LEARNING ANALYTICS AS A TOOL TO GIVE FEEDBACK TO LECTURERS AND TEACHING ASSISTANTS: FIRST CYCLES IN A DESIGN SCIENCE STUDY

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Feedback is an important part of any learning process. Not only do learners need feedback to assess their level of learning and improve their learning, but instructors in particular need feedback to adapt their teaching to the progress of their students. In large classes, however, it is particularly difficult for instructors to receive adequate feedback from students. Besides classical structured methods of collecting feedback, Learning Analytics can be of great help in this situation. In technology enhanced teaching, collected data can be used to supplement existing feedback processes and thus extend or triangulate them. The aim of this design science project is to develop an integrated feedback concept for a course with about 700 participants, which in particular uses Learning Analytics. Two design cycles have been carried out so far and conclusions for the ongoing third cycle have been drawn. Results of these design cycles are discussed in this paper.

THEORETICAL BACKGROUND

Role of Feedback in Higher Education

Hattie, who became famous for his meta-studies, has also focused on higher education in order to evaluate the effects of instructors' actions in their effect size (2015). He built these investigations on his work on learning in K-12 which became known as Visible Learning. At the same time, he also considered that learners at the university are older and more experienced in learning, but often more heterogeneous in previous experience, previous knowledge and social backgrounds. In this context, he evaluated meta-studies, which he collected to form a general overview of effect sizes of several aspects of university teaching. Together with his findings from his work on Visible Learning, Hattie thus arrived at a total of six particularly important tools for successful university teaching. Hattie described the most effective influence on university teaching as being when teachers critically question the success of their teaching. In third place on the list was the fact that university teaching, like any other form of learning, should always build on students' prior knowledge in order to expand knowledge networks (2015). Hattie drew the conclusion from these particularly important factors of successful university teaching that regularly requesting feedback from students helps teachers to improve their own teaching in general and at the same time to link much more closely to the needs of the students. Hattie described feedback that teachers get from their students as a core factor of successful university teaching.

To obtain such feedback, Hattie suggests a methodologically pluralistic approach to the students. This includes quantitative surveys as well as regular formative assessments and open methods of gaining knowledge from students. Hattie thus encourages instructors to use all the methods of empirical social science research for the evaluation of their own teaching and thus to continually improve their own teaching in the sense of a Scholarship of Teaching and Learning (SoTL) and to develop it in cooperation with their students (2015).

Learning Analytics

Although Hattie (2015) also showed that the size of the learning group has little effect on learning success, albeit a small and consistently positive one, the collection and evaluation of such feedback in large groups is nonetheless a problem. In small learning groups the interaction between instructors and learners is very direct and instructors get a good insight into the learning of their students without any active attempt for feedback. The impressions out of the close contact with learners are less systematic than a purposeful collection of feedback, but in some respects, they come close to the open formats of feedback collection demanded by Hattie. Instructors in small groups are thus faced with the challenge of reflecting on the impressions they have gathered about learning and of translating these impressions into adaptations for further teaching.

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For instructors in very large learning groups there is an additional challenge. They often interact with their students less directly and are therefore more dependent on obtaining feedback in an active manner. The social forms of these large groups, such as classical lectures, also make it difficult for instructors to gain a good insight into the learning process of their students. Educational literature has therefore developed a variety of possibilities to collect feedback from learners and make it available for further teaching (see for example Winstone & Carless, 2019).

When looking at these possibilities, it becomes clear that instructors already adapt many methods of empirical social research for the evaluation of learners and thus, in a way, meet Hattie's demand. In recent decades, however, social science research, like other fields of research and especially computer science, has gained a multitude of new possibilities through the significantly increased availability of data. The keywords Big Data and Data Science are only two of the particularly frequent attempts to describe and structure these new possibilities.

