# Teacher's Perspective on e-Assessment: A Case Study from Germany

Bastian Küppers[1,2][a] and Ulrik Schroeder[1][b]
[1]*Learning Technologies Research Group, RWTH Aachen University, Ahornstraße 55, Aachen, Germany*
[2]*IT Center, RWTH Aachen University, Seffenter Weg 23, Aachen, Germany*

Keywords: Electronic Examinations, Electronic Assessment, Computer Based Assessment, Bring Your Own Device.

Abstract: In order to verify common findings in the literature regarding teacher's (pre)conception of e-Assessment in general and e-Assessment on students' devices, we carried out a survey among teachers of two institutes of higher education in Germany. From the achieved results, it can be concluded that teachers seem to be open-minded regarding e-Assessment in general. However, major concerns were mentioned regarding the fairness and security of e-Assessment on students' devices. These concerns have to be tackled and clearer in order to successfully establish e-Assessment as an integral part of the examination landscape in higher education.

## 1 INTRODUCTION

The attitude of the examiners towards electronic assessment (EA) is rather cautious according to available literature (Rolim and Isaias, 2018). A main reason for this is the possibility of fraud, which, as Mellar et al. have found, is likely to increase, especially in bring your own device (BYOD) scenario:

> Teachers in all four contexts thought that there would be an increase in cheating, with the teachers in the distance education context being the most concerned. However, teachers also described a number of ways in which cheating might be reduced through assessment design, and the opportunities that e-Assessment offered for increased control of the assessment process.
>
> *(Mellar et al., 2018, p. 19)*

The last segment of the quote is in line with another study by Peytcheva-Forsyth et al., which comes to the conclusion that "*the role of technologies for prevention (rather than occurrence) of cheating and plagiarism in the assessment is emphasized*" (Peytcheva-Forsyth et al., 2018). In general, there is little information on the examiner's view on e-Assessment or digital teaching in general as is pointed out by Thoring et al.:

> The number of papers and studies which focus on the digitalization in higher education has increased recently. Most of them focus on the situation of students [...]. As Cope and Ward [...] point out, not just the students' perspective is important but also the perspective of the teaching person. While a good overview of the status quo of digitalization in the US is provided by the annual ECAR studies by EDUCAUSE – quantitative surveys conducted with approximately 50,000 students [...] and 13,000 lecturers [...] –, comparable statistics from Europe are missing. In Germany, the discourse still is driven mainly by politics, not science, and in consequence publications are often working papers with a normative character or guidelines based on experts' opinions [...].
>
> *(Thoring et al., 2018, pp. 295-296)*

Hence, a survey was carried out to understand the examiner's view on e-Assessment and BYOD and which factors influence it. This papers describes this research and is organized as follows in the second section, we give a brief overview of the findings already presented in the literature. In the third section, we discuss the setup of our survey, followed by a discussion of the achieved results in the fourth section. The paper closes with a summary and an outlook.

[a] https://orcid.org/0000-0002-5882-2125
[b] https://orcid.org/0000-0002-5178-8497



Küppers, B. and Schroeder, U.
Teacher's Perspective on e-Assessment: A Case Study from Germany.
DOI: 10.5220/0009578105030509
In *Proceedings of the 12th International Conference on Computer Supported Education (CSEDU 2020) - Volume 1*, pages 503-509
ISBN: 978-989-758-417-6
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## 2 RELATED RESEARCH

As already pointed out, there is only little related research available. Thoring et. al. come to the conclusion that "*E-assessment is of little importance in most disciplines, but has become a standard at the Department of Medicine [of Münster University] where exams are usually multiple-choice. Since there is a lot of criticism of multiple-choice test, e-assessment procedures are currently refined to be able to test practical knowledge (e.g. by using a digital microscope).*" (Thoring et al., 2018). While this conclusion is drawn from a qualitative study, it still hints to why there is so little research available: If the teachers do not recognize e-Assessment as a valuable tool, they do not bother to deal with their own perspective on it.

