Strengths and weaknesses of architectural education on-line classes conducted during COVID-19

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ABSTRACT: In this study are elaborated the strengths and weaknesses of the on-line form of classes that were carried out during two semesters in the Faculty of Architecture at Wrocław University of Science and Technology (FA-WUST). One of these semesters ran during the lockdown in Poland as a consequence of the COVID-19 pandemic. Traditional learning (TL) in architectural education includes activities that are especially difficult to translate into virtual forms; for example, hand corrections of plans and diagrams, group presentations and direct debates. In the article, the author discusses the forms of educational activities undertaken during the design course, which included on-line platforms (OP), blended learning (BL), the flipped classroom (FC) and the jigsaw classroom (JC). After the classes, students were encouraged to fill in surveys (N = 56) and report their opinions. Also, the author discusses both the methods, that were most effective and student-friendly, and those that could be improved or were proved unsuitable for architectural education.

INTRODUCTION

The COVID-19 pandemic has posed an exceptional challenge to all levels of education and, in particular, academic education. Many forms of academic activity were relatively easy to convert to on-line classes. This applied to lectures and academic seminars. However, a particular challenge is to provide on-line, academic activity that requires personal interaction, such as laboratories and design assignments. Hence, this study is an elaboration of the strengths and weaknesses of on-line classes carried out during two semesters in the Faculty of Architecture at Wrocław University of Science and Technology (FA-WUST).

BACKGROUND

The traditional learning (TL) method has been applied in architectural education at the FA-WUST, including standard forms of interaction with students, e.g. face-to-face (F2F) tutorials and reviews. Other reports that were recently published, e.g. by Gyurkovich [1], and Romaniak and Filipowski [2], reveal that other faculties of architecture in Poland have adopted a similar scheme for running architectural design classes. This method worked very well with direct contact with the students and proved to be effective, but suffered from a lack of novelty.

Recently, significant progress has been made in pedagogical science, taking into account new forms of communication with the student, the use of computers, mobile Internet and group work. This was recognised by the Polish Ministry of Science and Higher Education. In 2018, the Ministry launched the programme *Master of Didactics*, under which almost 1,000 tutors from Poland were trained, in new methods of teaching, at leading universities in Western Europe. The author took part in the training that was organised by the Faculty of Psychology and Educational Sciences at Ghent University, Ghent, Belgium, within the programme led by Valcke et al [3].

The *Master of Didactics* programme at Gent University includes:

- Study visit at the host university (5 days).
- Aftermath, including the on-line consultation and the preparation of the Educational Innovation Project.
- 120 hours of teaching realised by the tutor at the home university.
- Good Practice Days - on-line conference where results were summarised and the feedback was given.

The *Master of Didactics* programme covers:

- identification of learning objectives;
- introduction of new teaching and learning activities;

- evaluation/assessment and feedback.

Displayed in Figure 1 is the layout of the *working table*, part of the Educational Innovation Project, showing the proposed methods and their implementation for the *Master of Didactics*. The document was critiqued by staff at the University of Ghent.

Design brief analysis.	Not sure yet. At this point, students should analyse quite a complex brief for the project with an area of approximately 40 thousand m². They should group the functions according to the purpose.	Mind map might be an option here.	3 hours of homework.	
Increase awareness of the issues of sustainability, material and energy use.	Jigsaw method climate change from the previous point. Then, I will organise the competition! Students will be given an assignment to judge the embedded energy in the design solutions that they have developed. They will make an assessment based on a scientific paper. The results will be compared between the groups and the best group will win!	E-portal, WWW, YouTube.	3 hour workshop.	The results will be compared between the groups, and the best group will win!
Propose designs that address the most actual civilisation problems.	Blended learning. Flipped classroom. E-portal will contain the exhaustive description of the case studies that students will be asked to study at home/library. Then, a discussion will be organised and the most important methods of dealing with the problems will be outlined.	E-portal plus on-line test.	2 hours of case study at home (not the classroom time). 1 hour of discussion. 2 hours of individual design tutorials.	After completing the case-study phase, students will have to complete the on-line test.
Improve team-work skills.	Self-introduction in the beginning. Teamwork. Students will work in groups of four on one project. The tutor will select them randomly, therefore they would have to develop skills to cooperate and communicate, otherwise, they would not be able to deliver the finished project. Spaghetti challenges in the beginning.	Spaghetti challenge.	Spanning across the whole course.	The quality of the output the teams will generate. Feedback based on using rubrics given here: https://www.rcampus.com/rubricshowc.cfm?code=H52C5C.
Develop skills in designing and presenting medium-complex architectural projects.	Masterclass method. Face facing student and tutor. Teams will be consulted individually.	No media, direct face-to-face.	3-6 weeks of tutorials in groups.	Assessment of the quality of the design, and the progress that was made from the last tutorial - simply the design development.

