Flexible Hybrid Learning: Comparative Study

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Abstract. Hybrid learning has become a widely exploited approach within the ICT-enhanced instruction. Making it flexible, so that the process of learning reflecting students' needs and preferences was the problem solved in various ways at three Czech institutions of higher education. In the paper the whole process is described, describing the starting phase, which was identical at all three institutions, and comparing different models of flexible hybrid learning applied further, including the results of pedagogical experiments comparing learners' knowledge in flexible and non-flexible learning. The results did not proved clearly visible differences, as neither world-recognized research did. Despite this, authors are persuaded that research activities in this field should go on, paying deeper attention to learners' personal characteristics and other activities within the learning process.

Keywords: Hybrid learning · Pedagogical experiment · Adaptive environment · Flexibility · Learning preferences · Learning styles

1 Introduction

The process of ICT implementation within the Czech higher education system, which includes 26 public universities, started in 1999 after the new Higher Education Law No. 111/98 Coll., §21b had become effective, and the starting phase was closed in 2007 when all Czech public universities mentioned the process of ICT implementation in their annual reports. Within the analysis made by the Centre for Higher Education Studies, Prague (2006) it was declared that [1]:

- Nearly all universities declare and emphasize the use of ICT in the process of instruction and consider it as priority.
- Technical universities, closely dealing with results of technical development, ex-press more keen interest in the field of ICT than non-technical institutions.

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– Universities differ in approaching and solving the problem of implementation: technical universities often concentrate on material and technical point of view, i.e. they put emphasis on equipment and its technical characteristics, whereas faculties of education run the slow process, but they pay more attention to didactic aspects.

Several institutions were the leaders and following centers were established:

– University of Ostrava;
– VSB-Technical University of Ostrava;
– University of Hradec Kralove, particularly the Faculty of Informatics and Management (FIM), other faculties joined the process later;
– University of Economics, Prague.

All institutions provided either fully distance education, or the hybrid (blended) courses to support the full-time and part-time study programs. Rather wide exchange of experience was running with surrounding countries (mainly the Slovak Republic) and those being more experienced in this field, which resulted in participation in (European Union) projects, e.g. with Poland, Great Britain, Island, Italy, Finland, Portugal, Netherlands, Germany etc. Above all, since 2000 the eLearning conference and competition has been held at the UHK, hosting participants from the Czech Republic and Slovak Republic, whose papers were published in the conference proceedings and best ICT-supported courses for hybrid and distance education were awarded.

The problem authors of this paper focus on is how the process of ICT implementation ran in single institutions – leaders in the process, as different approaches and learning management systems (LMS) were exploited, either ready-made, or tailored to special needs of institution and designed by university staff, e.g. [2–4].

Authors of this article had following goals:

– summarize main concepts of ICT-enhanced teaching/learning on the basis of literature review;
– describe the current concepts of hybrid learning at the institutions;
– introduce the comparison of research results collected from two hybrid learning processes conducted at two institutions.

2 Theoretical Background

Depending on the share of information and communication technologies (ICT) in the process of instruction, several terms are widely used: hybrid or blended learning, web-enhanced or online instruction.

There is not a wide consensus on the definition of hybrid learning which is also called blended learning by some authors, e.g. [5–7]. The University of Washington, Bothell, defines blended courses as those where 25 % - 50 % of the traditional face-to-face class time is replaced with online or out-of-class work [8], compared to the Sloan Consortium, which defines blended learning as a course where 30 % - 70 % of the instruction is delivered online [9]. And, Yamagata-Lynch claims that “there is no agreed percentage of what constitutes a course as blended, and in many institutions

there are idiosyncratic definitions of online, distance education, and blended instruction" [10].

Nevertheless, reflecting the share of in-class and out-of-class work we can define the blended and web-enhanced courses, where learners continue to meet during the normal class hours and use the online component to supplement face-to-face time [8].