Jamil et. al. conducted a survey to be able to compare computer-based (CB) and paper-based (PB) examinations. Their findings draw a rather positive picture on the teacher's view on EA. They state that "*CB examinations saves time and also facilitate the students to improve their understanding which ultimately improve their GPA therefore a country-wide policy should be prepared at university level regarding CB examinations*"(Jamil et al., 2012). They found that all of the personal attributes they took into account do influence the view on e-Assessment in a certain way. However, the field of expertise ("*Department*"), the qualification and the experience with technology ("*Computer Training Certificate*") seem to have the biggest influence. This is in line with the findings by Imtiaz and Maarop who state that "*[t]he lecturers have a positive intention towards e-assessment use and would use it in the future*" (Imtiaz and Maarop, 2014).

On a different note, Kuikka et. al. come to the conclusion that "*Learning systems are not necessarily created based on teachers' needs but based on the creativity of developers. An approach where systems are developed starting from pedagogical and teaching perspectives - how to teach new skills- should be promoted. This eases teachers' entry into using the systems, and creates systems with better usability*" (Kuikka et al., 2014). Due to their investigation, they come to the conclusion that "*Timesaving is crucial for teachers. Features such as automatic evaluation and sharing of exercises help teachers save time. In order to utilise this fully, teachers can no longer work by keeping their questions private but instead cooperation between teachers is necessary. Moreover, in order to get teachers to use e-exam more widely,it is vital to provide support and to reserve enough time for them for the introduction of e-examination.*" (Kuikka et al., 2014). This is a first hint at things that teachers consider important.

## 3 DESIGN OF THE SURVEY

We constructed a survey to answer our research question:

**Q: Which factors influence the teacher's perspective on e-Assessment?**

We anticipated that the perspective on e-Assessment is influence by the following attributes:

- Gender [**G**]
- Age [**A**]
- Technology Affinity [**TA**]
- Field of Expertise (e.g. STEM) [**FE**]
- Teaching Experience [**TE**]
- Institution (University vs. University of Applied Sciences) [**I**]

These factors were adapted from our study on the students' perspective on e-Assessment (Küppers and Schroeder, 2019). Since we expected that the results would also be influenced by the general affinity of the teachers for technology, we needed to be able to distinguish between teachers with an affinity for technology and those without. To measure the technology affinity, the *TA-EG* questionnaire by Karrer et al. (Karrer et al., 2009) was used. The items of the TA-EG questionnaire have been rearranged to eliminate effects that might be caused by the clustered answers of the original questionnaire. Furthermore, we wanted to conduct the survey at several IHEs and for different study programmes, in contrast to the existing surveys. This resulted in the, originally German, survey which is available in the appendix. The survey was carried out amongst teachers at RWTH Aachen University and FH Aachen University of Applied Sciences. Due to the wide range of teachers at two institutes of higher education, no assumptions about the characteristics of this group can be made. For example, there is no information available on how informed on e-Assessment the teachers were prior to the survey.

## 4 ANALYSIS OF THE RESULTS

In total, 110 teachers responded to the survey with demographics (**A**, **G**) as shown in Table 1. About three quarters of the participating teachers are male, a little less than one fifth is female and about five percent consider themselves none of the former. Regarding the age distribution, about five percent are younger than 30, two fifths are between 30 and 50 years old and the rest is older than 50 years. The teaching areas

Table 1: Demographics of the participating teachers.

| | Male | Female | Diverse | Σ |
|---|---|---|---|---|
| < 30 | 0.9 % | 2.73 % | 0 % | **3.63 %** |
| 30–50 | 26.36 % | 11.82 % | 1.82 % | **40 %** |
| > 50 | 50 % | 4.55 % | 1.82 % | **56.37 %** |
| Σ | **77.26 %** | **19.1 %** | **3.64 %** | **100 %** |

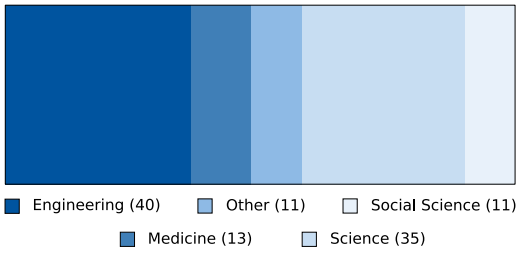


Figure 1: Distribution of the most important **FE**.

of the participants span a variety of fields, as Figure 1 shows. However, the majority of the participants teaches a STEM topic (**68.17 %**) and has been teaching for over 20 semesters (**66.39 %**), as shown in Table 2.