In this context, the still somewhat younger domain of Learning Analytics attempts to make use of learner-related data generated during the learning process. The data are to be used not only as a basis for further research about learning, but also to generate findings that are directly fed back into teaching and thus improve it. Long and Siemens (2011), for example give nine advantages of this new approach, which are already being used to a small extent to improve teaching, but which offer much more potential for the future. At the level of a course this means, for example, that the learning behavior of students can be analyzed for learning patterns in order to give both teachers and learners feedback on how to break through or improve these patterns. In addition, learning analytics can be used to identify students who have a particularly high risk of not fulfilling the course requirements. These students can then be offered more specific help (Long & Siemens, 2011). In this sense, learning analytics merges the research on learning and its improvement.

INITIAL SITUATION AND OBJECTIVE OF THE DESIGN STUDY

In the project presented here we follow a Design Science approach (Nührenbörger, Rösken-Winter, Link, Prediger, & Steinweg, 2019). The environment for the design is an introductory statistics course at the University of Goettingen. About 700 students take part in the course every year, most of them in their first year of a social science program. The course consists of one 90-minute lecture per week and 90-minute tutorials, which are led by experienced students supervising about 30 students each. Due to the size of the group and the format of the lecture, the responsible lecturer hardly has the possibility to get in touch with many students individually and to get feedback. The tutors are in closer contact with students but are also unable to provide individual support. In addition to the in-class sessions, the course consists of weekly tasks, which were previously provided as PDF documents. The only compulsory element of the course is the final exam.

So far, feedback has not played a role in the course in question. Apart from a few individual cases in which students gave unsolicited feedback to the lecturer at the end of the lecture, no feedback was carried out. Structured opportunities to collect feedback were not used, meetings between the lecturer and the tutors were only used for organizational planning but not for exchanging thoughts about the students and their learning. The further planning of the course was therefore always based only on old material and new inspirations of the lecturer, but not on empirical findings coming from the feedback of the students.

In this context, the goal was set, based on the theoretical background described above, to integrate student feedback into teaching much more than before and to use it to improve teaching. As suggested by Hattie, all methods of empirical social science research would be considered for this purpose. A special focus should be on evaluating weather Learning Analytics could be a valuable tool for feedback. Both the possibility of generating completely new insights from feed-back and the option of supporting existing insights in other ways should be under consideration. To achieve this goal, the project described here will use the Design Science approach. This approach appears to be particularly fruitful, as it combines practical implementation in the classroom with regular scientific evaluations of the success of the interventions. The result is both a concrete solution for the problem in the situation as well as a generalized understanding of how other similar situations could be addressed. The procedure in a Design Science approach is cyclic and alternates between practical implementations and their evaluation. In the following, we will describe which approaches were

implemented in the first two cycles and what findings of the evaluation mean for the subsequent cycles. In this sense, this paper is a progress report of our project.

DESIGNED FEEDBACK FOR THE LECTURER

First design cycle

As the first and at the same time largest element of the first design cycle, a potential that had previously been untapped was used. The tutors of the course have a much better impression of the students' learning than the lecturer, due to their teaching in smaller groups and also due to their greater closeness to the student's situation in life. This gives them a certain feeling for the learning success and the emotions of their students. Even if tutors are not professionally trained for teaching, these impressions from their daily teaching experiences can be important resources to generate constructive feedback. The weekly meetings between the lecturer and the tutors have therefore been fundamentally redesigned. Organizational aspects and the discussion of lecture content were pushed back as far as possible in order to have time to let the tutors report on their experiences. Thus, each session in this cycle begins with a "How's it going?"-round, in which each tutor has the space to share their personal state of mind as well as their perception of the students. The lecturer quietly receives these reports, trying to form clusters of recurring experiences. He uses these to check his correct understanding of the reports and to ask more concrete questions in a second round of discussions. The aim of the first two rounds of questions in the weekly meetings is to value the subjective impressions of the tutors as an important source for improving teaching and to discuss the students' level of learning. The goal of generating feedback is combined here with the general approach of involving all course team members in the constructive alignment of the course.

As the second main component of the first cycle, a first step towards technology enhanced learning was taken. This consisted of two sub-components: the weekly tasks were no longer provided as PDF files but were made available via an online learning platform. Although this platform does not allow much learning analytics, it does offer the evaluation of the students' success with the tasks both per learner and per task. The second part was the use of an audience response system. At different times during the course the audience response system was used as a tool of formative assessment, but sometimes also for voting on feedback questions. Thus, data similar to surveys were collected in an uncomplicated way.

