Συνέδρια της Ελληνικής Επιστημονικής Ένωσης Τεχνολογιών Πληροφορίας & Επικοινωνιών στην Εκπαίδευση

Τόμ. 1 (2018)

11ο Πανελλήνιο και Διεθνές Συνέδριο «Οι ΤΠΕ στην Εκπαίδευση»

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Βιβλιογραφική αναφορά:

Bälter, O., Riese, E., Enoksson, F., Hedin, B., Baltatzis, A., & Josefsson, P. (2022). The Challenge of Identifying the Importance of Drivers and Barriers for Implementation of Technology Enhanced Learning. *Συνέδρια της Ελληνικής Επιστημονικής Ένωσης Τεχνολογιών Πληροφορίας & Επικοινωνιών στην Εκπαίδευση*, *1*, 283–289. ανακτήθηκε από https://eproceedings.epublishing.ekt.gr/index.php/cetpe/article/view/4212

The Challenge of Identifying the Importance of Drivers and Barriers for Implementation of Technology Enhanced Learning

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Abstract

The potential of technology enhanced learning (TEL) can have both pedagogical and administrative benefits. In a previous study, we investigated the drivers and barriers for TEL in higher education using Force Field Analysis (FFA). In this follow-up study, we collected new data through a questionnaire to a group of pedagogical developers and at a presentation at a university internal conference for teachers. A Kruskal Wallis test was carried out to test if the groups filling out questionnaire deviated from each other in their ranking. A comparison was also done to the scores in the previous study. As a result of this triangulation, deviations were found between ratings for seven of the 20 identified forces. While the assessments of strengths in FFA is debated, we argue that each group's view is an important component to understand the situation, and triangulation of data is helpful in understanding the different views.

Keywords: Technology Enhanced Learning, Teachers as Designers of TEL, Force Field Analysis

Introduction

Many argue for the inclusion of teachers in the design of Technology Enhanced Learning (TEL) systems (e.g. Murthy et al., 2015; Glover et al., 2016; Baran, 2016; Wicks, Craft, Mason, Gritter & Bolding, 2015) and from a teacher's perspective, a TEL-system can have both pedagogical and/or administrative benefits. Examples of pedagogical systems could be online practice/test systems with automatic answer depending feedback (Lovett, Meyer, & Thille, 2008). Primitive tests systems are already available and deployed outside universities for instance when practicing for a driver's license. Teachers are facing a generation of students that naturally look for answers on online forums or expects an instruction video similar to "how to a sew a button by hand".

The administrative benefits of TEL-systems can enable means to achieve goals which would not be possible or to cumbersome to do manually. For example, having a well-motivated and complex fine-tuned grading system which calculates grades automatically or a system that automatically administrate peer review among students which, for courses with many students, might not otherwise even have been considered due to the amount of administrative work required.

A TEL-system needs both a student interface and one or more administrative interfaces to manage and control the system. These, often graphical user interfaces, will limit what the TEL-system can achieve and also limit how the system can interact with other systems already in use. To make the TEL-systems intuitive to use, both from a student and administrative

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perspective (which includes interacting with other systems), it is, as in all systems development, important to involve the users, teachers in this case, early in the development and provide use-cases for many different scenarios.

This potential of TEL has been shown, however there are also indications of "there is little evidence of this happening" (Conole, 2013, p. 3), and the present technology has in general not led to transformed teaching nor learning practices (Jenkins, Browne, Walker, & Hewitt, 2011). One explanation may be that teachers are not usually involved as designers in TEL contexts (Cober, Tan, Slotta, So, & Könings, 2015). In this study, we have investigated the views of teachers who are involved as designers of TEL with other teachers at the same university to explore their different views of their reality.

