Use and impact of the open source online editor Etherpad in a psychology students' statistics class

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The Etherpad is an open source online editor providing the possibility for collaborative writing and discussions in real-time via a shared link. Previous research has shown that the use of technology in higher education can be effective and that online editors can facilitate collaborative learning. This article outlines the use of the Etherpad in a psychology Master's students' statistics class. During the lecture, students asked and answered questions in the Etherpad, followed the discussion of others, and/or gave general comments on the lecture and its topics. A tutor and the lecturer acted as moderators of the Etherpad. For evaluative purposes, students' participation in the Etherpad and their feedback in a mixed-methods survey were investigated. In all, 50 out of 90 students attending the course sessions participated in the evaluation. Students' commitment and feedback were very positive. We conclude by discussing implications of the Etherpad use for lecturers teaching statistics.
Keywords: *Etherpad; online editor; large group teaching; statistics education; technology enhanced learning.*

THE IMPORTANCE of statistics in psychology has long been known (Cowles, 2005; Garrett, 1926), and just as long, statistics teachers have been facing several challenges (Conners et al., 1998): They have to deal with their students' negative attitudes or beliefs towards statistics (Doyle, 2017; Onwuegbuzie & Wilson, 2003), their differences regarding quantitative skills, achievement motivation and learning strategies, (Bude et al., 2007; Fonteyne et al., 2015) or a combination of both (Macher et al., 2011) and/or their often serious and increasing difficulties with the mathematical content (Carpenter & Kirk, 2017). The list of recommendations and advice for lecturers teaching statistics is quite long (Carver et al. 2016; MacGillivray, 2008), and researchers differ in their conclusions. Whereas Cobb (1992) recommended clarifying the relevance of statistics in class while providing concrete learning content and promoting active learning, Chamberlain et al. (2015) emphasised the 'need for additional support outside of the quantitative method courses' (abstract, line 8f.). More generally, Zepke & Leach (2010) recommended: (1) ensuring engagement and interaction of students and teachers; (2) establishing active and collaborative learning settings; and (3) creating new and enriching educational experiences for students.

In general, the use of technology in higher education can be effective (Bates, & Poole, 2003; Chance et al., 2007). It has been shown that the use of computer-based learning tools in which students actively practice the learning content (Ben-Zvi, 2000) can increase psychology students' performance in statistics (Aberson et al., 2000; Bliwise, 2005; Britt et al., 2002; Mitchell & Jolley, 1999), and that students judge such tools as helpful, and evaluate them positively (Neumann et al., 2011). Furthermore Walklet et al. (2016) have shown that the use of student response systems in class facilitates formative feedback and promotes active learning and critical thinking through peer interaction of undergraduate psychology students.

Also, collaborative forms of learning which involve many students in the learning processes have become increasingly popular in higher education (Bruffee, 1993; Zheng, Niiya & Warschauer, 2015), and are associated with a lot of benefits (Laal & Ghodsi, 2012; Nokes-Malach et al., 2015). Gorvine and Smith (2015) found an initial higher preference for

collaborative learning in psychology students, and thereupon lower levels of statistics anxiety and better course performances in group work settings. Perkins and Saris (2001) demonstrated that the cooperative and collaborative jigsaw classroom technique helped undergraduates in statistics to understand statistical procedures, and to use class time efficiently. Ben-Zvi (2007) showed that students' collaboration in a wiki can improve the learning of statistics for psychology students. A combination of both technological and collaborative learning methods is realised in synchronous (real-time) online classrooms, which allow students and instructors to exchange learning materials and to communicate and interact online (McBrien et al., 2009).

This article aims to provide a case example of using the online editor Etherpad (see www.etherpad.org) as a technological method for collaborative synchronous (real-time) support, and discussions in a large psychology students statistics class (master's degree). The method was established to: (a) offer students a way to ask and answer questions anonymously and ad hoc during the lecture, and thus provide an optional and individual, but low, threshold opportunity of support; and (b) facilitate cooperative and collaborative learning structures in students' learning of statistics.

