Study Materials in Online Courses

Analysis Reflecting Individual Learning Styles

Ivana Simonova
Faculty of Informatics and Management
University of Hradec Kralove
Hradec Kralove, Czech Republic
ivana.simonova@uhk.cz

Petra Poulova
Faculty of Informatics and Management
University of Hradec Kralove
Hradec Kralove, Czech Republic
petra.poulova@uhk.cz

Abstract—**This paper introduces results of research monitoring students´ satisfaction with studying in online courses reflecting individual learning styles. Students were provided various types of study materials and their satisfaction with the process of instruction was monitored by the questionnaire consisting of statements evaluated on the five-level Likert scale. The results showed no statistically significant differences in preference of a particular type of study material.**

Keywords—study materials; learning styles; online course; engineering education; analysis

I. INTRODUCTION

The learning style theory and practice have been accepted as a powerful didactic tool by numerous authors [1]. In 2010-2012 the research project "A flexible model of ICT-supported process of instruction reflecting individual learning styles" was solved at the Faculty of Informatics and Management, University of Hradec Kralove, Czech Republic. The main objective of the research was to verify whether tailoring the process of instruction in online courses to learner´s preferences resulted in improving students' knowledge in comparison to the traditional teacher´ style led instruction [2], [3]. The course of project was structured into four phases:

(1) detecting students´ individual learning styles;

(2) designing the online course "Library services – Information competence and education" in three versions reflecting (a) student´s individual learning style, (b) teacher´s style of instruction and (c) monitoring the process of instruction managed by each student individually;

(3) running the pedagogical experiment to accept or reject the hypothesis that tailoring the process of instruction to student´s preferences results in better knowledge expressed in higher test scores;

(4) monitoring students´ feedback after the process of instruction. In this paper results received from the final questionnaire are presented.

II. RESEARCH DESIGN

A. Defining Learning Content

The process of instruction was supported by the online course in the LMS Blackboard. The learning content resulted from two sources, covering both the teachers´ and students´ requirements. First, a team of experts consisting of ten members – academicians from all faculties of the University of Hradec Kralove provided their opinions; later on, two librarians joined the team and ran the expert work in finalizing the learning content. Second, students´ requirements were detected from the needs analysis questionnaire which had been applied at the Faculty of Informatics and Management for twelve years; data collected in last three years were used.

The online course reflecting individual learning preferences was called Library Services – Information Competence and Education (Informační výchova a gramotnost in Czech language, IVG) and covered eight topics: Basic terminology, Library services, Bibliographic quotations, Electronic sources, Bibliographic search services, Writing professional texts, Bachelor and diploma theses, Publishing ethics. The course home page is displayed in figure 1.

Each topic was worked out in six forms:

- fulltexts providing detailed information on the topic learned;

- distance texts structured for the distance form of education, where the structure of the material aspires to simulating the traditional face-to-face process of instruction;

- PowerPoint presentations;

- animations;

- video-recorded lectures;

- links to additional sources and study materials.

Each chapter included not only the learning content but also examples, practical applications and individual activities to simulate the real process of instruction.

Fig. 1. Library services course home page.

B. E-application

As mentioned above, the course was designed in three versions. An e-application was implemented in the version which reflected students´ individual learning preferences. Its main objective was to re-organize the entry page of the course and arrange various types of study materials according to student´s individual preferences which were detected by the standardized Learning Combination Inventory (LCI) designed by C. A. Johnston. The inventory contains 28 multiple-choice questions and three open-answer ones. The results were provided in the form of four figures describing student´s learning style pattern considering his/her learning preferences from the sequential, precise, technical and confluent point of view.

Single types of study materials were described by four figures of -1, 0, +1 values which corresponded to four types of learning preferences (sequential, precise, technical, confluent) as follows:

- minus one (-1) means this type of study material, activity, assignment, communication etc. is rejected, i.e. does not match student´s learning style;

- zero (0) is the middle value, i.e. the student neither appreciates, nor rejects, but accepts this type of material or activity;

- plus one (+1) means this type is appreciated and matches the given learning style.

After processing individual data by the e-application, various types of study materials were placed on the entry page in such order which reflected individual learning style of the student, i.e. the most appropriate materials were located on the top left position, the rejected materials were on the lower positions. Above all, the preferred types were emphasized in colour and size of the pictograms.

