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Digital examination in higher education – Experiences from three different perspectives

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ABSTRACT

Assessment through new technology has gained a firm foothold within the university system in the last decade. This paper summarizes the experiences during the introduction of digital examination over the past two years at the Royal Institute of Technology in Stockholm, Sweden. These experiences come from three different perspectives; teachers, students and administrators. From the teachers' perspective the experience has been very positive – less time was allocated to grading written examinations, the grades are perceived as fairer and the time saved can be spent on increasing the quality of other parts of the courses. From a student perspective the experience has also been very positive – most students are enjoying obtaining the results much more quickly, editing their answers on the examination more easily and the grades are perceived as fairer. The administrators' experience is far more complex. While some parts of the administrative system encouraged the introduction of digital examination, other parts tried to stop it. The paper concludes with some advice on implementing changes in written examinations, based on the experience of the Swedish case.

Keywords: Digital examination; change; assessment; incentives; efficiency in education.

INTRODUCTION

The Swedish higher educational system is under pressure. Competition from international universities is becoming fiercer, the expansion of massive open online courses and demographic projections indicate that the number of students entering the university system is peaking right now (cf. Breslow *et al.* 2013; Mirriahi *et al.* 2015). At the same time, financial support from the government is decreasing and universities are trying to locate new revenue streams. In order to stay competitive, Swedish universities are trying to develop strategies for using these scarce resources in the optimal way. The challenge is to strike a balance between quality and efficiency in education (Kaiser *et al.* 2014; Njoku 2015).

Over the past ten years much improvement has been made within the Royal Institute of Technology regarding quality and innovation in education. The numbers of pedagogical courses that are offered to the teaching staff within the university has multiplied, and these are now mandatory for teaching staff. Furthermore, the merits of educational experience have been emphasized in hiring new members of staff. Even though problem-based learning, constructive alignment and peer instruction are common in most courses today, some other aspects of education and learning remain the same (cf. Biggs & Tang 2007). One such conservative trait has to do with written examinations.

Since the founding of the university in 1827, all written examinations have been carried out using paper and pen. The problems with using paper and pen are numerous and include problems with reading and grading because of poor handwriting, distribution of examinations between teachers in the same course, written exams getting lost. In comparison with other parts of the educational system, little has happened to improve quality and efficiency when it comes to written examinations (cf. Okonkwo 2010; Albugami & Ahmed 2015).

During 2013 and 2014 a number of teachers initiated a project to increase efficiency in written examinations. There was a general understanding that the final part of the courses consumed too much time and effort in relation to the other parts. On average, teachers spent 20 percent of the allocated course time in grading examinations. Hence, newly developed software for digital examinations was identified and a license purchased. The purpose of this paper is to describe and analyse the implementation of this new assessment system.

THEORETICAL POINTS OF DEPARTURE

Professionalism vs bureaucracy

Over fifty years ago, there was a growing awareness that any university was home to two different ways of thinking: bureaucracy and professionalism, and that these two systems would at times conflict (Etzioni 1959). Among other things, it was shown that the experience of conflict between the two followed a U-shaped curve: universities with a high degree of differentiation or a very low degree of differentiation experienced less conflict. A high degree of differentiation would lead to a separation between the professionals and the bureaucrats, while on the other hand a high integration of the two would lead to a situation where both were continuously involved in daily operations, working in close cooperation (Darkenwald 1971). This description of the harmonious coexistence of bureaucracy and professionalism is based on an ideal equilibrium. However, at times, most organizations need to change in order to survive in changing institutional environments (Drew 2010). Change is perceived very differently in the two systems.

Legitimacy of change in the two systems

Somewhat simplified, the professional organization would be attuned to professional issues of teaching and research, based on a peer system where impulses for change can arise anywhere among grass-root peers (Blackmore & Sachs 2000). In comparison, bureaucracy is based on a strictly defined hierarchy, where impulses for change should adhere to the same command chains as every other strategic initiative. This means that among professionals, an impulse for change should originate among peers in order to be perceived as legitimate, whereas in the bureaucracy, the impulse for change should originate among top management, in order to be perceived as legitimate (Ramsden 1998; Macfarlane 2015).