Regarding the question of whether the Etherpad is a valuable method for facilitating online support and student engagement in large courses, it is of great importance to investigate

1. Whether students use the Etherpad to ask questions on the lecture content, and/or answer and discuss the questions of others. When and why do the students use it? Why not?
2. Whether students feel that the Etherpad has a positive impact on their learning experience.
3. What are the barriers to an effective use of the Etherpad (or other online editors), and how could the use be further improved?

This article gives insights into the use of the Etherpad in the lecture, and results of the evaluation, and concludes with practical recommendations and applications for its use in the teaching of statistics.

Intervention

'Multivariate Analysis in Psychological Statistics' is part of the 12-credit, mandatory module 'Research Methods' for first-year psychology Master's students at Bielefeld university (see recommendations of the German Psychological Society, 2005). The course is taught once a week (two hours), supplemented with a weekly tutorial (two hours), and covers five thematic units (structural equation modeling, four sessions; loglinear modeling, three sessions; logistic regression, two sessions; survival analysis, two sessions; and latent class analysis, one session). In all, 148 students enrolled in the online classrooms for the course starting in Summer Term 2018, and about 90 students regularly attended the weekly lectures.[1] The module aims to teach students key competences in general, such as scientific and quantitative thinking, problem solving, information technology, as well as psychology- and module-specific key competences, such as assessment of psychological examinations, selection of appropriate multivariate statistical techniques for hypothesis testing, data analysis, and interpretation of statistical results. The assessments for this module comprise a 90-minute written examination with open and multiple-choice questions on the aforementioned learning goals, regarding conceptual knowledge and empirical application.

In the very first organisational session of the course, the lecturer presented an overview

[1] Lecture attendance is not compulsory for students at Bielefeld university. Thus, many students decide not to attend the lectures, but use the course materials in the online classroom to prepare themselves for the final exam. However, the Etherpad particularly addressed students who attended the lectures.

of the thematic units, and introduces the Etherpad as follows:

> *Get to know the Etherpad, which is an open source online editor in which you can write simultaneously. In real time, you can see what others write, and everybody can edit the text. We will use the Etherpad within this course as follows: In each of the course sessions, you will get a link to an Etherpad. Therein you can ask questions you do not want to ask aloud, answer questions from other students, merely follow the discussion, and/or give general comments on the lecture and its topics. Your tutor will also read the Etherpad during the lecture, to answer questions and to moderate discussions. I will read the Etherpad after the lecture, will also answer questions (which were not fully answered), and will consider suggestions and critique out of the discussions, for following lectures. The content of each Etherpad will be saved and a copy will be provided to all students.*

Accordingly, in each of the following 12 course sessions, the lecturer presented the link to the respective Etherpad, and encouraged the students to use the pad.

Data gathering

We observed students' participation and commitment during the lectures and assessed the number of questions posted in the Etherpad and how many of these were answered during class hours by: (a) another student; (b) the tutor; or (c) the lecturer. After each lecture, we examined questions and answers in the Etherpad, and added or corrected answers, if needed.

To examine student perceptions of the use of the Etherpad, an online, mixed-methods survey was administered. All 148 students registered in the online classroom were emailed an anonymous survey hosted by 'Unipark' (Globalpark, 2007) at the end of the semester, 50 (34 per cent) of which responded. The survey contained ten items. We assessed whether students have ever used the Etherpad (yes/no), whether users have asked questions in the Etherpad (yes/no), and whether they have answered one or more question(s) in the Etherpad (yes/no). We further assessed whether students have used the Etherpad during the lectures (yes/no), how often they have used it during the lectures (1=not at all, 2=in some lectures, 3=in most lectures, and 4=in every lecture), whether they have used it after the lectures for post-processing (yes/no), and lastly whether they deem it helpful for their exam preparation (yes/no). Finally, we asked how helpful users perceive the questions and given answers to be (six-point Likert-type scale, where 1=not at all helpful, and 6=very helpful), whether their specific questions (questions they have posted) were answered (six-point Likert-type scale, where 1=not at all and 6=fully), and if the answers to their specific questions were helpful (six-point Likert-type scale, where 1=not at all, and 6=fully).

