



Blended learning in teaching materials science subjects at full time studies

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ABSTRACT

Purpose: The main aim of this article is to present the advantages and disadvantages of the use of blended learning in teaching Fundamentals of Materials Science and Metal Materials. The purpose of carried research is to analyse the effectiveness of e-learning as means of teaching in blended learning model.

Design/methodology/approach: This article includes a description of blended learning; comparison of students' results in materials science between the traditional method and remote teaching using the Internet; dependencies between the effects of teaching and results of students' tests written using the platform.

Findings: Students acquire different skills and knowledge varying pace with the personal support of the teacher. This method of assisting remotely the e-learning students has proved to be efficient.

Research limitations/implications: Larger population of students should be tested so as to give measurable results, which would imply what needs to be worked on and what changes to introduce in order to improve the e-learning process.

Originality/value: The document's research material confirms that e-learning makes it possible to use a new form of education which can connect the advantages of traditional learning and remote education in the field of materials science.

Keywords: Computer supported education; Moodle; Blended learning

EDUCATION AND RESEARCH TRENDS IN MATERIALS SCIENCE AND ENGINEERING

1. Introduction

E-learning at Polish universities is developing from a few years. The development of computers' infrastructure in our country, especially in recent years, lets the further use of the Internet in teaching. The specificity of teaching at full time studies in Poland makes, that among different forms of teaching the most popular is blended learning, that is proportional to set goals, the connection of teaching in a traditional and distant way [1]. Such kind of supporting training in a traditional way is more and more visible in education, on both, junior high school level and high school one. Blended learning, contrary to distant teaching, is less expensive and does not extort from the

universities' head teachers the implementation of revolutionary changes in organizations of teaching students [2]. The most important advantages of such kind of model of teaching are: the one. Blended learning, contrary to distant teaching, is less expensive and does not extort from the universities' head teachers the implementation of revolutionary changes in organizations of teaching students [2]. The most important advantages of such kind of model of teaching are: the possibility of optimization of the didactic and economic effectiveness of the teaching process, the direct contact between the students and the teachers in the main moments of the teaching process, a possibility to return to the traditional way of teaching and the realization of introducing the distant training "step by step".

2. The informatics' environment and the methodology of the research

The technical studies are the ones which do not let the lack of the physical contact of a student with the university because of the fact that the laboratory classes have to take place in modern laboratories. However, not every class is a laboratory one. The experiments are usually preceded by theoretical classes on which the students get to know about the aim of the practice/class, an instruction to it, the methods of working out the results and their interpretation. The preparation of the students to the task, the theoretical knowledge from the given topic, the description of the measuring devices and the use of them are also checked. In such a case the stay of the student at the university can be minimized in such a way that he/she will take part only in the experimental part in a laboratory at the university. The rest can be done by means of distant teaching. Blended learning seems to be an optimal solution because of the fact that checking the students' knowledge and a simulation of experiments can be done with the use of the Internet.

During preparation to the implementation of blended learning of the Institute of Engineering Materials and Biomaterials at the Silesian University of Technology, a pedagogical experiment was planned and carried out, which aim was to examine the effectiveness of teaching materials science subjects with a blended learning method, the assessment of pedagogical materials and the role of the teacher in e-learning.

As a part of introductory operations an e-learning Platform of the Institute of Engineering Materials and Biomaterials was established in October, 2004 as a modern distant teaching tool and containing teaching materials for lectures and materials science subjects as well as instructions for laboratory exercises carried out in the Institute, self-evaluation tests, crosswords and multimedia presentations. What is more, it functions as a virtual notice board and is a tool of communication between the students and the teachers. On the next stage the subjects were selected, a full set of didactic materials was prepared and both the teachers and the students, who were supposed to take part in the project, were chosen.

The research was carried out for two terms. Within the first term, the results of teaching were measured in the Fundamentals of Materials Science subject of taught in a mixed mode method to a group of 270 students. Within the second term the measurements were repeated taking into consideration the results achieved by 200 students taking part in the classes connected with the subject of Metal Materials. In both cases students were divided into two equal groups: mixed (in which e-learning method was used) and traditional one. Both subjects were taught by the same teachers, each of them was teaching in one traditional group and one that was mixed. The choice of the method by the students was based on voluntary signing to one of the groups – the questionnaires were carried out after each term and the data of the recruitment commission let characterize the given population.