Several recent studies (e.g. [10, 11]) show that much more institutions of higher learning are now showing interest in the official implementation of hybrid learning (e.g. [12]), as it is an advantage for their distance learning courses. In this way universities can be more economical as far as the use of faculty space, time and staff are concerned (e.g. [13]). Furthermore, other research studies (e.g. [14] or [15]) proved that hybrid learning/teaching had ample advantages such as learning effectiveness and learners' satisfaction.

The hybrid learning has also undergone a shift from exploiting non-portable (immobile) devices to mobile ones. In the past the process of implementation in the Czech Republic was limited by the fact that mobile devices were not available to such extent as in the developed countries. However, currently the situation has changed substantially and mobile learning can be exploited at all levels of education [16, 17]. Learners using mobile devices all days long have been literate enough to use them for education purposes. Before the process of the wide-spread use started, several questions had been researched in the Czech Republic focusing on whether students were sufficiently equipped with mobile devices, for what purposes do they use the mobile devices and what is the feedback after all [18].

Another phenomenon is intimately connected to hybrid learning, i.e. tailoring this process to learners' individual needs and learning preferences. In spite of numerous advantages, there exist several conflicting ideas. Therefore, the pedagogy might also support higher motivation and stimulation for students (e.g. [16, 19]). Moreover, hybrid learning might also match student's learning style since it can offer more interactive ways of learning and almost immediate feedback on students' tasks, assignments or tests. However, there is not still clear consensus on this issue ([16, 20, 21], and [22]). Mismatch in teaching/learning styles can cause a wide range of further educational problems [23]. Gregorc [24] discovered only individuals with very strong preferences do not study efficiently, the others may be encouraged to develop new learning strategies. Mitchell [25] emphasizes making the educational process too specific to one user may restrict the others. Up-to-now only limited number of studies have demonstrated that students learn more effectively if their learning style is accommodated [20].

Taking into consideration the research results in learning styles by the above mentioned authors and many others, methodology on how to implement learners' preferences into instruction was deeply worked out. However, Honey was the first one who asked question about learning styles in e-learning [26]. After monitoring the likes and dislikes about e-learning in the group of 242 respondents he concluded, their opinions did not differ so much as he had expected, despite various types of learners definitely had different features in mind, when speaking e.g. about learning at my own pace.

In the Czech education environment the Ross and Schulz´s approach (in [27]) and Gregorc´s concept (in [24]) were applied in hybrid learning reflecting learning styles preferences, i.e. the concrete/sequencing, abstract/sequencing, concrete/random and

abstract/random websites were designed. Mares proposed to adjust the World Wide Web to various learning styles, i.e. to sensory, social and cognitive preferences, and to design [30]:

- the visual Web providing static texts, images, graphs, animations, video-recordings etc.,
- the auditory Web with recordings of lectures, music, discussions,
- the kinesthetic Web providing hands-on activities and practical examples,
- the Web adapted to social preferences reflected in independent, pair or team work.

From learners' point of view, it is important for a student to be aware of his/her learning style, to know the strengths and weaknesses and be provided a variety of instructional methods to choose the most suitable ones [28].

3 Two Approaches to Flexible Hybrid Learning

The history of ICT implementation at both institutions started at the beginning of 1990s by using shared directories where study materials were presented. Step by step the e-mail service was used for communication between students, and students and teachers, followed by other services, e.g. electronic administration of credits and examinations, displaying syllabi, timetables, entrance exams results, university web-sites were designed. Then the professional virtual learning environment Learning Space was bought by FIM, in 2001 it was replaced by WebCT. At UO, the development of LMS Barborka started, been designed by UO academic staff.

At the same time first distance on-line courses were designed within European Frameworks, e.g. Tempus Project MUDILT (Multimedia and Distance Learning for Teachers) or PATTER (Public Administrators' Training Towards EU), ECDL (European Computer Driving License). The projects targeting at university students were conducted, e.g. OLIVA Project (On-LIne VýukA, on-line learning), to prepare both the teachers and students for e-learning in higher education. First courses were designed for subjects in the field of Informatics, Economy and Management, then in foreign languages, Psychology, Ethics etc. In 2014 more than 300 courses were available to 5000 VSB students and more than 250 courses to 2,300 students of FIM. UHK and UO also solved several international projects, e.g. Borderless Education, in co-operation with other Czech and international universities (RIUS Project (Run-up of Inter-University Study in selected universities in the Czech Republic and others).

