BLENDED – LEARNING IN TEACHING OF COMPUTER TECHNIQUES IN ARCHITECTURAL DESIGN

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Abstract. Application of blended-learning in teaching of Computer Techniques in Design subject was presented. In order to intensify results of teaching of Computer Techniques in Design subject an additional course based on Moodle e-learning platform was introduced. The course was divided into introductory part, laboratory modules and a summary. Introduction of e-learning platform allowed to strengthen the interaction between the teacher and the students. It also made resources related to this subject more accessible which positively influenced the results.

Keywords: blended – learning, Moodle platform, e-learning, CAD

The question of remote teaching is becoming more and more up-to-date due to increasing importance of information technologies in our everyday life, as well as in the scholarship environment. Two major trends can be distinguished in remote learning; namely, e-learning\(^1\) and blended–learning\(^2\).

The main difference between them rests in the number of the direct teacher-student contacts and the scope of the course as such. The subject of the distance education has been discussed in Alistair McNaught’s Exploring e-learning for literacy, numeracy and ESOL teachers [6] and Marek Hyla’s Przewodnik po e-learningu (A guide on e-learning) [3]. E-learning has been also discussed by Elżbieta Jarosińska in Znaczenie e-kursów w zdalnym uczeniu się (Significance of e-courses in distance education) [4]. With regards to teaching of mathematics this question is discussed by Krystyna Romanik in Nowoczesne technologie w nauczaniu matematyki studentów architektury (eng. Modern techniques in teaching mathematics students of architecture) [11]. The question of e-learning and of its information technology basics is presented by Robert Mazur in Wirtualne metody nauczania w odniesieniu do przedmiotu techniki komputerowe w projektowaniu CAD (eng. Virtual teaching methods in the teaching of subject: Computer Techniques in Design – CAD) [5]. In The LMS Platform as the tool of checking progress in the learning engineering graphic (Sławomir Bogacki and Ewa Terczyńska) a detailed description how to construct questions verifying knowledge in the field of engineering graphics is given [1]. In William Rice’s book Moodle E-Learning Course Development one can find a number of hints on how to structure courses based on Moodle platform [9]. Most of the authors endorse the idea of blended-learning as the one more complementary to the teaching methods of higher education.

\(^1\) E-learning – is a technique of remote learning which uses information and multimedia techniques. As defined by: Jarosińska E., Znaczenie e-kursów w zdalnym uczeniu się, Edukacja – Studia, Badania, Innowacje, Vol. 2 (110), Warszawa 2010, p. 62.

\(^2\) Blended–learning – is a technique of learning which joins traditional teaching with remote teaching techniques and is supplemental in the process of students education. As defined by: Jarosińska E., Znaczenie e-kursów w zdalnym uczeniu się, Edukacja – Studia, Badania, Innowacje, Vol. 2 (110), Warszawa 2010, p. 62.
Presented herein Computer Techniques in Design course is based on the blended-learning principle. The subject covers 60 hours of laboratory classes and is realized during two semesters of the first year of 1st stage stationary studies. Its aim is to allow students to learn how to prepare technical documentation, shape architectonic ideas in virtual space and how to present architectural concepts. Within its framework topics are realized using such software as: AutoCAD, ArchiCAD, 3DS MAX, Adobe Photoshop, Microsoft Power Point, Microsoft Word.

To intensify the results, and also due to specifics of the subject (work in the environment of a graphics editor) an Internet course was introduced in addition to laboratory classes held on University premises. It was developed based on Moodle e-learning platform [2] and published on the Cracow University of Technology e-learning website (ELF - e-learning framework). Two separate courses were developed, for semester 01 and 02 respectively. Their structure and major elements remain identical.

Each course was divided into introductory part, laboratory modules (10 during the first semester and 6 during the second one) and a summary [7].

Introductory part (Fig.1) covers aims of the program, its agenda, schedule of laboratory classes and detailed information on receiving the credit for the classes. It was agreed that during the first semester students receive 22.5% of points for works related to the e-learning platform and 77.5% of points for completed projects. During second semester these numbers are 12.5% and 87.5% respectively. Class register which lists points awarded for completion of each task supplements the platform (Fig. 2). Introductory module covers also a list of literature references, a list of Internet references and links to student versions of AutoCAD and ArchiCAD software. Available teacher-student and student-student communication channels are also provided, as well as current news. Furthermore, virtual office hours were implemented by use of a chat tool and a possibility to vote on the most convenient hours of laboratory consultations was added.

