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IMPROVING STUDENTS' INVOLVEMENT IN TRADITIONAL LECTURES – STUDENTS AS DESIGNERS OF KNOWLEDGE ASSESSMENT TESTS

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Abstract: The authors present two pilot experiments they conducted to find out possibility of enhancement of traditional lectures with simple tools of electronic tests. The pilot research was performed in two different forms, for different courses and different subjects in order to make preliminary qualitative comparisons of the pros and cons of selected approaches. The described approaches were employed for selected lectures of Management and Production Engineering bachelor and master courses at the Faculty of Production Engineering (Warsaw University of Technology). Qualitative findings from the pilot experiments will serve as a basis for the design of next rounds of experiment. The novelty of the experimental approach lays in application of electronic tests as a driver for students' engagement. The approach is based on an assumption that students are themselves designers of tests for specific lectures. Some questions, after verification by a lecturer, are later a part of an official final examination.

Keywords: educational innovation, traditional lecture, electronic tests.

INTRODUCTION

Traditional lectures are still a big portion of engineering and management courses curricula. Due to some administrative and bureaucratic issues they will definitely be still expected for some (maybe long) time. The difficulties related to the change of curricula of specific subjects, modules and courses are hard to overcome. The problems related to traditional lectures relate to their provisional character,

mainly one-way communication (teacher-student), students' passive role, substantial need for out-of-class time to understand knowledge, great importance of the lecturer's speaking skills, difficulties with attracting students attention for longer than 15 minutes, etc. Disadvantages may be somehow summarized by the following sentence attributed to Edwin Slosson: "Lecturing is that mysterious process by means of which the contents of the note-book of the professor are transferred through the instrument of the fountain pen to the note-book of the student without passing through the mind of either." (Miller, 1927). It may be noted that the issues related to excelling lectures and elimination of their disadvantages have been part of scientific discourse and practitioners' discussions for a long time and it is still a current issue in the academic community.

1. ADVANTAGES AND DISADVANTAGES OF LECTURES

The definition of a lecture agreed by the authors in this article is the following: "[lectures] represent a conception of education in which teachers who know give knowledge to students who do not and are therefore supposed to have nothing worth contributing" (Bligh, 1998). "Many articles and books on teaching indicate that students' attention declines in the first 10 to 15 minutes of a lecture" (Wilson & Korn, 2007). However, lectures also may have some advantages, e.g. easy scalability of numerous groups. There are also studies proving that some shortcomings of lectures may be eliminated, and lectures may also include active learning principles. Advantages of the lectures (especially in management education – which is the case discussed in this paper) may be summarized in the following way: (Griffin & Cashin, 1989):

- possibility of communicating the intrinsic interest of the subject matter, possibility of clearly communicating a lecturer's own enthusiasm, "which in turn, should logically enhance the audience's interest in learning",
- possibility of covering material not available by other means,
- reaching many learners at one time,
- putting control of the situation clearly in the instructor's hands,
- minimal threat to the student.

On the other hand, disadvantages of the lecture are following (Griffin & Cashin, 1989):

- the lack of students' feedback to the lecturer on learning effectiveness, etc.,
- passive attitude of the student,
- inconsistency of lecture duration and listeners interest spans,

- inability to include individual differences, preferences, characteristics of students,
- dependence on the public speaking skills and abilities of the lecturer.

Improving or even substituting traditional lectures gained interest of many researchers and practitioners including development of massive online open courses, online lectures, video-based lectures (Chen & Wu, 2015), podcasts (Evans, 2008), flipped classrooms (Berret, 2012), blended learning formats (Dalsgaard & Godsk, 2007) and others.