Additionally, three open-ended qualitative items asked students: (1) why they judge the use of the Etherpad as either positive or negative; (2) which criteria they use to decide to ask and/or to answer a question; and ultimately (3) for suggestions to improve the use of the Etherpad in the lectures, and/or to generally improve the teaching of the content.

Evaluation

In sum, 52 questions were posted in the Etherpad in twelve sessions across the five thematic units. Eleven (21 per cent) of these were answered by a student during the lecture, 25 (48 per cent) were answered by the tutor during the lecture, and 16 (31 per cent) were answered by the lecturer afterwards. Table 1 shows examples of questions and answers. Overall, no question was posted twice, and only very few (N=3) questions were similar to each other. General comments on the lectures (N=7) mainly focused on requests for examples or practical exercises (N=3), and suggestions to revise the sequence of slides (N=3).

Our impression was that students were open to use the Etherpad in class: Most of the students brought along a device with internet

access, and opened the Etherpad link at the beginning of the lecture. In the Etherpad, the students tried to precisely state their questions and/or to give understandable answers (even when they were not sure of the correct answer, as some respondents stated), and were thankful for the given answers (most inquirers thanked for the response). Additionally, in our view, most of the students' answers were of good quality, and hence appropriate for a better understanding and learning, and further discussion on the content.

Table 1: Examples of Questions and Answers in the Etherpad.

Theme	Total number of questions	Question	Answer from	Answer
SEM	24	Should the residual matrix (of covariance differences) differ significantly from the zero matrix? Or should it not differ to show that the model depicts reality?	S	I think the latter. In that case, the sample covariance matrix and model-implied covariance matrix correspond.
LLM	12	Model comparison: What is compared in the model comparison (on slide 18)? How to interpret the χ^2- values?	L	The model comparison qualifies the increase in the misfit of a model without both interaction effects AxBxC and AxB compared to a less restricted model without the interaction effect AxBxC. The χ^2- values qualify the misfit of the respective model.
LR	9	How does one get from 'chance' to 'probability'? I don´t understand why a chance of 1 means a probability of .50!?	S/T	A chance of 1 (or 1:1) has two cases: One in which the event occurs and one in which the event doesn't occur. (S) That is right, a chance of 1:1 means that the event occurs in one out of two cases: Thus, the probability is one out of two (1:2), which is .50. (T)
SURV	4	Are censored data considered in the calculation of the median lifetime?	L	Yes, the median lifetime (ML) relies on the survival rate: ML refers to S(t) = .50. If there is no censored data, the event has occurred in half of the sample then.
LCA	3	Can I use the same data for the model development and for the model test?	T	First, collect data, perform a LCA and estimate how well the classes are identifiable. Second, with new data, predict classes to determine how many classes have been identified by the model (assumption: 'true' classes are known). If that works out well, apply the model to new data with unknown classes.

Note: SEM = Structural equation modeling, LLM = Loglinear modeling, LR = Logistic regression, SURV = Survival analysis, LC = Latent class analysis, S = Student, T = Tutor, L = Lecturer

Quantitative analysis of the single-choice questions in the mixed-methods survey: Table 2 displays the results of the Etherpad use. Table 3 presents the results of the Etherpad assessment.

A total of 33 students stated that they have used the Etherpad, 12 students stated that they have asked questions, and six students stated that they have answered questions. Furthermore, 20 students have used the Etherpad during the lectures, with 16 students using it in some lectures and four students using it in most lectures. A total of 13 students stated that they have (also) used the Etherpad after the lectures for post-processing, and 23 students stated that they deem it helpful and will use it for their exam preparation.

Twenty-four students judged the helpfulness of the questions and answers (Md=4, *M*=4.250, SD=.944), and 12 judged whether their posted questions were answered (Md=5, *M*=5.250, SD=.866), and if the answers were helpful (Md=5.500, *M*=5.167, SD=1.193).