KTH Royal Institute of Technology is a relatively large one-faculty technical university located in Stockholm, Sweden. In 2017 the university had 13.000 students, most of which were enrolled in either 5 year long programmes in Master of Science in Engineering or 2 year long master's programmes. These programmes were at the time of this study organized in ten different schools which had all been formed by previous mergers of about one hundred relatively independent institutions, teaching and researching in many different technical topics. This means that there were several different local cultures in how to teach, but these are not as diverse as in many multi-faculty universities. In an attempt to develop and spread good practices in teaching and learning, in 2013, KTH initiated a three-year project where 24 faculty members were recruited internally to act part time as "Faculty Pedagogical Developers" (FPDs), local change agents with the goal to support the development of pedagogy and teaching practices at the different schools through communities of practice (Lave & Wenger, 1991). Close to the end of the project, a study was made where the experiences of these FPDs in trying to act as change agents for encouraging teachers to increase use of TEL in the education was assessed. The results were presented in a paper (Josefsson et al., 2018). The method used was Force Field Analysis (Lewin, 1943), which is a method by which driving and restricting forces for the desired change are identified and then quantified in order to provide a foundation on which to base decisions on strategies and prioritizations for how an organisation should act in order to get closer to the desired goal. While there is criticism that Force Field Analysis used today is an oversimplification of Lewin's field theory, it is still widely used in organisational change (Burnes & Cooke, 2012). However, exactly how a Force Field Analysis is conducted differs, especially how the scores are assigned to the different driving and restriction forces. In our previous study, we used a mainly qualitative approach where we analysed transcripts of focus group discussions with the FPD,and based on that assigned a numerical store to each driver and restriction (see below). Another common approach is to use broader surveys with likert-scale questions (Philips, 2013; Capatina, Bleoju, Matos, & Vairinhos, 2017).

In this paper we have done a follow-up on our previous study and triangulated the numerical scores assigned to the driving and restricting forces using such a survey, where identified forces were presented to both FPDs and to teachers at the university who then quantified them using a questionnaire. The goal was to investigate whether this kind of triangulation would provide similar results with regards to the scores assigned.

The previous study

In the previous study (Josefsson et al., 2018), thematic analysis was used to identify 20 different themes for TEL adoption. This was followed by a Force Field Analysis (Lewin, 1943) in which each theme was classified as a driver and/or a barrier and assigned a score to indicate the strength, from 1(weakest) to 5 (strongest). The assigned scores were based on how

prominent each force was understood to be using the data from focus group interviews. The ten forces identified as drivers were: collegial discussions, locally developed systems, increased access, sufficient funding, increased automatization, flexible learning, TEL support for teachers, enable more satisfying allocation of time, technology savvy students and faculty engagement. The ten identified forces acting as barriers were: locally developed systems, lack of central management, insufficient funding, inexperience with digital tools for learning, lack of engagement, obstruction by central systems, lack of follow-up initiatives, unclear return on time investment, automatization - poor system integration, and lack of collegial discussions. Noteworthy, locally developed systems, automatization, funding, time, and collegial discussions were seen both as drivers and barriers for TEL adoption.

Method

After the analysis described in the previous paper and described and summarized above, we distributed an online survey to all FPDs, asking them to rank the strength they saw on a scale from one (weakest) to five (strongest) for each of the drivers and barriers. One month later, during a presentation of the results for teachers at our university we handed out a paper survey with the same questions. The teachers were asked to anonymously rank the strength they saw on a scale from one (weakest) to five (strongest) for each of the drivers and barriers. The FPDs present were explicitly asked to not answer the questionnaire again. These drivers and barriers were explained orally in the presentation given and the questionnaire was gathered at the end of the break following the presentation session. Thus, the available data are from 4 groups: 1) from FPD taking part in the focus groups, 2) from FPD not taking part in the focus group interviews, 3) from teachers at the presentation and 4) our score, based on consensus discussion from the focus groups interviews. On the data from group 1-3, a Kruskal Wallis test was carried out to statistically test if the ranking of each force deviated between these groups. As the data from group 4 consists of rankings summarized from a consensus discussion among us researchers (based on the result of the focus group interviews) they do not constitute a statistical material. It is therefore not possible to make any statistical comparisons with that data to the other groups. In order to be able to make a comparison between the researchers' score and the other groups, box plots were created for each force. The researchers' score is considered as deviant if it's rank was outside the box of the box plots (displaying 50% of the answers) for all of the groups 1-3 and outside more than two whiskers (highest and lowest value).

Results

The questionnaire distributed to the FPDs (group 1&2) resulted in 15 respondents, whereof two opted out, which gives a response frequency of 54%, which is in line with previous email surveys to teachers at KTH. Of the teachers at the live presentation, 16 handed in the questionnaire. As people were coming and going during the presentation, we cannot give an exact estimate of the response frequency, but the room's capacity is 32, and as mentioned, some in the audience were FPDs. A summary of the questionnaire answers for the drivers can be found in Table 1 and the barriers in Table 2.