Figure 1: Home page of the Computer Techniques in Design course

Each course was awarded with Individual Prize of the Chancellor of Cracow University of Technology.
Subsequent modules present relevant groups of laboratory classes. Each of the modules has its short summary and is accompanied by an icon presenting its topic (Fig. 3).
Figure 4: Teaching documentation provided in modules – tutorials and example works

Each of the modules covers:

- a part dedicated to theoretical introduction (Fig. 4), in which topics are randomly assigned to students and which provides teaching documentation and job-aids containing examples of work of previous years students and laboratory classes tutorials. The job-aids and examples were prepared as PowerPoint presentations and made available as PDF files. These tutorials show how to proceed with given exercise, yet they are not giving ready solutions as this could lead to mechanical mapping of the task. Typically they cover presentations of various commands and ways how they can be used during work on the given subject. Further slides of the tutorial present sequence of activities related to use of a given command and are accompanied by description and graphical record of the screen (Fig.5).

Figure 5: Building elements of slides used in tutorials

An assumption was made that each time a need will arise to use command which was already presented, the tutorial will cover only the name of the command and assumed parameters. Tutorials were developed for each of the modules, often they had to be divided into parts in order to adapt them to the number of laboratory classes foreseen for the given subject. Tutorials contained in the course are not intended to supersede laboratory classes;
rather, they facilitate revisions of the material and memorizing of commands and their use. They also provide valuable basis for those students who for various reasons have to catch up with the material and have to be updated every year as new versions of software are introduced on the market [8].

- a part dedicated to verification of the gained knowledge through a type of a test-quiz, which uses random questioning mechanics implemented in the Moodle platform [10]. The following mechanics were implemented: *match the correct answer, multiple choice* (Fig. 6), *short text answer* (Fig. 7), *numerical, true-false*. Most of the questions are accompanied by their graphical record in the form of Print Screens of CAD software.

Example questions from the test-quiz verifying skills and knowledge gained during given module

![Multiple choice type question](image6.png)

**Figure 6: Multiple choice type question**

![Short text answer type question](image7.png)

**Figure 7: Short text answer type question**

The questions and the way they were formulated directly refer to CAD certification tests – e.g. AutoCAD certification tests by Autodesk. Such approach allows students to prepare for this form of certification.
- a part dedicated to handing in of works. During one semester two types of submissions were foreseen: submission of files at the end of laboratory classes and submission for review. Two options are available in the scope of file submissions: send a file and advanced file upload. The former allows to send to the platform one file only (in class record one score will appear), the latter gives the possibility to upload a number of files related to one task (in class record one score will appear for all submitted works). Advanced file upload allows also for implementation of an option send for review which allows for submissions of works in progress. Files submitted via this route can be reviewed by the lecturer and send back to the student for amendments. Student has the possibility to replace submitted files until the very moment of final submission.

Figure 8: Competition for the best composition of solids in the form of Moodle workshop

Figure 9. Example definitions in the dictionary of the Computer Techniques in Design subject

- a competition, in the form of Moodle workshop, for the best composition of solids related to a given idea (Fig. 8). Application of this tool allows students to view works submitted for the competition and to evaluate them.

Final module contains a summary which comprises: final test, in which possibility to randomly choose from each set of module questions is given, and handing in works representing all laboratory projects in the form of a presentation.

The course contains also parts created jointly with students such as dictionary of terms related to computer assisted design (Fig. 9) and a database of 2D and 3D objects developed by students. Creation of the dictionary by students (under strict supervision of the lecturer)
facilitates the gain of knowledge related to the subject.

Application of e-learning platform to assist teaching of Computer Techniques in Design subject constitutes a good supplement to laboratory classes. Introduction of the e-course made resources related to this subject more accessible. Unlimited in time access and self-studying through solving of tests and use of tutorials have shown positive influence on the scores the students are receiving. A significant improvement in the quality of works and lack of previously encountered mistakes related to architectural drawing have been observed. In figure 10 average grades of students who received credit for the course Computer Techniques in Design in years 2008 - 2012 in groups lead by the author have been shown. The analysis covered each time 80 – 100 students. The results have been given separately for each of the semesters due to differences in the scope. Average grades ranged from 4.50 to 4.64 before introduction of the e-learning course and between 4.70 and 4.80 after its introduction in the system where grades range from 2 to 5 and 5 is the highest grade possible.