Figure 1: *Working table* showing the proposed methods and implementation (Diagram: M. Brzezicki).

DESIGN COURSE CURRICULUM

The curriculum of the design course is difficult to modify because it was based on the student-master relationship, which is forged during F2F (face-to-face) meetings, tutorials and reviews. Direct interaction between the tutor and the student includes conversations, hand-sketched corrections of paper drawings, and physical modifications (additions and removals) of parts of architectural models. Usually, the subject of the design assignment is the design of a building. In the beginning, the students are given a *design brief* document with a description of the design task they are supposed to perform. The design brief contains information on all parts of the building to be designed, with their areas and spatial arrangement. The design assignment is gradually developed from the scale of the whole site (1:500) to the scale of the detail of the building (1:20).

Traditional course TL (traditional learning) consists of weekly tutorials and approximately two or three reviews during the semester. This traditional formula of the design course has been subject to modifications. Novel learning and teaching activities at the FA-WUST were carried out during two semesters: in the winter and the summer semester of the academic year 2019/2020. Those semesters and the tools employed are briefly described below.

WINTER SEMESTER 2019/2020 - EDUCATIONAL INNOVATION PROJECT

Participants were second-year Master's/postgraduate students (N = 32 in two groups of 16), enrolled in the *Factory of the Future* course, in the academic year 2019/2020. Student ages ranged from 22 to 23 years and 71.8% of the students were female. Course sessions of 180 minutes were organised once a week involving the author as leader and one PhD assistant, J. Romanowska. Student teams each had four students. All students were physically present in the classroom.

The Educational Innovation Project included changes to:

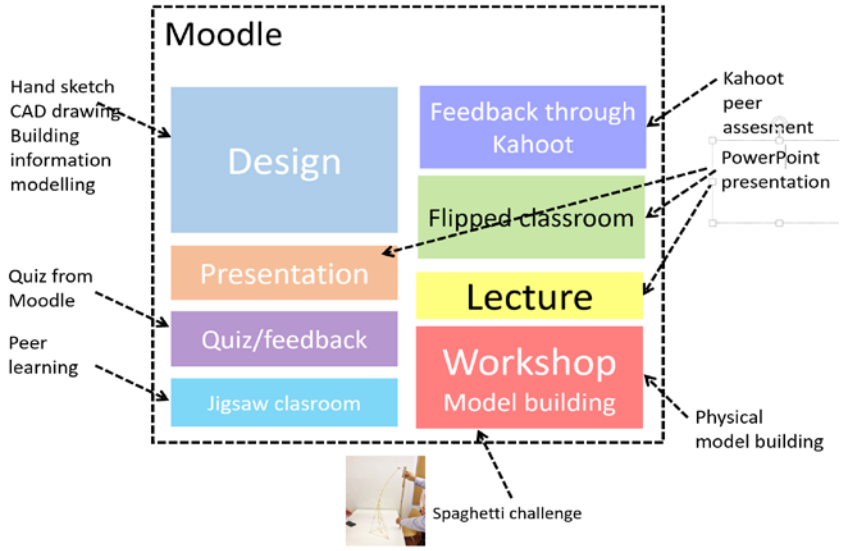
- the course structure;
- learning activities during the classes;
- tools used.

All these will now be described.