Some changes do originate in the institutional environment, such as in new directives from the government, or new legislation. These changes would be championed by central university administration, and expected to be implemented down through the hierarchy (Ginsberg 2011). Other changes originate in the daily teaching or research work, and such changes would be championed by the peers who discovered or invented them, and then propagate laterally around the university through professional networks, unless they were discovered by university top management and adopted by them (Wei *et al.* 2014). The changes that have the best chance of success in a university context would be those where the interests of top management and the professional peers coincide, regardless of where the idea for change originated. Such changes would activate incentives found in both systems (Wedell 2009).

Incentives for change in the two systems

The incentives that motivate employees in the two systems differ markedly. For professionals, performance is based on the professional ideals such as pursuit of knowledge, democratic ideals, academic performance, intellectualism, and a system of peers within the profession (Deem & Brehony 2005). Any performance within this system is judged in terms of pedagogy or research

results (Winter 2009). As long as the results are successful, there is plenty of room for improvisation, intuition, creativity and eccentricity in both teaching and research. This means that teaching and research can be either conservative or progressive, depending on the specific context.

In the bureaucratic system, work is specified in terms of procedures, and must follow these procedures impersonally (Breton & Wintrobe 2008). The end result of a bureaucratic procedure is not as important as following the procedure in detail. There is no room for improvisation, creativity, intuition or individuality/eccentricity in a bureaucratic system. This means that the bureaucratic system is inherently conservative – errors and deviations are more dangerous than any potential improvements (cf. Kahneman & Tversky 1979; Parkinson 1957; Evoh 2007).

Thus, the only time incentives for change overlap between the two systems is when a change is accepted by the professionals as well as championed by university top management.

THE STUDY

The Royal Institute of Technology

The Royal Institute of Technology is Sweden's leading technical university and is situated in the capital of Sweden, Stockholm. The university employs 4 000 teachers, researchers and administrators and approximately 14 000 students are enrolled in different programs. The majority of students are studying engineering degrees and a substantial number are international students, especially in the master's programmes.

The Royal Institute of Technology is organized in ten schools, from the School of Industrial Engineering and Management to the School of Computer Science and Communication. The schools have some freedom in developing their own strategies and using funds, even though centralization has increased during the last couple of years, especially when it comes to compliance with laws and regulations (cf. Ginsberg 2011). For instance, in the past five years the cost of administration has risen more than 30 percent.

The study presented in this paper emanates from the Department of Real Estate and Construction management within the School of Architecture and the Built Environment, the second largest school of the university. It is responsible for some of the most popular and sought after programmes within the Royal Institute of Technology. The top three most popular programmes as of 2014, in terms of applicants per admitted student, are the programmes in architecture, real estate and finance and real estate development with agency. This department is responsible for the management of a number of programmes at bachelor and master level.

In the autumn of 2013 the programme director for two of the department's programmes was contacted by an administrator at the school level, who had been contacted by a Swedish firm that had developed new software for digital examination. Among its customers were two of the leading Swedish universities. The programme director was invited to continue the dialogue with the supplier if he deemed the software to be of interest. After two meetings with the supplier, the programme director decided to test the software owing to the perceived benefits it had in a number of dimensions.

Empirical data

The empirical data in this paper comes from a number of different sources. Multiple sources were used when the data was collected, as recommended by a number of earlier studies (Corley 2004;

Gioia *et al.* 2012) to address the issues of reliability and validity. Firstly and most importantly, students' course evaluations from courses involving digital examination were used. According to Swedish regulations, these evaluations are mandatory. Secondly, ten teachers who used digital examinations were interviewed. These interviews took around 30 minutes to one hour to complete. The interviews were semi-structured and centred on the perceived benefits and drawbacks of digital examination (Wengraf 2001; Diefenbach 2009). Thirdly, negotiations and meetings with representatives from the central university administration and local school administration were attended. We have also interviewed two local administrators.