Qualitative analysis of the open questions in the mixed-methods survey

A total of 44 students stated an open feedback. Thirty-six gave positive feedback and referred to the Etherpad as 'helpful because of the possibility to ask questions anonymously' (*N*=7), or 'low threshold opportunity for support' (*N*=6), or 'individual support in real time' (*N*=4). However, negative feedback was also given, and some students stated that reading in the Etherpad distracts (them) too much (*N*=6), or that 'the answers confused [them]' (*N*=3). Two students mentioned that the(ir) Internet connection was not stable enough to read and write in the Etherpad.

Almost all students who formulated criteria for their decision to ask a question (*N*=10) emphasised that they first tried to answer upcoming questions on their own (e.g. by their own considerations or consultation of course material, or fellow students sitting next to them). If those efforts failed, but the question was essential (e.g. for personal interest or relevance for subsequent content), students posted their question in the Etherpad. Students who formulated

Table 2: Results of the Mixed-Methods Survey on the Etherpad Use.

	N	% of evaluation participants	% of course participants
Sample			
Online material users	148		
Course participants	90		
Evaluation participants	50		
Single-choice questions			
General use of the Etherpad	33[a]	66%	37%
Asked questions	12[a]	24%	13%
Answered questions	6[a]	12%	7%
Use during sessions	20[a]	40%	22%
Some sessions	16	32%	18%
Most sessions	4	8%	4%
Use for postprocessing	13[a]	26%	14%
Use for exam preparation	23[a]	46%	26%

Note: [a]number of participants who answered 'yes'

Table 3: Results of the Mixed-Methods Survey on the Etherpad.

	N	Md; M(SD)
Helpfulness of questions and answers	24	4; 4.250(.944)
Availability of answers to own questions	12	5; 5.250(.866)
Helpfulness of answers to own questions	12	5.5; 5.167(1.193)

Note: Md = Median

criteria for their decision to answer a question (*N*=5) especially emphasised that they had to be relatively sure of the correct answer, and had to be able to communicate it intelligibly.

Suggestions for improving the use of the Etherpad in the lectures mostly concerned technical details (stabile Internet connection, bold or italic answers from the lecturer and the tutor) (*N*=3), and suggestions to generally improve the teaching mostly requested the provision of additional learning material (practical exercises, feedback on exam-relevant tasks) (*N*=4).

Discussion

The aim of this article was to investigate if the online editor Etherpad is a valuable method for facilitating online support and student engagement in a large psychology students' statistics class. Overall, the method was evaluated positively by the lecturer, the tutor, and the students. Specifically, a significant number of questions and answers were posted in the Etherpad, and thereby offered users the possibility to receive ad-hoc support, and to better follow the lectures. Furthermore, a significant number of students (two-thirds out of the respondents of the evaluation, which is more than one-third of the students who attend the course) stated that they have used the Etherpad, and either asked and/or answer questions or silently followed the discussion of others. Most of the users used the Etherpad during the lectures as intended, but some (also) used it after the lectures for postprocessing, and/or stated that they intended to use it later again for their exam preparation.

These findings fit well with research of Bebermeier and Nussbeck (2014), showing that the use of support depend on students' individual competences, needs and motivation. Whereas some students perceive the Etherpad (in class and/or after class) as helpful, and thankfully use this support, others did not perceive the Etherpad as helpful, and waived its use. Additionally, users judged the impact of the online editor as positive on their learning experience: The posted questions and answers were perceived as helpful, and the method itself is seen as very flexible and appropriate for better understanding statistics. We therefore conclude that the use of an online editor in a large statistics class is useful, and seems to be a promising support alternative in the broad(er) spectrum of support, especially for meeting students' heterogeneity and facilitating student engagement.

Limitations and recommendations for lecturers

This article is meant to help statistics teachers in psychology to assess whether the Etherpad is a valuable tool for their teaching purposes. Correspondingly, we discuss relevant applications and challenges, and provide recommendations.