Course Structure and Learning Activities

The most important innovation in the Educational Innovation Project was establishing a blended learning (BL) environment - mixing the activities during the class and using the class time effectively. The two basic elements of the course, tutorials and reviews, have been enriched with group work, flipped classroom teaching, peer assessment, quizzes and a jigsaw classroom structure, as explained below.

The BL course curriculum was prepared based on an analysis of activities, identifying the places and times of possible intervention (e.g. times when the students were bored during classes, worked alone with little effectiveness or left the class early). New activities were introduced in those time spots, forming an *educational cocktail* as addressed by Thai et al [3]. A schematic diagram of the layout of the course curriculum after modification is shown in Figure 2.



a)

b)

Figure 2: Course curriculum after the intervention: a) the layout of the curriculum; and b) diagram illustrating the proportions of the learning activities; both colour-coded (Diagram: M. Brzezicki).

Learning Activities

The learning activities included the following new elements:

- Activating prior knowledge - a quiz was used to activate students' prior knowledge from previous courses.
- Short lecture - approximately 20 minutes' lecture given by the tutor during the design studio.
- Buzz groups - small groups of students discussing the problems set by the tutor.

- Flipped classroom (FC) - students process the basic course material on their own before class, which frees up time for more interaction and demand-driven learning during the actual class. The method is discussed by Thai et al [4] and by Akçayır and Akçayır [5].
- Jigsaw classroom (JC) - students are split into groups with one member assigned to each topic. Working individually, each student learns about a topic and presents it to the group. The method was developed by Aronson and Bridgeman [6].
- Feedback and peer assessment - this activity involved anonymous and personalised opinions.
- Guiding questions - questions on architectural model building and assessment following Bloom's taxonomy.

Tools

The traditional course is carried out with the use of a pen and pencil, with some architectural model building. As mobile Internet access became more widespread numerous new tools emerged, including:

- A Moodle-type on-line platform (OP) was used to provide educational material and store the results of students' work. At the WUST, this platform is eportal.pwr.edu.pl;
- Kahoot and Socrative for feedback and peer assessment;
- Google Docs (presentations), rubrics for assessment in architecture.

The lessons and experience learned from the winter semester 2019/2020 of the Educational Innovation Project were later used in the summer semester 2019/2020, for establishing tutor-student communication and providing educational materials for students during the lockdown COVID-19 semester.

SUMMER SEMESTER 2019/2020 - COVID-19

Participants were third-year undergraduate students (N = 30 in two groups of 15), enrolled in the *Workplace Design* course, in the summer semester of the academic year 2019/2020. Student ages ranged from 21 to 22 years and 76.6% of the students were female. Course sessions of 180 minutes were organised twice a week involving the author as leader and two PhD assistants, A. Jasiolek and P. Nowak. Students mainly worked individually, with only two teams of two people. Students were not physically present in the classroom and classes were run via on-line teaching tools.

The last TL class at the FA-WUST took place on 10 March 2020. After this date, the FA-WUST was closed. Learning activities were through on-line apps such as:

- On-line tutorials; questions tackled in group discussion, with elements of collaborative learning.
- Group design reviews, with instant feedback.
- Quizzes with graphic material (detailed drawings).
- Delayed feedback given on-line by e-mail.

The tools used were similar to those in the previous semester, with the introduction of MS (Microsoft) Teams tool and the Zoom system for lectures. The Moodle-type platform was used to provide educational material and store the results of students' work. However, in practice, the Moodle-type platform turned out to be not interactive enough, and the voice and image communication was established through the MS Teams platform. Students were split into four groups of 7 or 8 students, two simultaneous tutorials were given, one by the project leader and the second by the PhD assistant. Every second week the groups were switched.

STRENGTHS AND WEAKNESSES (CHALLENGES)

The use of the Moodle-type platform in the winter semester showed how much the students' education can be enriched by using different teaching tools and introducing blended learning. The lessons were less monotonous and the students were more active. This was reflected by 92% attendance in comparison to approximately 70% attendance in previous years.