Thus we can state, up-to-now both students and teachers have collected rather wide experience in this field. There is no doubt, the information and communication technologies provide a wide range of tools and strategies each student can choose from and learn efficiently. The result is that the student is positively motivated and able to develop the possibly highest level of knowledge in the shortest time period spending least efforts [30]. To reach such a level in the real process of instruction, the requirement for optimizing the teaching/learning arose, particularly the call for improving the flexibility of the process, mainly by applying the individualized approach [16].

3.1 Model of Flexible Hybrid Learning at University of Ostrava

The flexible and personalized education is a current research topic at the OU and VSB; where automatic adaptive learning has being exploited. The optimal adaptive process should respect students' differences in learning styles and level of their knowledge and skills [28]. On the basis of identification of their personal characteristics and qualities, students are provided such study materials which reflect their learning preferences.

The monitored features are as follows:

- sensory perception, covering verbal, visual, auditory, kinesthetic preferences (VARK questionnaire by Fleming and Mills was used);
- social aspects, dealing with individual, pair, team work (LSI – Learning Style Inventory (Dunn and Dunn, 1993);
- affective aspects, including inner and outer motivation (LSI);
- learning strategies, i.e.
  - whether learners prefer system or free work (ILS – Inventory of Learning Style, by Vermunt),
  - theoretical deductions or experimenting (ILS),
  - analytic or holistic processes (TSI – Thinking Style Inventory by Sternberg and Wagner),
  - deep, strategic or shallow learning (ASSIST – Approaches and Study Skills Inventory for Students by Entwistle).

Out of all above listed questionnaires the LSI was the only one which had been translated to Czech language and gone through the process of standardization; the others were translated and piloted by 200 UO students, for the purpose of this project. Then, further activities were applied within the process of adaptive learning:

- providing students the introductory information on how to study in online courses;
- applying the pre-test detecting learners' starting knowledge;
- applying the SSBI (Styles and Strategies Based Instruction) to detect learners' preferences;
- providing students the introductory information on how to study in online adaptive courses so that their preferences were accommodated (in this phase adequate learning strategies are also provided to students);
- designing the adaptive online course for learners with visual, auditory and kinesthetic preferences;
- run the process of teaching/learning (adaptive materials are used in the phase of independent out-of-school learning, i.e. homework);
- applying the post-test detecting students' knowledge after the process of instruction;
- collecting learners' final feedback.

The adaptive personalized instruction is directed by the expert system [3], the schema is displayed in Fig. 1.

The system consists of three parts: Student, Author and Virtual Teacher. The process is a student-centered, so the student is the center. Various types of information are required about the Student relating to main fields: starting knowledge and learning preferences, both are tested before the process of adaptive learning starts, as described

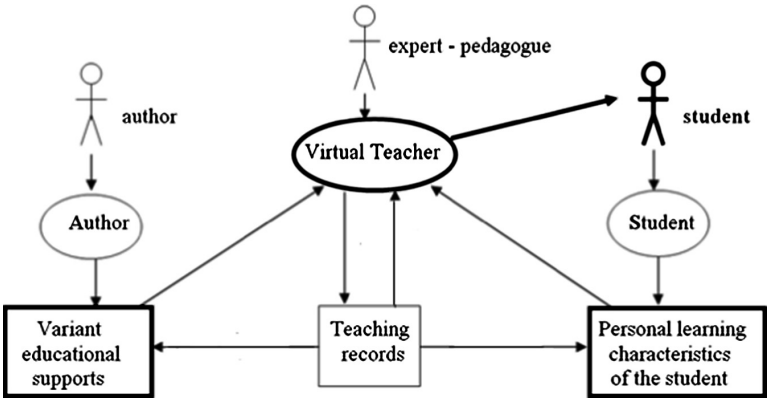

Fig. 1. Model of adaptive personalized instruction (designed by authors)

above. Author works as a modifier of student's learning; data from tests are applied in this activity, and study materials are adjusted to them. Then, Virtual Teacher reads all information about the student and recommends an optimal way of learning. Within this step pedagogic rules and didactic principles are taken into account; the final process of learning is really individualized, i.e. tailored to student's needs and preferences.