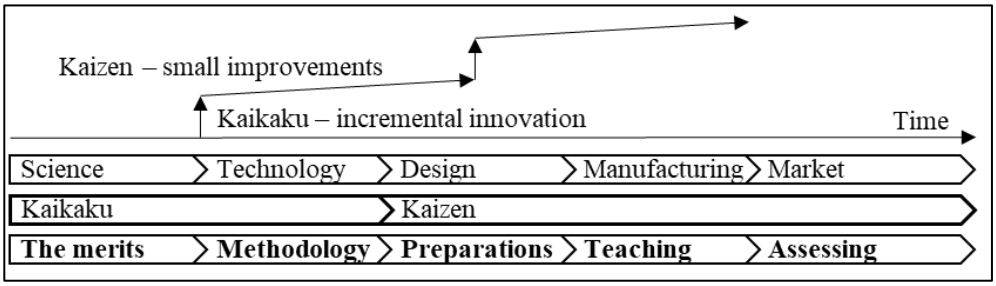

Figure 1. Innovations in education
Source: Own work

Any system, process, and organization need improvement in order to maintain competitiveness. Educational organization does not compete in a purely economic meaning (financial), but they still need to create and maintain strategic advantages. Therefore, as any organization, educational units needs to improve their processes. One may analyse those improvements per analogy to frameworks known from management sciences. One such framework, originated in Japan, considers continuous (ongoing) improvement as a result of everyday small actions (jap. kaizen) and incremental (substantial) changes (innovations) (jap. kaikaku). Figure 1 presents the mentioned analogy and depicts which phases of educational processes are mainly related to kaizen and which to kaikaku.

In this article the authors focused on presentation of their framework focused on traditional lectures and aimed at students' involvement in lectures through a simple means of electronic tests. Students' roles vary and they become not only learners, but also evaluators ~~of~~ themselves. It is approached through assignments of evaluation tests' design. The proposed approach is of an evolutionary nature rather than the revolution and incremental innovation. Therefore, it might be considered rather as improvement and not an innovation in its colloquial meaning of "big change" (Figure 1).

2. EXPERIMENTAL FRAMEWORK SETTINGS

2.1 General characteristics

The limitations of lectures are mostly related to their teacher-centred nature. Therefore, a student-centred approach and constructivism paradigm were adopted in the presented research. The method chosen was a teaching? experiment. Therefore, a phenomenon of students as independent knowledge evaluators, i.e. designers of tests) and its impact on some characteristics of learning outcomes were triggered in a natural students' environment. Then, some observations were performed, and initial conclusions were outlined. Presented research is of a pilot research nature. The goal was to make a pilot test of a construct. The construct assumed that involving students in assignments of the design of knowledge evaluation tests for lectures, is attractive from students' perspective and fosters knowledge assimilation through the need of knowledge structuration by students themselves.

There were two rounds of the pilot experiment performed by the authors. They were performed parallelly in the same semester. Each round was dedicated to a different course. The courses are described in Table 1.

Both experiments, A and B, were performed applying the Kahoot! application (kahoot.it). There are also many other applications easily available on the market, e.g. forms.office.com, quizizz.com, socrative.com. They differ in some features, but basically serve as easy to use applications for evaluation tests (usually short tests) and are available as a freeware. The choice of application is in the authors' opinion based mainly on individual preferences of a lecturer. Therefore, it was not the goal to assess an application itself. The goal was to perform a pilot test of the proposed procedures, to check if they are attractive for selected students, and if they would enable to minimize disadvantages of traditional lectures.

There was also a similar experiment performed, which included three groups of Microeconomics subject. Each group numbered 25 students. It was related to Management and Production Engineering course on Bachelor of Science in Engineering level. It involved only practical classes. Therefore, it is beyond the scope of this article.

The differences between settings included size of a group, subject, level of studies, workload for students (measured in ECTS), individual vs small team assignment, size and number of tests designed by students, scope of possible awards.

Table 1.

Characteristics of pilot experiments

Experiment Students	Course title	Course level	Subject title; ECTS and workload; Curriculum
A 33	Management and Production Engineering	BSc Eng. 6th semester	Production Management, 3 ECTS, stationary course 15 hrs lecture 30 hrs of practical classes (not included in the experiment) usosweb.usos.pw.edu.pl code: 1106-00000-ISP-ZAPRO
B 45	Management and Production Engineering	MSc Eng. 2nd semester	International Industrial Marketing, 5 ECTS, non-stationary course 22 hrs lecture 14 hrs of practical classes (not included in the experiment) usosweb.usos.pw.edu.pl code: 1102-ZP000-MZP-MIMAP

Source: Own work

2.2 Experiment A – basic

The Experiment A framework followed the procedure listed below consisting of four steps. The duration was one semester and it was performed for one group of students.