To evaluate the Educational Innovation Project (winter semester), voluntary surveys were conducted in which students (N = 30) answered both closed- and open-ended questions. The advantage of the classes conducted with the use of new didactic methods was reflected by 90% of the students claiming that their time was used more effectively. Also, 60% of the students reported that it took them less time to complete the design assignment (only 10% claimed *more* time). In addition, 70% stated that working in groups allowed for more effective information exchange compared to other similar courses at the FA-WUST. Finally, 76.6% positively assessed elements of blended learning: quizzes, short lectures, workshops, peer feedback. The most important results are presented in Figure 3.

Other strengths were mentioned by the students in their answers to the open questions. These include:

- A systematic approach with the use of a Moodle-type platform.
- Transparency in evaluation and assessment.
- Constant access to both educational materials and previous versions of the design assignment.
- Better student and tutor rapport.

Based on the answers to the open questions the biggest challenges (weaknesses) faced by the students were:

- Issues with Internet access (not always possible, data limits for mobile access).
- Some students reported four-person design teams as being too big, due to the problem of co-ordination.
- Some students reported a high workload associated with the Moodle-type platform (uploading design assignments was time consuming).

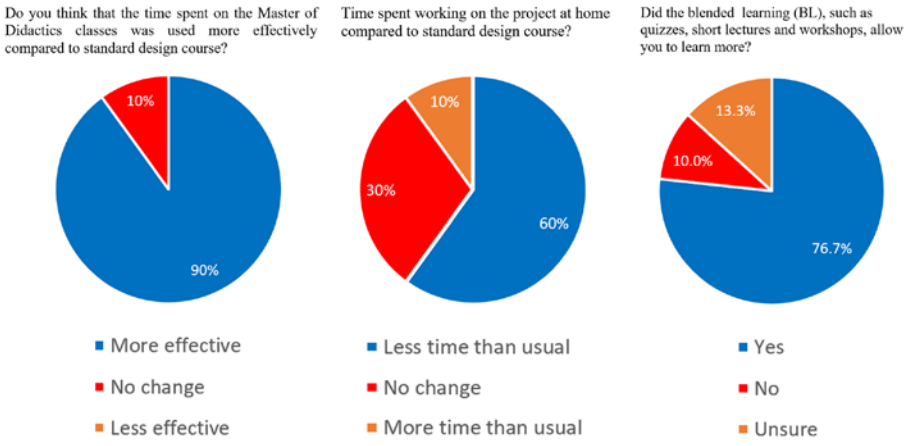


Figure 3: The results of the surveys for the winter semester (Diagram: M. Brzezicki).

The use of the Moodle-type platform and MS Teams in the summer semester (under COVID-19 restrictions) showed different strengths and weaknesses for the on-line form of the classes. Despite problems with Internet connections, the course attendance reached 90% on common course days and 100% during the design assignment reviews and final presentations.

To evaluate the on-line tools used during the COVID-19 semester, a voluntary survey was conducted in which students (N = 26) answered both closed- and open-ended questions to study the impact of different conditions on students' learning performance. From the answers to closed questions, 63% of students claimed that presenting the design assignment on a shared screen was more effective than printing the drawings or presenting the design assignment using an overhead projector/beamer. This was because the whole group of students could see and listen to every tutorial given by the tutor. This resulted in common design mistakes being identified by students, i.e. mistakes spotted and talked about in one design assignment were corrected in another assignment without the need for tutor intervention. A total of 81.5% of students claimed they have had no difficulty in understanding instructions given by the tutors, even though they were given via an on-line tool, such as MS Teams.

An impressive 70.4% of students reported that on-line learning is more time-effective, because students do not have to waste time commuting and printing design assignments. To the question, *Do you think your design assignment could have been of better quality if it had been carried out traditionally?*, 74.1% replied *No*, which means that three-quarters of the students consider on-line classes to be at least as effective as tutorials given F2F. In the answers to the open questions, students also stressed that the teachers/tutors were more willing to share educational materials and that the on-line form of the classes makes it possible to participate if students are unwell.

The most important results are illustrated in Figure 4. For the tutor, one of the biggest advantages of the on-line course with the Moodle-type platform was the possibility of using the course material again.