Table 1. Summary of questionnaire answers and the researchers' score for drivers

Respondents:	1. FPD focus groups (median, n=7)	2. FPD non-focus group (median, n=6)	3. Teachers (median, n=16)	4. Researchers (score based on the focus groups)
Collegial discussions	4	4,5	4	5
Locally developed systems	2	2,5	2	1
Increased access	3	5	4	1
Sufficient funding	3	2,5	3	2
Increased automatization	4	3	3	4
Flexible learning	3	3	4	3
TEL support for teachers	3	5	4	4
Work content improvement	3,5	3	4	4
Tech-savvy students	4	3,5	3	1
Faculty engagement	3	4	4	1

Table 2. Summary of questionnaire answers and the researchers' score for barriers

Respondents	1. FPD focus group (median, n=7)	2. FPD non-focus group (median, n=6)	3. Teachers (median, n=16)	4. Researchers (score based on the focus groups)
Locally developed systems	2	2	2	5
Obstruction by central systems	4	3	4	4
Lack of funding	3	3	3	4
Tech knowledge	2,5	2	3	2
Lack of engagement	3,5	3,5	3,5	3
Lack of central decisions	3,5	3	2	5
Lack of follow up	3,5	3	3	1
Unclear ROI	4	3,5	4	5
Poor system integration	3	3	4	1
Lack of collegial discussions	3	4	4	1

The Kruskal Wallis test showed that the groups 1-3 were not different in their rankings, with one exception. The only significant difference between the groups was the barrier "lack of central decisions", where the teachers' score had a significant ($p = 0.026$) lower ranking, compare to the two groups of FPDs. That is, the teachers were not missing central decisions to the same extent as the FPDs. When we compared group 4 to the rankings of group 1-3, three driving forces and four barriers deviated. Below we illustrate that with box plots where the box shows 50% of the answers and the median, the whiskers show the highest and lowest score, and the small rings represent mild outliers whereas the asterisks represent extreme outliers.

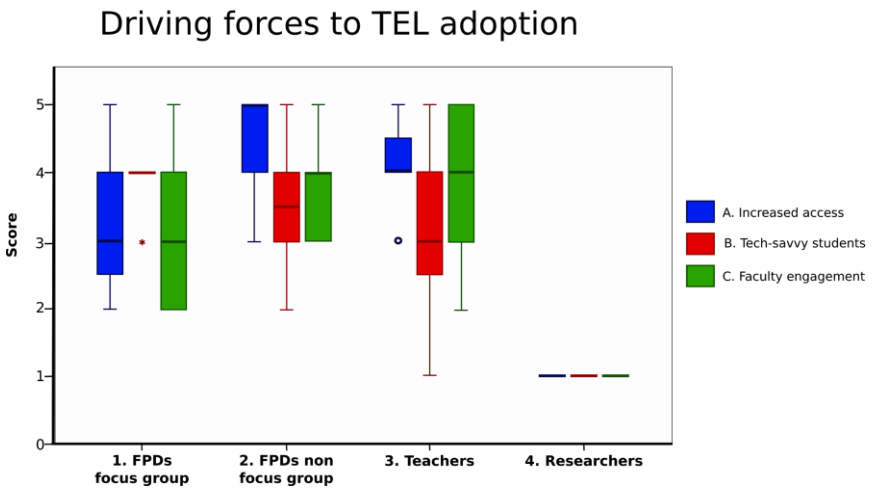

Figure 1. Box plots of groups 1-3 and the values for group 4 of the driving forces where group 4's score deviated from groups 1-3.