3.2 Model of Flexible Hybrid Learning at University of Hradec Kralove

The approach to flexible hybrid learning conducted at FIM (UHK) arose from the theory by C.A. Johnston. She partly agrees with theories of Piaget, Jung, Skinner, cognitive psychologists etc., i.e. with the tripartite theory of the mind – feelings, thoughts, behavior – which are expressed in the processing self, i.e. cognition, performing self (conation) and developing self (affectation). She describes the whole process of learning as a combination lock saying that cognition (processing), conation (performing) and affectation (developing) work as interlocking tumblers; when aligned they unlock individual's understanding of his/her learning combination. The will lies in the center of the model, and interaction is the key. She compares human learning behavior to a patterned fabric, where the cognition, conation and affectation are the threads of various colors and quality. It depends on the individual weaver (learner) how s/he combines them and what the final pattern is [4].

Johnston designed the Learning Combination Inventory (LCI) focusing on not the product of learning, but the process of learning, on how to unlock and what unlocks the learner's motivation and ability to learn. Respondents' answers form the schema (pattern) consisting from four categories as follows [31]:

- sequential processors, defined as the seekers of clear directions, practiced planners, thoroughly neat workers;
- precise processors, identified as the information specialists, into-details researches, answer specialists and report writers;
- technical processors, specified as the hands-on builders, independent private thinkers and reality seekers;

– confluent processors, described as those who march to a different drummer, are creative imaginers and unique presenters.

Data collected from LCI were exploited by the e-application which matches appropriate types of study materials to individual student's learning style pattern. The e-application reorganizes the Course Content page of the online course, i.e. the most appropriate types of study materials are listed there. Each topic of the learning con-tent was designed in six forms (i.e. full texts providing detailed information; short texts structured for the distance form of education, PowerPoint presentations; animations; video-recorded lectures; links to additional sources). The LCI data are provided to the e-application in the form of four figures reflecting the individual combination of the sequential, precise, technical, confluent preferences which formed the individual pattern of each learner. Single types of study materials are classified by four figures of the value of -1, 0, and 1 which corresponded to four types of processors preferences (Sequential, Precise, Technical and Confluent) as follows:

– minus one (-1) means this type is rejected, i.e. does not match the given learning style;
– zero (0) means the student neither appreciates, nor rejects, but accepts this type;
– one (1) means this type is appreciated and matches the given learning style.

Having evaluated the appropriateness of each type of study materials and exercises to single types of learning styles (Sequential, Precise, Technical and Confluent), and having detected the individual student's learning style by LCI, all data are processed by the e-application and the Course Content page is restructured for each student reflecting his/her individual learning preferences. On the individualized page of Course content the titles of preferred types of study materials are written in dark bold font while rejected ones are displayed in light color.

4 Flexible Hybrid Learning in Practice

Both models of flexible hybrid learning were verified by the method of pedagogical experiment and conducted in 2013/14 academic year following the 'pre-test – instruction – post-test structure'. The main research objective was to answer the above mentioned question, i.e. whether students learn more if the hybrid process of instruction is tailored to their learning preferences.

4.1 Research Design and Results at the OU and VSB

The online hybrid course of English for Specific Purposes (ESP) was exploited for the research. Students attended two lessons per week (90 min) and adapted materials were available to them for out-of-school study.

Totally 40 students participated in the research; they were divided in two groups: experimental (FEI-VAK), where the adaptive hybrid learning was applied; and control group (FEI-CON), where no learning preferences were reflected. The process of instruction followed the schema displayed in 3.1.