By using three different sources of data, it is believed that the results of this study represent important insights into the consequences of an implementation of this type in a university setting (Kumar et al. 1993; Gioia *et al.* 2010).

RESULTS FROM THE STUDY

Stage 1 – Pilot trial

During the spring semester of 2014 a live test of the examination system was undertaken on a smaller course with only 28 students. The course had two midterm examinations and one final examination and all students took the examinations on their laptops. Two students who did not have a computer for the examination were supplied one by the head teacher in the course.

In the course evaluation, students were asked whether the department should continue with digital examination. Of the 28 students, 26 were very positive and expressed the view that digital examinations should be the new standard while 2 indicated that the decision should be taken by the head teachers. None of the student preferred the traditional, written examination. The comments left by the students indicated that the overwhelming majority of the students were of the opinion that the programme director should change all written examinations to digital examinations throughout the entire programme. The remaining comments could be summarized by the comment:

> "*Digital examination is the best thing that has happened", anonymous student*.

From the teachers' point of view, the experience was overwhelmingly positive. The main advantage was the time saved during the assessment and grading of the examinations. Even during this pilot trial, when all teachers needed to learn the software, time was spent on the examination by teachers was the same as in the old system. In the old system it usually took around one day to grade all midterm examinations but with digital examinations the time was reduced to less than half a day. For instance, when the midterm examination was in the morning, the students obtained their result the same day, since the teachers could grade the examination the same day, there being no need to wait for administration to sort, copy and distribute the examination papers.

Stage 2 – Going live

The experiences from the pilot trial were shared among the colleagues on the department during a teacher's conference and there was great interest among those who hadn't tried digital examination. The main reason for not introducing digital examination, among the teachers who hadn't tried it, was a perceived lack of time and lack of planning.

Up to date, 31 examinations have been offered digitally for 1138 students, involving 22 teachers. Some students have taken only one course with digital examination while others have taken up to five examinations. Since it is not mandatory to have a laptop to study at the Royal Institute of

Technology, exams are not mandatory, but close to 90% of students chose the digital examination.

For the total number of examinations taken at the department during the autumn, since the courses differ in number of participants, 65% of the examinations were digital, while 27% of the students were in courses which didn't offer digital examination. 9% of the students chose the traditional exam even if a digital examination was offered.

It is believed that, with time, most of these courses will offer a choice between traditional and digital examinations. For the 9% of students that choose to take the traditional examination, the head teachers asked those students during the course evaluations why they chose the traditional examination. A few of them preferred a traditional examination but most said either they didn't have a computer they could bring at the moment or that they had forgotten the computer on the very morning of the examination.

ANALYSIS OF THE RESULTS

The students' perspective

Of the perspectives we have analysed in this paper, students are probably the most positive towards the change from paper and pen to digital examination (cf. Bertheussen 2014). From the analysis of the comments in the course evaluations, the pattern is very clear. So far, the small number negative comments on digital examination have been constructive suggestions for improvement of the software. Once the developers received the suggestion, they promised to implement them. Some comments were from students using the system for the first time: they were worried about trusting the system.

The advantages of the new system have been highlighted through the comments on the course evaluations, but also in dialogue with representatives from the students' unions. In short the major advantages with digital examination are the following:

- Faster grading and quicker feedback. On average, the time spent on grading was cut in half, which meant that the students received more timely feedback on their examinations. The importance of quick feedback from a learning perspective has been highlighted by other researchers (see, Biggs & Tang 2007; Mostert & Quinn 2009).
- Less stress. As the students were able to edit their answers using software instead of pen and eraser, they experienced much less stress during the examinations. With traditional examination, cramp in the hands and wrist pains are quite common.
- Anonymity. A number of students felt that the fact that teachers were unable to identify students either through their name or hand-writing rendered the examinations fairer.