C. Research Sample

The sample group consisted of students of Faculty of Informatics and Management, University of Hradec Kralove who enrolled in 2011/12 academic year. They were randomly divided in three groups.

- Students in the experimental group 1 (group LCI) were provided such types of study materials, exercises, assignments, ways of communication and other activities which reflected their individual learning styles (patterns) as the e-application was implemented in this version.

- Students in experimental group 2 have access to all types of materials and the process of selection was the matter of student´s individual decision (group CG – content general).

- Students in the control group 3 (group K) studied under traditional conditions, i.e. their course was designed and run according to the teacher´s style of instruction which they were made to accept.

The process of instruction in all groups was tracked by the LMS.

Totally, nearly 400 respondents started the pedagogical experiment but only 324 finished it, from various reasons. Starting and final amounts of respondents are presented in table 1.

TABLE I. RESEARCH SAMPLE

	Before pedagogical experiment (n)	After pedagogical experiment (n)
K	130	113
CG	131	103
LCI	131	108
Total	392	**324**

D. Final Assessment Questionnaire

The pedagogical experiment having been closed (phase 3), students expressed their opinions, experience and attitudes in the final questionnaire, both from the technological and didactic point of view. The questionnaire included 22 items, while detailed information about the sample group was provided in five items (part 1) and 17 questions dealt with respondents´ experience in studying the course – seven statements were evaluated on the four-level Likert scale, four items used the four-level classification (1-best, 4-worst) and six ones were open-answer questions (part 2).

III. RESEARCH RESULTS

Data collected in part 1 of the questionnaire described the main characteristics of the research sample. The sample group consisted from 60 – 63 % of men in each group. Respondents were from 20 – 50 years old, approximately 80 % in the 20 – 24 year-old group. They mainly graduated from secondary

professional schools (62 – 67 %), followed by grammar school graduates (29 – 45 %). Most of respondents (60 – 65 %) did not have any previous experience in studying online courses, approximately 20 % of them had studied one course and 5 % were experienced online learners having passed four or more courses.

In part 2 the questionnaire focused on students´ satisfaction with the process of instruction in online courses. Most respondents (64 – 68 %) did not have problems to acquire the learning content from the reason of short period for studying but one third of them (32 – 35 %) would appreciate slightly more time. On the other hand, 41 – 52 % of respondents found the three-week period for studying the course in their schedule without any problems, followed by another group of 37 – 46 % of respondents who might have had some slight problems and expressed partial satisfaction in this point. Data describing students´ feedback on the difficulty of mastering the learning content showed that chapters Creating quotations and Professional writing were considered the most difficult topics.

A. Correlations between Learning Style Pattern and Type of Study Material

As mentioned above, before the process of instruction started, individual learning style of each respondent was detected by the LCI. The structure of research groups from the point of learning style pattern did not differ significantly as displayed in figure 2.
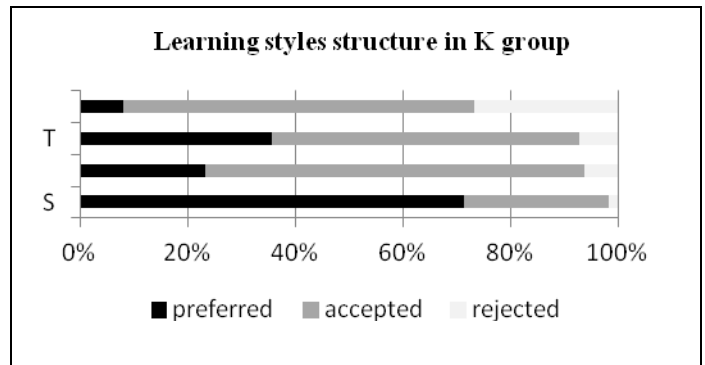

Fig. 2. Learning styles structure in the LCI, CG and K groups.

Further on, correlations* between learning patterns and different types of study materials were calculated and are presented in table 2.

According to the results, students preferring the *sequential* style mostly use electronic study texts, books and professional literature, video-recorded lectures and presentations; they reject self-tests and other supportive materials, e.g. dictionaries.

Students preferring the *precise* style like work with books and professional literature, animations, examples, electronic study texts and other supportive materials, e.g. dictionary; they do not like video-recorded lectures.