The results showed (Fig. 2):

- both groups reached statistically significant improvement on 0.05 level (i.e. in-crease in knowledge (2.766 points in FEI-VAK group and 2.565 points in FEI-CON group; maximum 10 points);
- in FEI-VAK the variability of test scores in post-test was lower compared to pre-test (see shorter right lower box) in Fig. 4;
- both groups reached rather high test score in post-tests (8.7 in FEI-VAK and 7.6 in FEI-CON;
- above all, the FEI-VAK post-test box illustrates that the adaptive hybrid approach enhanced learning in FEI-VAK, as variability of test score decreased compared to pre-test (compare the upper right box to upper left one) and the group was more homogenous compared to the pre-test level of knowledge; and, the increase in test score was higher with students who reached weak results in pre-test.

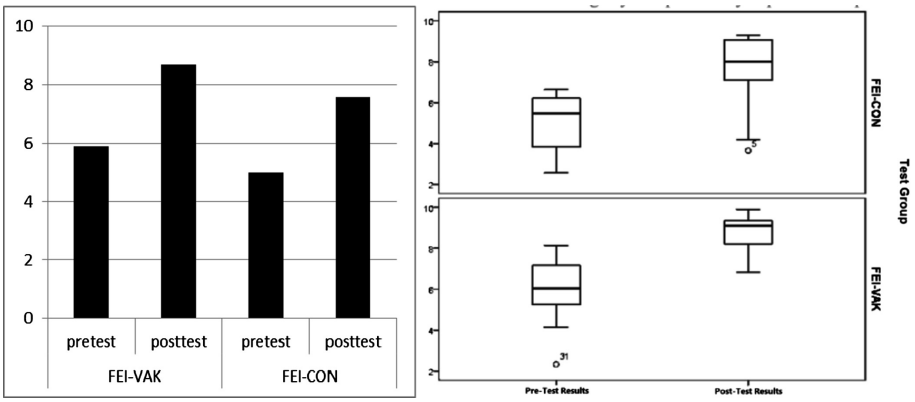

Fig. 2. Research results: University of Ostrava

4.2 Research Design and Results at UHK

The online course Library services – Information competence and education was designed. It was provided in three versions:

(1) reflecting the learner's style (experimental group 1, online course LCI, n = 108) where the e-application was used to tailor the course;
(2) providing all types of study materials to the learner; the process of selection is the matter of individual decision, the choices were tracked and compared to the LCI group (experimental group 2, online course CG, n = 103);
(3) reflecting the teacher's style (control group, online course K, n = 113) where the course was designed according to the teacher's style of instruction.

The hybrid process of instruction included the face-to-face instruction (identically 90 min per week) supported by independent study in the online course to fix and practice the learning content, develop new knowledge and be able to apply it in practice.