The *TA-EG* questionnaire covers a suitable set of features for performing a cluster analysis on. Figures 2 and 3 depict comparisons between the two clusters that have been revealed by the cluster analysis using a *k-medoids* algorithm (Kaufmann, 1987; Jin and Han, 2011). Figure 2 shows a comparison between the minimum and maximum values of both clusters. Figure 3 shows a comparison of the median of both clusters.

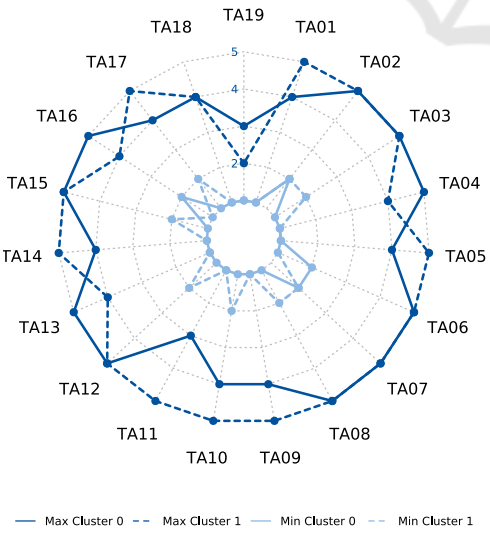


Figure 2: TA-EG: Clustering 1.

Additionally, the data set was split into subsets to determine the influence of *gender*, *age*, *field of expertise*, *teaching experience* and *institution*. These

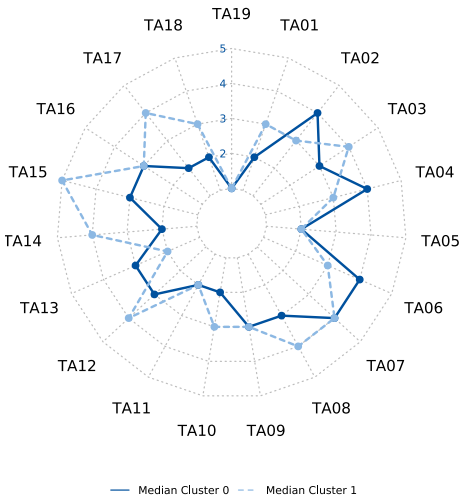


Figure 3: TA-EG: Clustering 2.

subsets were then analyzed for significant differences with a $\chi^2$ *Test for* $r \times c$ *Tables* (Sheskin, 2003, pp. 493-572). The resulting p-values for the Likert-scaled items can be found in Table 3.

Given these p-values, conclusions on the influence of *gender*, *age*, *technology affinity*, *field of expertise*, *teaching experience* and *institution* can be drawn to a certain extent. As it turns out, *gender* and *age* have a statistically significant influence The data indicate that male teachers are more convinced that a BYOD approach can be beneficial for assessment than other groups. The age of the examiners influences their view on question **E3**. The data suggests that with increasing age, the preconceptions regarding e-Assessment rise as well. For question **E3**, the distribution of the age leads to the conclusion that examiners of ages above 50 do not see e-Assessment as a suitable replacement for paper-based examinations, whereas younger teachers have a rather positive view on e-Assessment replacing paper-based examinations. As already mentioned, the cluster analysis revealed two clusters that were derived using a *k-medoids* clustering algorithm (Kaufmann, 1987; Jin and Han, 2011). These clusters represent one group that clearly has high affinity to technology (*Cluster 0*) and another, more reserved group (*Cluster 1*). For these clusters, statistically significant differences between the clusters were found for question **E1**. The participants in *Cluster 0* have a more positive attitude towards e-Assessment than the participants in *Cluster 1*. The *field of expertise* has a significant influence on question **E3**. Teachers from the fields of *medicine* and *social Sciences* see e-Assessment as a suitable replacement for paper-based examinations. Teachers from other fields (*humanities*, *engineering*, *sciences*) are more reluctant regarding e-Assessment

Table 2: **TE** (in semesters) and **FE** of the participating teachers.