Students preferring the *technical* style often use animations and video-recorded lectures; they do not work with electronic study texts, other supportive materials, e.g. dictionaries and presentations.

Students preferring the confluent style work with books, professional literature and self-test; they do not use electronic study texts, video-recorded lectures, presentations and other supportive materials.

TABLE II.   CORRELATIONS BETWEEN LEARNING STYLES AND TYPES OF STUDY MATERIALS

	Sequential	Precise	Technical	Confluent
Books	0.11	0.27	0.05	0.11
Borrow books	-0.01	0.34	0.12	0.22
Electronic study text	0.12	0.11	-0.18	-0.17
Presentation	0.01	0.01	0.11	-0.10
Video-recording	0.09	-0.03	0.20	-0.16
Animation	0.01	0.24	0.23	-0.02
Self-test	-0.04	0.11	0.12	-0.14
Examples	-0.11	0.00	-0.12	0.09
Dictionary	0.05	0.12	0.02	-0.04

*correlation coefficient > 0.15

B. Evaluation of Study Materials

In part 2 the questionnaire also focused on learners´preferences in study materials in detailed. Four most frequently used types of materials (fulltexts, distance texts, PowerPoint presentations, animations) were evaluated by the respondents. Generally, study materials are considered an
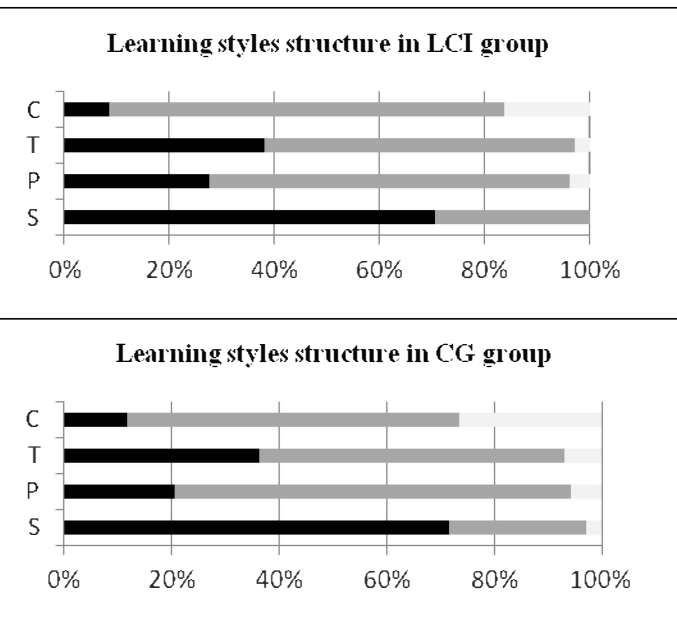
important value in the process of instruction (together with the tutor´s and learner´s personality characteristics) so data collected in this part of questionnaire were crucial for evaluation of the online teaching/learning process.

Large amount of data were collected covering the field in detail, the study materials were considered from two points of view:

- respondents expressed their preferences in descending order, i.e. they scaled study materials from those which they consider to suit best their learning style (value 1) to those least suitable (value 4), i.e. each value could be used once only;

- learner´s individual satisfaction with each type of study materials was marked from 1 (highest satisfaction) to 4 (lowest satisfaction) while each value could be used for more than once.

Results are presented in figure 3 (descending order) and figure 4 (individual order).

The first feature which is apparent in figure 3 is that the results differ from the point of various types of study materials, but not so strong differences can be seen in comparison of three groups. As mentioned above, all groups were stated identical from the point of learning patterns structure. The results of the experimental group 1 (LCI), where the study materials were re-organized by the e-application so that the process of instruction reflected individual learning styles, show rather strong preference of full text study materials (1 – 39 %, 2 – 22 %) and texts structured for distance learning (i.e. where the methods, tools and style of writing simulate the real process of instruction, 27 %, 37 %), while approximately half of respondents (20 %, 33 %) appreciated presentations; and animations were considered the least preferred type of study materials (23 %, 21 %).

Respondents of the experimental group 2 (CG), who were provided all types of study materials and no re-structuralization was made in this course, also showed strong preference to full texts (40 %, 23 %) and texts structured for distance education (27 %, 33 %); but presentations showed the lowest preference in all three groups (13 %, 31 %), they were even less appreciated that animations (21 %, 17 %).