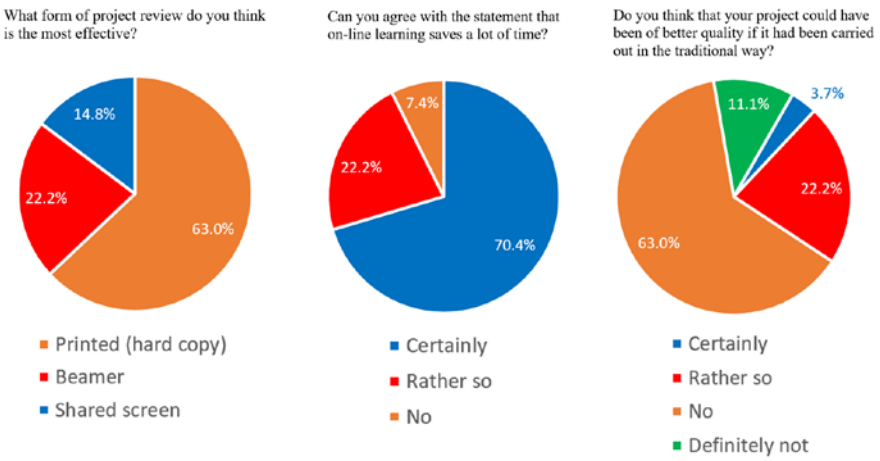


Figure 4: The results of the surveys for the summer semester (COVID-19) (Diagram: M. Brzezicki).

The biggest challenge during the COVID-19 semester was the sudden loss of personal contact between the student and tutor. As the decision to close the schools was unexpected, it took almost two weeks to develop new forms of communication.

The Moodle-type platform, which in the previous semester performed well for classes conducted F2F, proved to be insufficiently interactive for classes that were conducted on-line only. New forms of contact had to be worked out. At the FA-WUST, the MS Teams system allowed for direct tutorials and on-line corrections of the design assignments.

The biggest challenges the students reported were (derived from the answers to the open questions):

- Lack of direct contact with the other students in the group.
- Unequal workload among the members of the group preparing one design assignment.
- Lack of F2F access to library resources.

Technical issues:

- Problems with Internet access (not always possible, data limits for mobile access).
- Problems with microphones and sound.
- The resolution of the screen, i.e. not big enough to correctly display architectural drawings in the scale 1:200.
- Lack of the possibility of drawing or sketching *on the screen*; difficulties with using the mouse for sketching.

CONCLUSIONS

The Educational Innovation Project in the winter semester and on-line teaching in the summer semester (COVID-19) both employed a rich blend of educational activities, with the use of a variety of tools. Students in a BL environment reported significantly larger positive changes in their self-efficacy and time-effectiveness. Quantitative data show that approximately three-quarters of students have a positive perception of the BL course and the on-line teaching. The BL elements were either presented on-line or in F2F tutorials and activities, which implied that the BL environment can be used to conduct the design assignments. Qualitative data (i.e. answers to the open questions) show that drawbacks and challenges are mainly technical - mobile and Internet access. The results of surveys confirm the positive impact of BL on student satisfaction and academic achievements, as shown by Deperlioglu and Kose [7], and Glogowska et al [8].

As previously reported by Alonso et al, integration of multimedia technologies and BL due to differences in access to resources provides a different learning experience [9]. This was also manifest in the two semesters of the classes organised at the FA-WUST, where F2F activities, which were possible in the winter semester, were not possible in the summer semester. This break of direct F2F contact cancelled out many positive aspects of BL, e.g. group interactions, but also showed strengths, such as more effective time use and open on-line tutorials. This shows that blended learning (BL) could be utilised to combine the benefits of F2F learning and on-line e-learning. An on-line environment could be used for the just-in-time provision of material, while collaborative learning tasks could be performed with F2F contact. When not possible F2F could be replaced by an on-line environment using tools for group work e.g. breakout rooms in Zoom or separate channels on MS Teams.

Shown in this article is that in architectural education, which is traditionally based on the master and student model, blended learning has the potential to support deep and meaningful study in higher education, as reported by Garrison and Kanuka [10]. Blended learning has demonstrated the potential to upgrade the effectiveness of the learning experience.

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