| | $1-5$ S. | $6-10$ S. | $11-20$ S. | $>20$ S. | **[NA]** | $\Sigma$ |
|---|---|---|---|---|---|---|
| Engineering | 4.55 % | 7.23 % | 4.55 % | 19.1 % | 0.91 % | 36.34 % |
| Medicine | 0.91 % | 0 % | 0.91 % | 10 % | 0 % | 11.82 % |
| Sciences | 0 % | 0.91 % | 7.27 % | 23.65 % | 0 % | 31.83 % |
| Social Sciences | 0 % | 0.91 % | 4.55 % | 4.55 % | 0 % | 10.01 % |
| Other | 0 % | 0 % | 0 % | 2.73 % | 0 % | 2.73 % |
| Humanities | 0 % | 0 % | 0 % | 6.36 % | 0 % | 6.36 % |
| **[NA]** | 0 % | 0 % | 0.91 % | 0 % | 0 % | 0.91 % |
| $\Sigma$ | 5.46 % | 9.05 % | 18.19 % | 66.39 % | 0.91 % | 100 % |

Table 3: $p$ for the $\chi^2$ Test.

| | **G** | **A** | **TA** | **FE** | **TE** | **I** |
|---|---|---|---|---|---|---|
| **E1** | 0.98 | 0.17 | *0.002* $[<\alpha_{0.01}]$ | 0.11 | 0.49 | 0.73 |
| **E2** | 0.32 | 0.52 | 0.23 | 0.42 | 0.84 | 0.66 |
| **E3** | 0.17 | *0.014* $[<\alpha_{0.05}]$ | 0.69 | *0.024* $[<\alpha_{0.05}]$ | 0.44 | 0.59 |
| **B1** | *0.005* $[<\alpha_{0.01}]$ | 0.15 | 0.06 | 0.14 | 0.51 | 0.16 |
| **C1** | 0.75 | 0.22 | 0.19 | 0.28 | 0.72 | 0.73 |
| **C2** | 0.59 | 0.33 | 0.46 | 0.38 | 0.63 | 0.21 |

replacing paper-based examinations. The reason for this might well be the present examination policies in these fields. For example, as "*[m]ultiple-choice questions [...] are still used in high stakes exams worldwide to assess the knowledge of medical students*" (Freiwald et al., 2014, p. 1), it is easy to see how teachers in medicine using this mode of examinations perceive it as suitably replaceable by EA. The examiners generally agree that e-Assessment is a good supplement to paper-based examinations, while their estimate on the opportunities of cheating does not show a clear tendency. However, there seems to be a consensus that it is easier to cheat in e-Assessment than in a paper-based examinations.

**Perceived Advantages and Disadvantages of e-Assessment.** From the teachers's perspective, the main advantage of e-Assessment is *faster correction* (91.8%), while aspects like *more realistic examinations* (15.5%) and *more diverse examination tasks* (30%) are not as relevant. It turned out to be useful to cluster and analyze the free text comments to get a clearer picture of the examiners' opinion on EA. The examiners submitted 71 comments in total, including 25 comments regarding the advantages and 46 comments concerning the disadvantages. The results of clustering the comments appear in Figures 4 and 5. The clusters of the advantages are interconnected, i.e. they affect each other. For example, better readability of exam answers leads to simpler correction. The same holds for the clusters of the disadvantages, where for example inappropriate assignments can lead to stress. It is important to note that the number of clusters that were created for the disadvantages exceeds the number of clusters found for

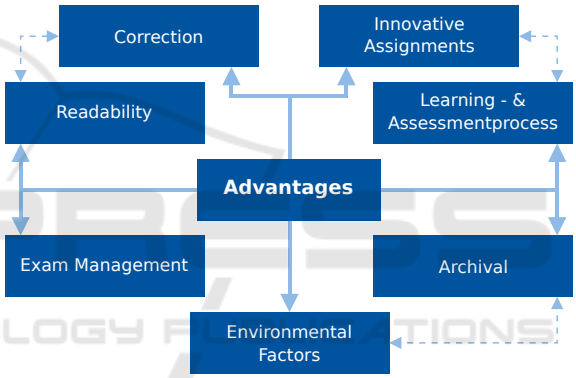


Figure 4: EA: Free Text Comments about Advantages.