To summarize, negative comments were extremely few and very much on the constructive side. In all, the students felt that the incentives of taking the digital examination were great in comparison with traditional paper and pen examination. Or in the words of one of our students:

> "*Without doubt, digital examinations are the best that has happened to assessments. I like the fact that you can feel 100% anonymous during the grading, not only regarding date of birth but also handwriting. I also like that you may proofread your answers and change typos or errors easy. This way you won't lose any points on carelessness*".

The teachers' perspective

The teachers' perspective of the changes is the one that is closest to programme implementers, as change agents involved in the planning and implementation of the digital examinations. Even

though implementers were positive after the first trials, the speed of the change and the interest from fellow teachers was underestimated. The positive results from using digital examinations emanating from the discussions with the teachers and implementers' experiences can be summarized in the following points:

- A quicker grading process. Most teachers estimated that using digital examination saved them at least 50% of the time traditionally allocated to grading. The saved time could be used for other things, such as course development.
- A fairer system for grading. Since the time it takes to grade examinations is shortened, the fatigue is reduced which increases the likelihood for fair grading (cf. Biggs & Tang 2007; Alomari 2009). Furthermore, many teachers indicated that students could no longer hide behind poor handwriting, which also is important for fair grading.
- Less risk of losing examination papers. From time to time, examinations have been lost or mixed up. With the digital examinations, there are no longer any physical copies of the exams to lose hence this risk is mitigated.

The incentives for changing from traditional to digital examinations are very concrete and the negative effects from the teachers' perspective are slight if not non-existent. The only issue highlighted in the interviews was the time it took to learn a new system. Apart from this, comments were very positive.

The administrators' perspective

The administrators have a number of important roles within the university system. At the Royal Institute of Technology, administrators can be found at three different levels: the local level in the department, the school level and at central headquarters.

The administrators at the local level were very positive about the introduction of digital examinations. The primary advantage for them was the reduced physical handling of examination papers, such as copying, and the reduced time they have to spend on these issues.

The administrators at the school level have less to do with the daily operations and meeting with students. Therefore they had more difficulty grasping the positive aspects of the introduction of digital examinations. It took a number of meetings with them in which a number of risks with the software were discussed as well as compliance issues. Budgeting, the cost of the software and other less immediate issues tended to dominate these meetings.

Finally, there have been a number of meetings with administrators from the central headquarters of the university. Since they are furthest from the daily operations of teaching and learning at the grass root level, the positive effects that both students and teachers experienced with digital examination and the positive effects it had on course design were not apparent for them. Neither was this a reasonable and relevant argument in the discussion. The overarching goal for central administrators is to comply with the legal framework within the university system. They are not incentivized by more satisfied students or teachers who are enjoying their work. This is more or less a non-issue for them. It should not have been a major surprise that central administrators tried to stop digital examinations. Furthermore, one year earlier, against the advice of teachers, they had decided to scan all written examinations, which represented an enormous investment for the university. The introduction of a cheaper and quicker solution from the grass-roots was not popular (cf. Ginsberg 2011).

CONCLUDING REMARKS

There are a number of important findings in this study that could be applied to other settings. First of all, we do recommend other teachers to look for alternatives to the traditional paper and pen examination, used in most universities worldwide. The advantages are enormous, from both a pedagogical and economical perspective.

Given the importance of sustainability, there are obvious and large benefits in using digital examinations over traditional examinations. Every year universities worldwide spend a lot of resources on exams. Digital examinations will effectively eliminate much spending.

The major obstacle to the introduction of digital examinations can be found at the central administration level. Our recommendation would be to find ways of engaging them at an early stage of the process and to find incentives that they perceive as rewarding and aligned with their mission. This is not an easy undertaking, but it can be done (cf. Ginsberg 2011).

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