During the experiment all the students had access to the Internet, but 80% of them did not have any time limit. On the basis of the collected data it was stated that all the students from the mixed group and 95% of the traditional one are internauts, that is people who at least once a month use the Internet, and accordingly 60% and 50% use the Internet daily for two hours. In similar researches [3] carried among the students of AGH University of Science and Technology in 2005 it was noticed that 49.9% of the respondents every day over two hours use the Internet (Fig. 1).

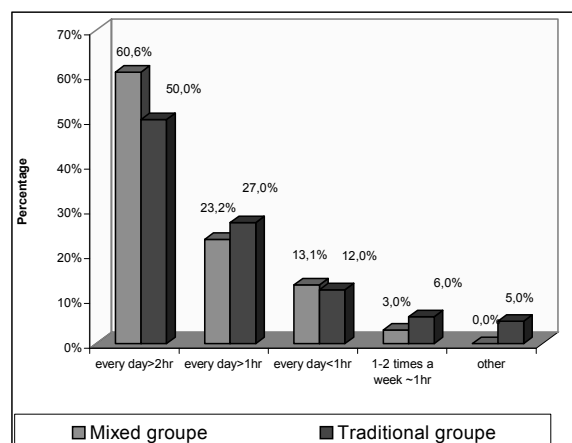


Fig. 1. The time spent in the Internet by the respondents

The traditional group had two types of tasks: in even weeks the laboratory classes, on which the students familiarized themselves with the devices and made the measurements according to the manual and board tasks in odd weeks, on which the teachers checked the theoretical preparation of the students and were talking over the results of the measurements and additionally were doing some model tasks. The mixed group in even weeks had the same classes as the traditional one, however, instead of board classes, they participated in an online Internet course which was available on the educational platform of the institute. For both subjects there were separate courses prepared, which included the following devices: the instructions to the tasks, presentations, self evaluation tests, tasks, short tests which checked the preparation to the synchronous discussion, a forum and a chat, which was obligatory for the students and the teachers who took part in blended learning [4-9].

3. Result of the research

To compare the effectiveness of teaching the materials science subjects by means of blended learning, a comparison between the results of the final tests of both groups (Table 1) and the average number of points which the students got during the recruitment process (Table 2), was made. The second task substituted a diagnostic test at the very beginning of the experiment.

To prove the thesis “the teaching of materials science subjects by a mixed method is comparable to a traditional method” a statistical test, equal to two average on the basis of a model, which is used when populations have a normal or different place, and variations σ_1^2 and σ_2^2 are unchanging but finished, was carried out. The number of the examined populations is bigger than 30 and that is why a verification was carried out for big groups. On the basis of carried out tests it can be stated, that for the level of importance 0.05 the average results of recruitment and the average results of tests from the subjects “Basis of the Materials Science” and “Metal Materials” for both examined groups, are equal. It can be stated that the teaching of materials science subjects by means of blended learning is comparable to traditional method [4, 5].

Table 1.
Statistic description of the final test results from the Fundamentals of Materials Science and Metal Materials

Subject	The Fundamentals of Materials Science		Metal Materials		
	Traditional	Mixed	Traditional	Mixed	
Average	points	11.90	11.99	23.94	24.02
	%	51.17	52.13	66.50	66.72
Median , points	12	12	25	25	
The highest result, points	21	21	33	32	
The lowest result, points	4	5	10	12	
Standard deviation	3.04	3.30	4.75	4.02	

Table 2.
Recruitment results of traditional and mixed group

Group	Traditional	Mixed
Numerical force in groups	104	92
Recruitment results' average, %	35.000	36.457
Standard deviation	16.232	16.391

In distant learning the role of the teacher changes. E-teacher usually realizes the script prepared by the author of the course, because the content and the main ways of passing the knowledge should be contained in the instructions. The teacher has some freedom in the ways of communicating with the students, the assessment of the work and arranging in the process of teaching and motivating to work. To check the role of the tutor some results of the students from different sections were compared. Next, a variation analysis was carried out with a zero thesis that the results in given sections in the final tests are equal. The same thesis was implemented during the analysis of average number of points in the sections in the recruitment process. The results of the analysis are presented in Tables 3 and 4.