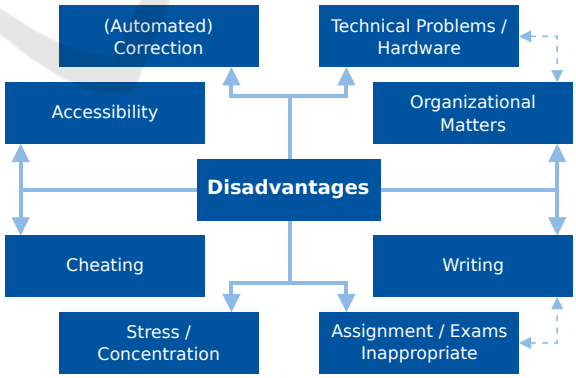


Figure 5: EA: Free Text Comments about Disadvantages.

the advantages. This could be caused by the *positive-negative asymmetry* (Pietri et al., 2013; Baumeister et al., 2001; Mittal et al., 1998), yet this can not be safely concluded from the data.

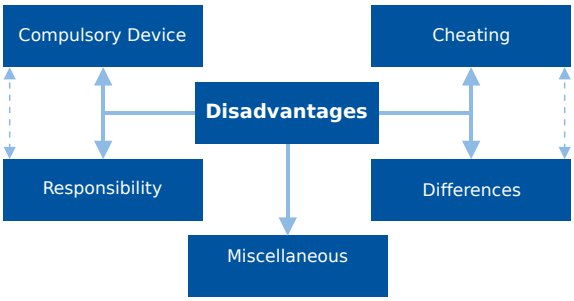


Figure 6: BYOD: Free Text Comments about Disadvantages.

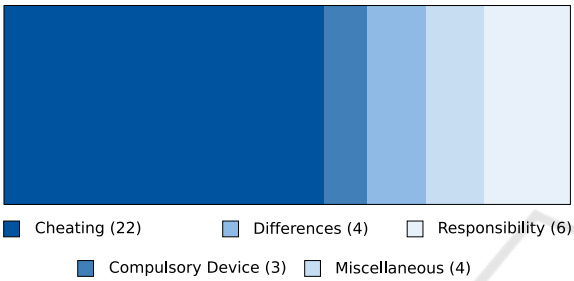


Figure 7: BYOD: Shares of Clusters of Disadvantages.

**Perceived Advantages and Disadvantages of BYOD.** According to the data collected, teachers have a fairly clear view of e-Assessment in a BYOD scenario: they do not support it. In total, only eleven comments on the benefits of BYOD were made in the survey. However, four of these comments stated things like *no benefits* (no benefits) or *no benefits* (none), leaving only seven positive comments. In contrast, a total of 36 comments were made on the disadvantages of BYOD. The resulting clustering and the proportions of each cluster for the disadvantages are shown in the figures 6 and 7.

## 5 CONCLUSION

The data collected lead to several aspects that the examiners consider to be critical. The examiners see several positive aspects of EA, such as better *exam management*, including student administration and statistics, and *innovative tasks*, possibly including multimedia. On the other hand, examiners are concerned about certain tasks or even entire exams that are not suitable for an electronic environment, or about problems with organizational matters. Overall, the positive and negative aspects of e-Assessment balance each other out, but when it comes to e-Assessment in a BYOD setting, examiners clearly reject this idea. Almost no positive aspects were mentioned by the examiners, and most negative aspects concern the possibility of fraud. It is therefore extremely important to address these issues in the concept of a framework to convince the examiners that e-Assessment can succeed in a BYOD setting without opening the doors to fraud. From the data collected, the following list of important aspects to be considered was derived:

1. An e-Assessment software has to ...
   (a) ...offer a way to carry out management comfortably (register students, create assignments, correct, archive, ...).
   (b) ...offer a software interface to implement and adapt types of assignments to the examiners' needs.
2. Measures have to be taken to prevent ...
   (a) ...unfair advantages for particular students.
   (b) ...cheating during the EA.
   (c) ...manipulation of the students' answers.
   (d) ...data loss during the exam, e.g. due to a system crash.
3. The whole e-Assessment process has to be transparent to the examiners to clear up doubts.