Figure 10: Weighted average of scores received by students of the Faculty of Architecture of Cracow University of Technology in groups of Farid Nassery, Ph.D., arch, in years 2008 - 2012 within the framework of Computer Techniques in Design subject

An important aspects of e-learning courses is the possibility to submit works by uploading them onto the platform which allows to amend the projects in a remote manner. Self paced quizzes help the students to verify their knowledge and skills in computer assisted design. The course is currently used by virtually all students, which may be an indication of its usefulness and functionality and also of the need for further development of this form of teaching. The introduction of multimedia and information technologies into the course requires however a careful design of the course architecture, visual aids and the selection of the topics.

References:


Referat prezentuje zagadnienie blended – learningu w nauczaniu przedmiotu Techniki Komputerowej w Projektowaniu, realizowanego na 1 roku studiów stacjonarnych I stopnia Wydziału Architektury Politechniki Krakowskiej im. T. Kościuszk. Przedmiot ten ma na celu nabycie umiejętności tworzenia dokumentacji technicznej obiektów budowlanych, kształtowania idei architektonicznych w przestrzeni wirtualnej oraz prezentacje koncepcji architektonicznych.

W ramach intensyfikacji efekty kształcenia z tego przedmiotu, a także z powodu jego specyfiki wprowadzono oprócz zajęć laboratoryjnych odbywających się na sali, wspomagający kurs w oparciu o platformę e-learningową Moodle. Podzielono go na: informacje wstępnne, moduły laboratoryjne i podsumowanie. Moduły prezentują poszczególne grupy zajęć laboratoryjnych zawierające elementy:
- część teoretyczną w skład, której wchodzą zestaw indywidualnych tematów oraz materiały dydaktyczne i pomocnicze obejmujące przykłady prac studentów z poprzednich lat, a także tutoriale do wykonania zajęć laboratoryjnych.
- część sprawdzającą opanowanie materiału w formie testu – quizu.

Ostatnim modułem jest podsumowanie zawierające test końcowy, w którym wykorzystano możliwości losowego wyboru z każdego zestawu pytań modułowych oraz oddanie prac prezentujących wszystkie projekty laboratoryjne. Zastosowanie platformy e-learningowej do wspomagania nauczania przedmiotu Techniki Komputerowej w Projektowaniu jest dobrym dopełnieniem zajęć laboratoryjnych. Wprowadzenie e-kursu pozwoliło na wzmocnienie interakcji pomiędzy prowadzącym zajęcia a studentami. Zwiększyło także dostępność zasobów informacyjnych, związanych z zagadnieniami z tego przedmiotu. Nieograniczony ramami czasowymi dostęp oraz samodzielne powtarzanie związane z rozwiązywaniem quizów i korzystaniem z tutoriów pozytywnie przełożyło się na wyniki opanowania materiału dydaktycznego. Zauważono, a także znaczące polepszenie jakości całych prac oraz brak wcześniej popełnianych błędów związanych z zasadami rysunku budowlanego. Na wykresie (II.10.) przedstawiono średnie ocen studentów,
którzy uzyskali zaliczenia z przedmiotu Techniki Komputerowe w Projektowaniu w latach 2008 - 2012 w grupach asystenckich autora. Analiza obejmowała każdorazowo ok. 80 – 100 uczestników kursu. Wyniki podano osobno dla każdego z semestrów, ze względu na zróżnicowanie materiału w semestrze I i II. Możliwe stało się ich zestawienie i porównanie, ponieważ zakres realizowanego materiału w analizowanych okresach był prawie identyczny. Średnia ocen przed wprowadzeniem kursu e-learningowego wynosiła pomiędzy 4,50 - 4,64, a po jego uruchomieniu 4,70 - 4,80 w skali od 2 do 5, gdzie ocena 5 jest najwyższą oceną.

Ważnym aspektem kursów e-learningowych jest możliwość oddawania prac poprzez przesłanie ich na platformę, co daje między innymi możliwość korekty projektów inżynierskich na odległość. Natomiast wprowadzone quizy samosprawdzające pomagają studentom samodzielnie ocenić zdobyte umiejętności i wiedzę z zakresu projektowania wspomaganego komputerem. Obecnie z kursu korzysta niemalże 100 % studentów, co świadczy o jego przydatności i funkcjonalności, a także o konieczności ciągłego rozwijania tego kanału przekazu wiedzy, dostosowanego do społeczeństwa informatycznego. Wprowadzenie technologii multimedialnych i informatycznych wymaga jednak dokładnego zaprojektowania architektury kursu, a także pomocy wizualnych oraz zwrócenia szczególnej uwagi na wybór tematów.