First of all, our results might suggest that the number of questions in the Etherpad, and the number of questions answered during a session, was low in relation to the number of sessions; 36 of the 52 questions in 12 sessions were answered during the session, which results in an average of 4.3 questions per session, of which 3 were answered in-session. However, we assume that aggregating the number of (answered) questions across topics is more meaningful because parts of the sessions were dedicated to organisational issues, recapitulations, or

other teaching methods. When aggregated by topic, an average of 10.4 questions were answered for every topic during the sessions. As we did not additionally record the number of questions the lecturer was asked face-to-face in the sessions, we can only assess the extent to which the Etherpad facilitates online in-session discussions about topics. Furthermore, our evaluations show that only a minority of questions were answered by other students. This might indicate that students do not feel competent enough to provide intelligible answers, and thus use the Etherpad for asking questions rather than answering them. Also, because we did not evaluate whether students in these cases knew the correct answer or not, or did not feel confident enough to provide an (assumedly correct) answer, we recommend that lecturers encourage students to attempt at providing (partial) answers in order to foster overall participation, and to decrease the proportion of silent readers of the Etherpad.

Transferring the results to other groups of students is more reasonable, the more similar the respective target group is to our psychology Master's students (e.g. with regard to subject of study, previous education and experience, and skills and motivation). Psychology Master's students who have already completed a six-semester Bachelor's degree in psychology regularly know their learning preferences and how to follow a lecture. We assume that Master's students are able to decide whether they deem the use of the Etherpad as helpful. Although undergraduates might find it more difficult to choose which support methods are helpful and valuable for them, there are no serious reasons for not using the Etherpad in courses with undergraduates.

In summary, the Etherpad can tackle the challenge of integrating students with differences in quantitative skills and achievement motivation (Bude et al., 2007; Fonteyne et al., 2015), but this benefit only occurs if a variety of students participate. In total, 33 students stated having used the Etherpad, compared to 50 participants in the evaluation out of 90 students attending the course, and 148 students in the online classroom. On the one hand, these results might suggest that the actual number of Etherpad users was higher than 33, given that students who did not participate in the survey might still have used the Etherpad. On the other hand, the low turnout rate of 33 might indicate that course engagement and Etherpad use are low. As a result, the impact of the Etherpad on student engagement and support to all course participants could not be assessed with certainty. It should also be mentioned that we did not investigate whether using the Etherpad has effects beyond student engagement and self-reported helpfulness. In particular, the impact of the Etherpad use on course enjoyment, anxiety reduction, the exam grade or proficiency in statistics is still unclear, which makes future research necessary. However, the use of the Etherpad in class aligns with recommendations to foster engagement and collaborative learning among students, to facilitate learning (Zepke & Leach, 2010), which might, in turn, not just facilitate learning and performance, but reduce statistics anxiety in general (Gorvine & Smith, 2015). Notably, future evaluations should examine effects of the Etherpad use (it's influence) on enjoyment, anxiety or performance. It is further necessary to investigate factors ensuring that more than just highly committed or competent students participated in the Etherpad discussions.

Apart from a possible dependence of student motivational or skill-related characteristics, the Etherpad can only be used by students who bring a device with internet access (e.g. laptop, netbook or smartphone) during the lecture, whereas students who do not own, or want to use, such devices in class were excluded from the method. Beyond that, it might also pose a challenge for the participants and the lecturer if the Etherpad and its content; or more generally, the engagement in an online activity distracts students from following the lecture. In our

evaluation, nine participants stated that either concentrating on the tool itself, or on the answers, was distracting. Hence, offering the possibility for collaborative learning during the lecture comes – to some extent – with the challenge to switch attention between the Etherpad content and proceeded lecture content, which might diminish the learning process. Furthermore, the use of tools for online learning, such as the Etherpad, might also encourage unrelated online activities, which, in turn, might decrease academic performance as well (Ravizza et al., 2017). Thus, lecturers might consider alternatives to the continuous availability of the tool if necessary, such as dedicating some time slots of the lecture so that students can type questions and answers.

To conclude, the Etherpad offers a promising addition to an advanced statistics course in psychology if: (1) general conditions allow its use (e.g. internet connection); (2) the Etherpad is embedded in the structure of the lecture and the potential benefit is clear (e.g. clear communication of how the tool can be used, and who should/will answer the questions); and (3) students are encouraged to participate regardless of assumed competencies or achievement motivation.

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