## 6 SUMMARY AND OUTLOOK

This paper describes a survey on e-Assessment that was carried out amongst teachers at RWTH Aachen University and FH Aachen University of Applied Sciences. The analysis of the results revealed that a teacher's view on e-Assessment is influenced by personal attributes such as *age* or *teaching experience*. Generally, it seems that teachers are cautious regarding e-Assessment, because they see a high risk of cheating, especially if students are allowed to use their own devices. Nevertheless, the teachers also recognize advantage of e-Assessment, for example the possibility of a faster correction. From our point of view, the most important result of the analysis is the need for transparency when utilizing e-Assessment. Only by implementing a transparent process for e-Assessment, it will be possible to convince the teachers to accept e-Assessment as an integral part of the examination landscape in higher education.

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# APPENDIX

The survey is shown in Figure 8. Particular options for the tagged items are:

1. $<$ 30 Years; 30–50 Years; $>$ 50 Years
2. Humanities
   - Archaeology, Ethics, History, Cultural Studies, Literature Studies, Philosophy, Theology, Linguistics, Other Humanities

   Engineering
   - Civil Engineering, Biotechnology, Electrical Engineering, Information Technology, Mechanical Engineering, Medical Engineering, Environmental Engineering, Process Engineering, Materials Engineering, Other Engineering Science

   Medical Sciences
   - Health Sciences, Human Medicine, Pharmaceutics, Veterinary Medicine, Dental Medicine, Other Medical Science

   Natural Sciences
   - Biology, Chemistry, Geoscience, Computer Sciences, Mathematics, Physics, Other Natural Science

   Social Sciences
   - Comparative Education, Human Geography, Communication Studies, Media Studies, Political Sciences, Psychology, Laws, Sociology, Economics, Other Social Science
3. Diverse, Female, Male
4. $1-5$ Semesters; $6-10$ Semesters; $10-20$ Semesters; $>$ 20 Semesters;
5. Faster Correction, More Realistic Examinations, More Diverse Examination Tasks, Other (free text)
6. Security, Usability, Fairness, Uncertain Legal Situation, Other (free text)
7. Familiar Device, Location-independent Examinations, Cost Reduction for the IHE, Other (free text)
8. Security, Differences Between Devices, Other (free text)

| Part | Item | Scale |
|---|---|---|
| General | Age | 3 Options[1] |
| | Field of Expertise | 47 Options[2] |
| | Gender | 3 Options[3] |
| | Teaching Experience | 4 Options[4] |
| TA-EG | I like to have new electronic devices. | Five-level Likert Scale (5LLS) |
| | Electronic devices cause illness. | |
| | I like to go to stores for electronic devices. | |
| | I (would) have problems understanding electronic and computer magazines. | |
| | Electronic devices provide a high standard of living. | |
| | Electronic devices lead to intellectual impoverishment. | |
| | Electronic devices make many things more complicated. | |
| | I inform myself about electronic devices, even if I have no intention to buy them. | |
| | Electronic devices make you independent. | |
| | I enjoy trying out electronic devices. | |
| | Electronic devices make everyday life easier for me. | |
| | Electronic devices increase security. | |
| | Electronic devices reduce personal contact between people. | |
| | I know most of the functions of the electronic devices I own. | |
| | I am thrilled when a new electronic device comes onto the market. | |
| | Electronic devices cause stress. | |
| | I know about electronic devices. | |
| | It is easy for me to learn how to operate an electronic device. | |
| | Electronic devices help to obtain information. | |
| e-Assessment | E1: I think it is very good to have electronic examinations in my studies. | 5LLS |
| | E2: I think that electronic examinations are a good complement to paper-based examinations. | |
| | E3: I think that electronic examinations are a good substitute to paper-based examinations. | |
| | E4: I see advantages of electronic examinations, namely… | 4 Options[5] |
| | E5: I see disadvantages of electronic examinations, namely… | 4 Options[6] |
| BYOD | B1: I find it very advantageous if electronic examinations are carried out on my own electronic device (laptop). | 5LLS |
| | B2: I see the following advantages in using my own electronic device (laptop) for an examination, namely... | 3 Options[7] |
| | B3: I see the following disadvantages in using my own electronic device (laptop) for an examination, namely.... | 3 Options[8] |
| Fraud | C1: I think that cheating in paper-based examinations can be done very easy. | 5LLS |
| | C2: I think that cheating in electronic examinations can be done very easy. | |

Figure 8: Survey (translated to English).

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