The evaluation of the redesign of the meetings between lecturer and tutors was mainly carried out by interviewing the tutors. Firstly, the tutors were asked about their personal satisfaction with the course, and secondly, they were asked to estimate the students' satisfaction. As a third aspect, the tutors were also asked to estimate the perceived learning enhancement. In all these questions, special attention was paid to the tutors who had already assisted the course following to the old model in the previous year. This half of the tutors were always asked to compare the two years in all questions. The results of these interviews show that the satisfaction of the tutors was especially high, but that the satisfaction of the students also increased. A comparison of student performance between the years can hardly be carried out quantitatively due to various external circumstances but is assessed by the tutors as slightly positive. Since the consequences of the redesign were difficult to see for the students of the course, no detailed evaluation by the students was carried out. However, the university-wide evaluation also asking about the coordination between lecture and tutorial was in that point rated significantly better than in the previous year. A more detailed quantitative analysis was carried out on the audience response questions used. While the formative questions are rated slightly above the theoretical mean of the Likert scale, the feedback questions consistently achieve best scores.

The use of the data on student performance in homework was also rated positively by the tutors. At the same time, however, they criticized that the information is too fuzzy and does not consider too many aspects of the learning process. So far, the information from the data has been evaluated as hardly profitable compared to the personal impression in the tutorial, only their availability a little earlier is considered a gain. For the second design cycle, it was therefore decided to retain the elements of the first cycle, while expanding the possibilities for learning analytics.

Second design cycle

In the second design cycle, the project benefited greatly from the parallel project "Interactive Learning on Demand". In this project, a technical online assistance system was developed to help students in all aspects of learning. This includes the provision of course materials, video recordings of lectures, online quizzes, an audience response function and, in particular, an integrated chatbot that can automatically answer course-related questions. With this new course infrastructure, a basis was there that could provide a large amount of data for the use of Learning Analytics. However, since the technical system was new, it was necessary to dispense with constantly updated analyses of all learning data. However, task-related knowledge about the learning success of the students was available. In addition, the questions asked by students in the chat were considered a valuable addition to the feedback received so far. For this reason, a project assistant proofread all the questions asked and reported his perceptions in the weekly meetings as the new third round. Questions from students could thus be included in the discussion before the tutorials took place. Based on this and the knowledge about the difficult tasks, possible problems of the students were discussed between the lecture and the tutorial sessions to adapt the tutorials directly. The other elements mentioned in cycle one were also continued.

The above-mentioned evaluation of the fit between lecture and tutorial could again be significantly improved with this approach. In addition, in a supplementary questionnaire, the students were very satisfied with the tutorials and their fit to their own questions. Furthermore, asking feedback questions via audience response system also in the tutorial was evaluated with a very high level of satisfaction.

Interviews with the tutors showed that they perceived the previous information from the question difficulties and especially from the students chats as valuable information for the preparation of their tutorials. The question of whether such projects should be continued therefore showed consistently positive results. At the same time, however, there was a clear desire to learn more about student learning in order to be even better prepared.

CONCLUSION

The third cycle of the project will take place from April to August 2020. All approaches to feedback used so far will continue to be implemented. In addition, data from the learning system will be used much more in the third cycle. Two workshops with tutors and other lecturers on ideas about which variables would be the most interesting revealed that the time taken to complete the tasks and the absolute frequencies of the subject specific terms queried by the students are of particular interest. In addition, the presence in lectures and tutorials as well as the use of lecture recordings will also be evaluated. Especially pausing or jumping in videos promises insight into the learning process. All this should serve to better understand which preparation for the tutorial sessions students have. In order to better process this data, the weekly meeting will be supplemented by a fourth round in which the relevant data will be jointly reviewed and discussed. In this way, all participants hope to be able to prepare the tutors even better for their tutorials in the near future and also to give the lecturer valuable feedback for his lecture. The methods already used in the first rounds remain an important part of the feedback culture.

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