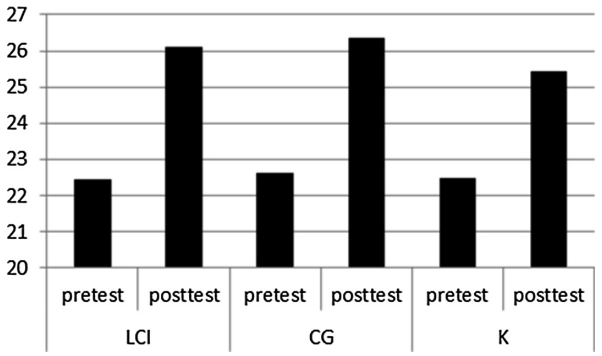

Fig. 3. Mean test scores in pretests and posttests in LCI, CG and K groups

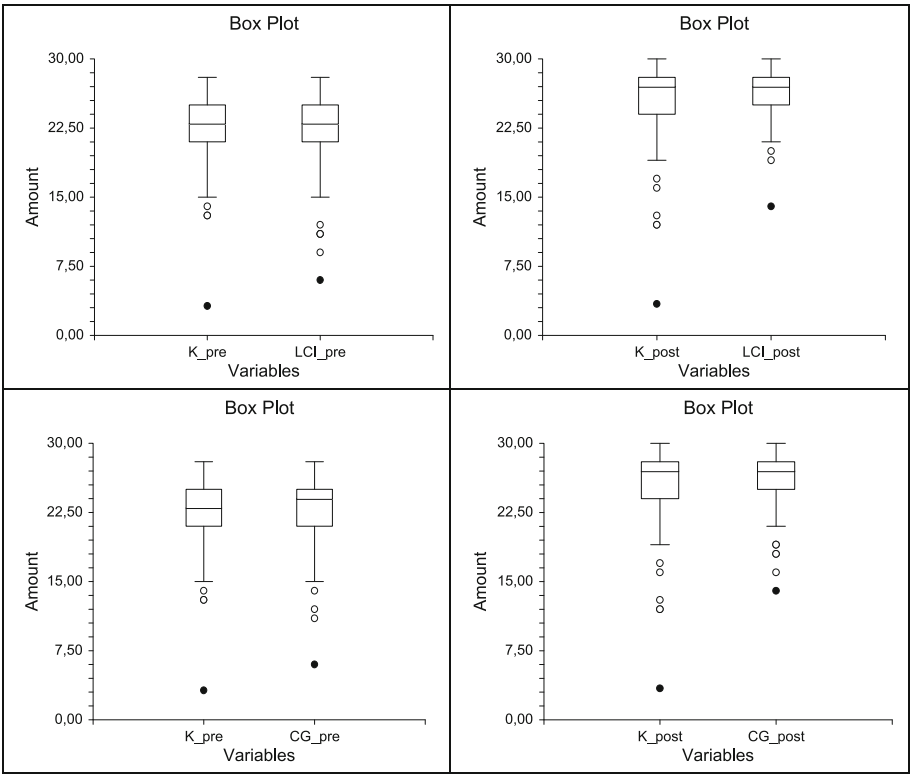

Fig. 4. Comparison of pretest and posttest test scores in LCI/K (left) and CG/K groups (right)

The sample group consisted of 324 students of University of Hradec Kralove. All students were randomly divided in three groups, each of them studying one of three versions of the same online course.

Unfortunately, no statistically significant differences were discovered in learners' performance. The mean values and test scores in LCI, CG and K groups in pre-tests and post-tests are displayed in Figs. 3 and 4.

This result was surprising and rather disappointing for the research team. Reflecting the research results of authors mentioned above (e.g. [4, 26] and others) we expected, if not significant, some larger differences would be detected in the LCI group where the face-to-face learning was supported by the online course reflecting students' learning preferences. Above all, in other researches dealing with hybrid learning which had been conducted at FIM the statistically significant differences were discovered in favor of hybrid learning, e.g. [32].

5 Conclusion

The main objective of this research was to answer the above mentioned question, i.e. whether students learn more if the hybrid process of instruction is tailored to their learning preferences.

To sum up, within these researches the contribution of adaptive hybrid learning model was detected at the University of Ostrava, but no differences were detected in an increase in learners knowledge in the sample group of University of Hradec Kralove where the process of hybrid learning was detected in three groups reflecting/non-reflecting learners preferences. Being conscious of a small size of the research sample at UO/VSB (n = 40), the results cannot be generated. But, they prove to some limited extent that the model of adaptive hybrid learning can work. Contrary to this, the research sample at UHK was rather numerous (n = 324).

Comparing these results to those reached by recognized team, they can be considered of the same type – the contribution of flexible hybrid learning was not clearly proved.

Despite all the facts, the information about both approaches to solving this problem may be useful to those who are trying to answer the same questions; consequently, to those who are trying to find other ways to reach the target.

In both solutions ICT was used to design appropriate models of flexible hybrid learning; we consider this to be the right way for further research activities in this field.

The research results show that more detailed analysis of learner's personal characteristics will be required, supported by their deeper reflection in tools of the hybrid learning process (assignments, tests, communication, schedule etc.).

From the results presented above it can be seen there is no definite solution. It is important for a student to be aware of his/her learning style, know what his/her strengths and weaknesses are and be provided a variety of instructional methods to choose the most suitable ones. In the days of fast technical and technological development, globalization, demand for further, lifelong education, the importance of education is increasing. These terms and conditions support the development of the whole system. Teachers' and students' awareness of learning styles and preferences may help substantially.

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