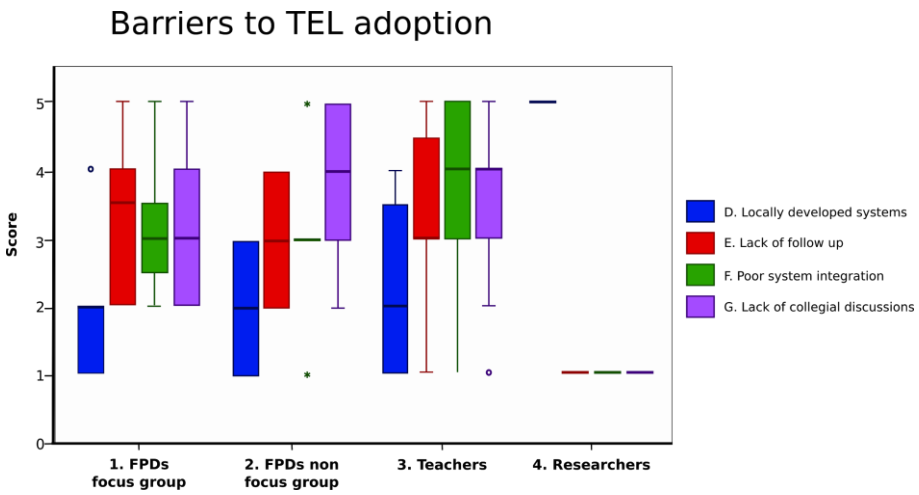

Figure 2. Box plots of groups 1-3 and the values for group 4 of the barriers where group 4's score deviated from groups 1-3.

Discussion

The survey result gave no serious proposals to more factors to include. Thus, the themes used as factors from the thematic analysis presented in Josefsson et al. (2018) seem to be valid. That the statistical difference between groups 1-3 was limited to one barrier (i.e. the barrier lack of central decisions) indicate that we cannot really say that there is a difference between those groups. Thus, the FPD initiative can from this data be seen as good way to find representatives of how the teachers think about TEL. However, as can be seen in Figures 1 and 2, the score derived from the focus groups interviews deviated from the other groups in about a third of

the identified forces. It should be noted that the data from group 3 were collected after the presentation of the researchers' score. This could have influenced how this group answered the survey.

There can be several explanations for the difference between group 4 when compared to group 1-3. First, it is possible that the lens of our own experiences through which we analyzed the focus group interviews affected our judgement of the strength in their statements. Second, as the respondents used the entire scale (1-5) for almost all forces, it is also clear that the respondents' reality, or at least their view of reality, differ. As they do belong to different schools within the university, it is likely that their reality differs. Some schools have naturally used IT for a longer period of time, for example Computer Science and Electrical Engineering who are pushing the limits for IT forward, while others are more of a follower in IT development. Third, there are several transformations done in this study to the answers in the questionnaires: from the focus groups to the researchers, the researchers' interpretation of the focus groups' statements identifying the themes, the researchers' interpretation of the focus groups' importance of these themes, the formulation of the questionnaire questions, and finally the respondents' interpretation of the questions. Although this is a normal procedure in many questionnaire studies, we should be humble for the possibilities that this also turns into a whispering game, where the outcome may differ from the origin.

When looking into more details of the differences found when comparing group 4 to the other groups is that almost all of the rankings of group 4 have the value 1, with the exception of the factor D (locally developed systems), which was ranked 5. That is all of them are values at the end of the scale. Also, for the factors where group 4 has ranked 1 in figure 1 and 2, group 1 tend to score lower than group 3, with the exception of the factor B (tech-savvy students). The reason to why group 1 scored lower could be that they are very experienced teachers and a bit ahead in using the various systems available, which would explain a difference in factor A (increased access). Similar reasons could also explain the difference for the driver C (faculty engagement) and the barriers E (lack of follow-up), F (poor system integration) and G (lack of collegial discussion), something which the FPD would have experience of and thus probably have seen how much impact it has had or not. So, even though there was no significant between group 1 and 3 the scores ended up lower for some factors. And, since group 1 were the persons interviewed in the focus group interviews the lower overall score on these factors might have impacted the judgment of the scores for group 4.

As mentioned in the results, teachers were not missing central decisions to the same extent as the FPDs. There can be several possible explanations for this. One is that the FPDs were more progressive than other teachers, after all that was one of the criteria they were selected on. Being progressive means attempting new things and when this was hampered by, for instance, lack of central decisions regarding e.g. choice of Learning Management System, the FDPs noticed. Another possibility is by being appointed FPD they got closer to the top-down decision process (if not already involved by being e.g. program responsible or director of studies) and thereby got more insight in the political game surrounding every major decision.

The differences between the groups and individuals are important to acknowledge. In the end, someone is going to decide which of the drivers and barriers the organisation's money should be spent on. Knowing that there are different views within the organisation, and what these views are, is important. If these views are ignored in the transformation/implementation phase, many of the involved may question whether resources are spent on an issue that, according to their reality, is insignificant. At least, it is an information problem that needs to be resolved.

Conclusions

There are several realities within any larger organisation, and when planning for larger changes, it is important to gather views from all that are affected by the change.

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