Table 3.
The analysis of the variances in view of the number of points from recruitment in particular sections

Subject	Group	F	F α , r-1, n-r
The Fundamentals of Materials Science	Traditional	0.97	~2.03
	Mixed	1.04	~2.06
Metal Materials	Traditional	1.23	~2.11
	Mixed	1.12	~2.12

Table 4.
Analysis of the variances in view of the results of the final test in sections

Subject	Group	F	F α , r-1, n-r
The Fundamentals of Materials Science	Traditional	3.14	~2.03
	Mixed	1.81	~2.06
Metal Materials	Traditional	4.36	~2.11
	Mixed	1.82	~2.12

Where: F – value of statistics, F α , r-1, n-r – value of F-Snedecor's fractile (from the Tables)

On the basis of the calculations it was stated that in a traditional teaching process the role of the teacher has a great influence on the results of the teaching of materials metal subjects. In mixed teaching the thesis is not proved, that is the influence of the teacher on the effects of the teaching is lower than in traditional teaching. After a discussion among a board of teachers, who participated in the experiment, a following conclusion was put forward: a longer training for tutors where the newest devices of the e-learning platform and the ways of the use of them would be showed. Moreover, it is important to notice that leading classes by means of blended learning is more time consuming for e-teachers [2].

After the experiment some questionnaires were carried out among students and teachers from Institute of Engineering Materials and Biomaterials. The first one is discussed in [4, 5]. The most important conclusions from the second one are presented below.

The respondents occurred to have a wide knowledge of terms connected with e-learning, what is proved by their statements, because 82% of them believes that they have knowledge about it. The result is very optimistic, a better one than that which was gained in other researches [10]. The majority of teachers, about 90%, is for enriching education with some forms of e-teaching. Such a big number of supporters is a result of having knowledge about this kind of teaching, and, what is more, is connected with the experiences taken from participation in trainings by means of distant learning. Over 40% of respondents participated in e-courses and those people are supporters of the implementation of such an innovation at our University.

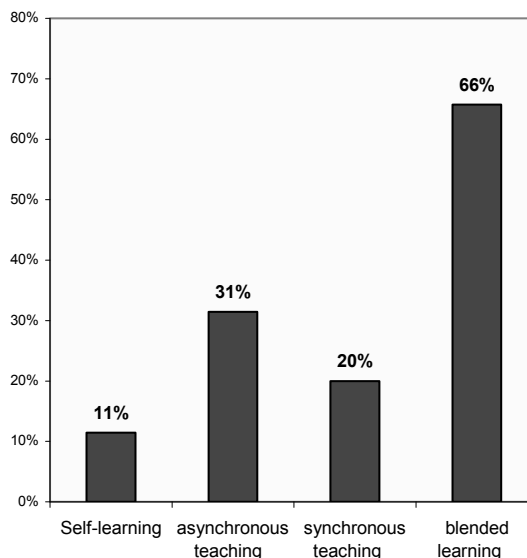


Fig. 2. Teachers' ideas on implementing different forms of e-learning

The teachers who are ready to introduce the methods of distant learning during the classes believe, that the most useful in teaching their subject is blended learning (Fig. 2). Among the proposed forms of e-education the most popular are: enriching traditional teaching of obligatory subjects in additional materials which are available on educational platform and are directed at the close group

of students (78%), a program of universal supplementing of extramural studies (67%), lectures and video conferences of famous scientists from the co-operating universities (58%).

4. Conclusions

The results of the research allow to draw the number of conclusions. Research results for courses presented in this article confirm that an e-learning method enables the usage of the new teaching formula, which may embrace the advantages of traditional teaching and distant teaching of the Materials Science.

To the most important advantages of this educational method using the Internet we may include:

- teaching effectiveness using the Internet is comparable to the traditional educational methods,
- commitment and students' self-education with the use of educational materials based on a platform has an influence on final results and assures a convenient way of current improvement control of the students,
- a teaching method with the usage of the Internet assures the possibility of gaining new skills by the students, they are respected on the labour market, such as tele-work and work in virtual teams,
- a teaching method with the usage of the Internet assures the possibility of reconciliation common scientific journeys with the didactic work, particularly the so-called independent research workers.

To the disadvantages, or to be more accurate, to the challenges that organizers of complementary education studies with the usage of the Internet must face we may include:

- increased costs connected with the preparation of the teaching with the Internet conditions, investment costs of the information infrastructure and its exploitation, author's elaboration costs, software materials and didactic support costs, the costs connected with the employment of e-learning experts and finally increased costs of teaching the school by the teachers),
- smaller teacher's influence on the results achieved by the students.

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