1) Students worked on tests design individually.
2) Each student was assigned ~~to~~ exactly one lecture topic.
3) Students were asked to design an approximately ten-minute test related to the assigned topic (directly in the Kahoot! application) and share its hyperlink with the lecturer. The deadline was the following lecture. This way ca. 4-5 ten-minute tests were collected for each topic (lecture) and each was required to deliver exactly one test design as a mandatory requirement to get positive final evaluation. The design of test was assessed in binary mode (passed, i.e. delivered / failed, i.e. not delivered).
4) Final exam was designed by a lecturer including 50% of questions (or their modifications) from tests collected from students.

2.3 Experiment B – extended

The Experiment B framework follows the procedure listed below consisting of five steps. The duration was one semester and it was performed for one group of students.

1) Teams consisting of two students were the same as teams formed for practical classes for the same subject.
2) Last ten minutes of each lecture was dedicated to students work. They were asked to design 2-3 questions related to the lecture and write them down. The requirement given to students was to construct questions in a manner suitable for the Kahoot! application. The design of questions was assessed in binary mode (passed, i.e. delivered / failed, i.e. not delivered).
3) Every lecture (excluding the first one) started with a short Kahoot! test prepared by a lecturer. The test consisted of ca. 5-10 questions (ca. 20 seconds per question). The set of questions was chosen, after the lecturer's verification, from questions formed by students. If needed, the questions were modified and supplemented by new proposals of the lecturer.
4) The tests mentioned in p. 3) were evaluated and students who achieved top five results were rewarded. The final exam consisted of two parts: a test part and an open questions part.
    a) Top two results achieved highest grade from the test part of the final exam. However, they had to answer the open questions part of the final exam.
    b) The following three highest results were awarded with extra points for the test part of the final exam.
5) The test part of the final exam was designed by a lecturer, including 50% of questions (or modified questions) collected from students during the semester.

3. RESULTS

The proposed framework was positively verified as the one enabling improvement of traditional lectures without revolutionary changes. It has a four-fold role, i.e.:

- it motivates students for learning,
- it enables to gamify the lecture (only to a limited extent, and just for Experiment B),
- it engages students by adding new activities to a traditional lecture,
- it allows continuous diagnosis of students' knowledge (only for the Experiment B).

The preliminary qualitative analysis of the results and informal discussions with the students showed that the proposed framework might be interesting and encouraging from the students' perspective. Students stressed (in informal discussions) that the proposed approach is interesting for them, because it is "something new and not traditional" and allows better understanding of a knowledge.

The other important issue to be exploited in the proposed approach is the motivational factor. Therefore, approach motivated for learning by rewards in terms of final examination (Experiment B), but also motivated to active participation in tests' design assignment by applying the rule that 50% of questions in final examination are related to those designed by students.

It was impossible to note students' exact behaviours while working on tests' design since they were preparing this assignment as ~~a~~ homework. However, informal interviews showed that students themselves applied a kind of similar framework to this task. First, they analysed the whole lecture and fragmented it into similar pieces of topics. Then they created a similar number of questions per topic. Depending on the lecture, the number of questions and the assigned time to answer varied, but the number and time had viable dominants (Table 2).

Table 2.

Some characteristics of tests in Experiment A

	Min	**Max**	**Average**	**Median**	**Dominant**
Number of questions	10	17	14	15	15
Time to answer	20	60	24	20	20

Source: Own work

Students vastly preferred more shorter questions (dominant 15 questions of 20 seconds per each) of single choice. It was observed that students structured the tested knowledge properly.