Results in the control group (K), where the process of instruction reflected the teacher´s style, preferences were nearly identical with the experimental group 1 where the learners´ needs were reflected, i.e fulltexts were the most appreciated type of study materials (25 %, 35 %) followed by texts structured for distance education (23 %, 26 %); presentations received the highest rate of appreciation from all groups (24 %, 30 %) and animations were in-between the experimental group 1 and 2, reaching 32%- and 14%-preference, which is a higher rate than in the LCI group and lower than in the CG group. These results clearly show

- very positive appreciation of fulltexts in all three groups;

- comparable rate of full and partial appreciation of texts structured for distance learning;

- rather high rate in rejecting presentations;

- strong appreciation of full texts in the control group where the process of instruction followed the teacher´s style.
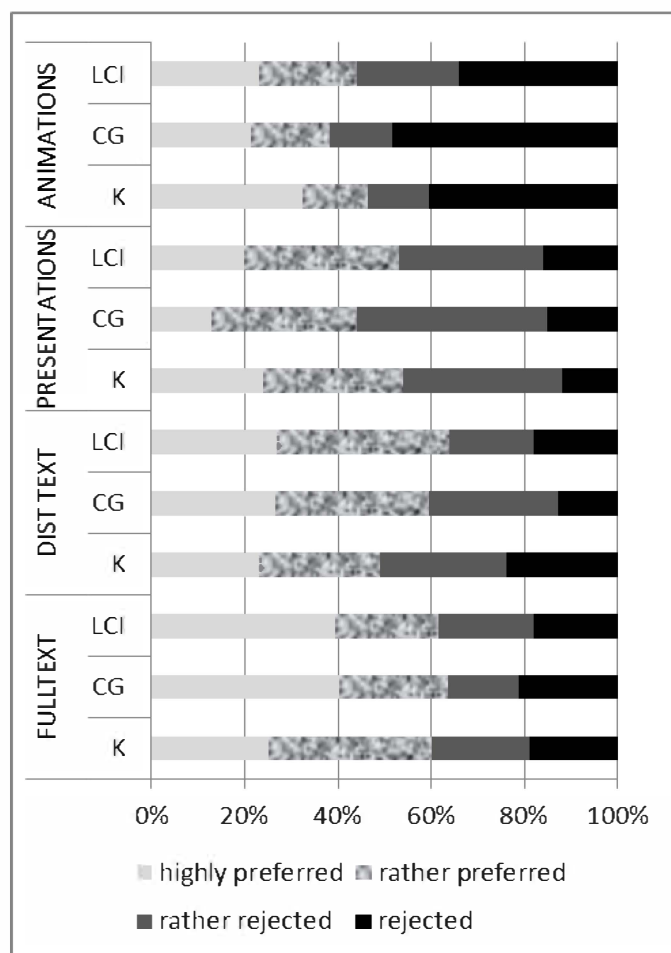

Fig. 3. Study materials evaluation: descending order.

On the other hand, figure 4 displays results of individual evaluation where each value could be used several times or completely omitted.

The results of the experimental group 1 (LCI, with study materials re-organized by the e-application), showed rather strong preference of full texts (1 – 51 %, 2 – 25 %), which was the same results as in the previous item. Texts for distance learning reached a slightly lower but still high rate (43 %, 38 %). The same result was with presentations where about one third of respondents (32 %, 38 %) appreciated this type of study materials; and animations were considered the least preferred type of study materials (33 %, 20 %) in all three groups.

Respondents of the experimental group 2 (CG) showed the strongest preference to full texts (44 %, 26 %) of all groups. Texts structured for distance learning were preferred by three quarters of respondents (44 %, 36 %), which was the same result as under the previous criterion. Presentations also showed the lowest preference in all three groups (22 %, 41 %) and animations were the least preferred type both within all

three groups (24 %, 26 %) and in comparison to the previous criterion.

