceedings, K. Verbert, M. Sharples, and T. Klobučar, Editors. 2016, Springer International Publishing: Cham. p. 513-516.