Such quantitative analysis was not prepared for Experiment B, because the assignment was much stricter. It was defined that each team must prepare 2-3 questions (single choice) with 4 answers per question (see section 2.3, paragraph 2) every lecture. However, qualitative observations showed that, before the design of questions students analyzed the lecture's content by asking themselves the following questions: if the lecture could be structured into blocks and then what was the most important issue within each block. Thus, they designed questions that relate to possibly all general issues tackled during the lecture. Students revised and discussed the material, which ~~what~~ consolidated their knowledge. Students who were the best scorers in tests, were also among those who were the most active during lectures.

Exemplary tests are available from the authors (Gladysz and Malenczyk, 2019).

The final results (average final mark) were oscillating around 3.8 for the subject in Experiment A. It was higher than in the previous three semesters (ca. 3.5), when the lecture was performed in a purely traditional way. Scores are given in Polish higher education scale, i.e. 0.0 (not classified), 2.0 (failed), 3.0 (moderate), 3.5 (moderate and half), 4.0 (good), 4.5 (good and half), 5.0 (very good). Such comparison was not possible for the Experiment B. However, the authors observed better understanding of topics by students in both experiments. For Experiment A, it seems that students achieved better scores for questions related to the tests that they designed. This is one shortcoming of the framework in Experiment A. It was not covering the whole lecture, meaning that students significantly deepen their knowledge only for selected topics. That was not the case of Experiment B. However, in this case deepening knowledge was not that much strong as in the case of Experiment A. A very important factor strengthening effectiveness of teaching was that students had to analyse a portion of knowledge (lecture topic), structure it and decide what should be included (i.e. is important) in the test designed by them.

The approach proposed in Experiment B seems to be more attractive and involving from the students' perspective. However, it significantly more time consuming from teacher's perspective. On the one hand it engages students during whole semester and for every lecture, but it is not covering all the topics in such details as the other approach (Experiment A) covers one selected topic per student.

CONCLUSION

The strength of the proposed framework is decrease of some disadvantages of traditional lectures without revolutionary actions. The framework reflects issues expressed in the following way: "I hear and I forget. I see and I remember. I do and I understand" (attributed by many to Confucius) or Xunzi's "Not hearing is not as good as hearing, hearing is not as good as seeing, seeing is not as good as knowing, knowing is not as good as acting; true learning continues until it is put into action" (Hutton, 2016).

Thanks to students' engagement in the design of tests for knowledge evaluation, they practice structuring of knowledge, which facilitates their better understanding. The proposed framework minimizes some disadvantages of a lecture (Table 3) as listed by Griffin and Cashin (2007).

It is still an open question, how to address advantages and disadvantages identified for both approaches. Therefore, the open question is also how to construct one unified and reference framework employing basic features present in both proposals. This feature is engagement of students into design of tests to assess their own knowledge.

Table 3.

Decreased impact of disadvantages of traditional lectures

Disadvantage	Description
The lack of students' feedback to the lecturer on learning effectiveness, etc.	It is possible to get some feedback on learning effectiveness through regular but small tests. This enables flexible reactions of the lecturer and deeper discussion of unclear (poorly scored) topics.
Passive attitude of the student	Students' attitudes are less passive. This is achieved through engagement of students in the process of tests' design and motivational factors (simple gamification in Experiment B).
Inconsistency of lecture duration and listeners' interest spans	Tests may be used as breaks in lectures. This may be an enabler to make lecture duration and listeners' interest spans more consistent.
Inability to include individual differences, preferences, characteristics of students	Lecturers are enabled to identify some individual characteristics of the student. This is possible through assessment of tests designed by individuals and observation of their work on tests' design.
Dependence on the public speaking skills and abilities of the lecturer	The attractiveness and effectiveness of the lecture is not fully dependent on the merits and speaking skills of the lecturer. It is also related to simple gamification through tests and students' engagement.

Source: Own work

The research will be continued using the described frameworks to enable deeper analysis and better understanding of the mechanism. For this purpose, experiments will be repeated for next groups for the same subject, but also for new subjects and new groups. Unfortunately, it is impossible to repeat the experiment for another subject within the same group due to course duration constraints.

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