Respondents in the control group (K) expressed the strongest preference to presentations (34 %, 43 %) followed by full-texts (38 %, 34 %), preferences of texts for distance learning showed nearly the same values (33 %, 29 %) as animations (36 %, 25 %).
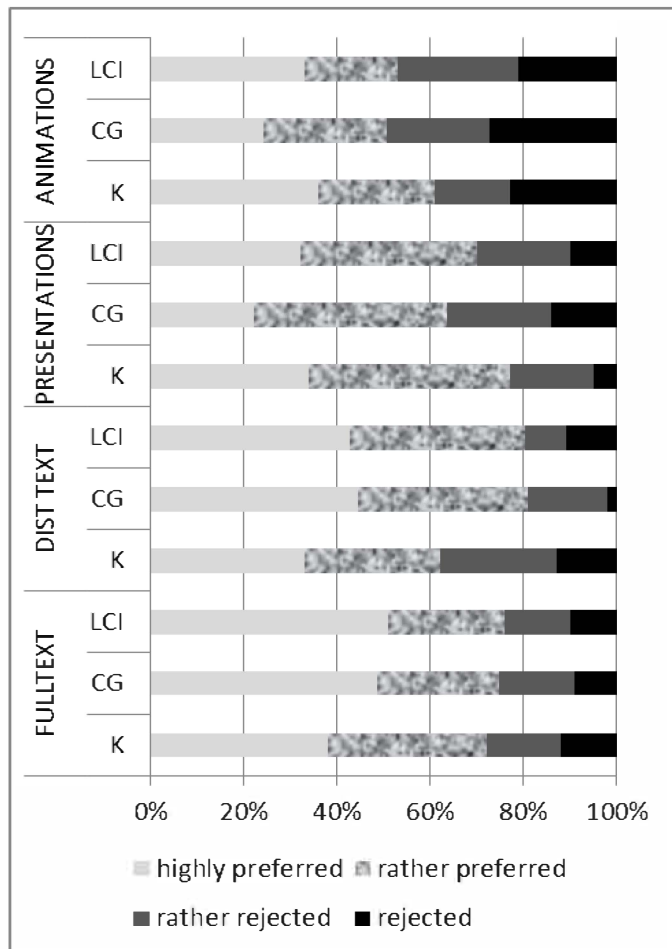

Fig. 4. Study materials evaluation: individual order.

Results displayed in figure 4 confirmed those discovered in figure 3 (dealing with descending preferences) showing

- strong preference in full-text study materials;
- rather equal values of fully and partially preferred texts for distance learning;
- rather strong rejection of presentations, partially in the LCI group;
- very strong preference of full texts, mainly in the group reflecting teacher´s style of instruction.

The criterion of individual order played the role of cross-evaluation in the questionnaire to verify or falsify the results received in the previous question. This objective was reached as the results were confirmed reaching similar values in both figures (compare figure 3, figure 4).

IV. RESULTS INTERPRETATIONS AND DISCUSSIONS

From the above presented results can be clearly seen that respondents – participants in the online course expressed their positive approach and satisfaction with the course of study, despite which version they studied. Hardly any crucial problems appeared which could be also caused by the fact, that the respondents were students of Informatics and Management study programmes and neither the online learning, nor the entire learning environment built limits and restrictions to them in the process of learning. As they mentioned in the questionnaire, approximately 80 % would take another course (other courses) within their university study, i.e. they would prefer online learning to traditional face-to-face approach.

There might be several reasons how to interpret the results.

First, based on the reached results we agree with e.g. Honey [5], Mitchell [6], Sternberg [7] saying that slight mismatches in learning and teaching styles result in developing new learning strategies, which is contributive to the learner. Thus the research question is as follows: Is it really worth dealing with learning styles if the pedagogical experiment did not prove any increase in knowledge?

Second, as mentioned in the theoretical part, there exist some researches (and researchers) rejecting the theory of learning styles and tailoring the process of instruction to individual preferences, e.g. Honey and Mumford [8], Honey [9]. The proposal might be

- to work with learners showing very strong preferences in one learning style and help them develop other strategies and approaches, and/or
- to work with those of very weak preferences and help them study efficiently using any strategy or approaches and methods which might be closer to their preferences.

Both ways can increase their motivation in learning, make the process more interesting for them, and such support is not of little importance [10].

Third, there could be several other reasons why the expectations and hypotheses were not verified, both on the researchers´ and learners´ side. In further research activities other approaches running the process of instruction reflecting individual learning styles can be tested, i.e. tutor´s role as a facilitator could be strengthened and emphasized so that learners studied in a more friendly environment, wider technical and didactic support could be provided to learners, their experience in online learning developed in this course could be used, and many other measures could be taken. On the learners´ side the skill of independent work and study should be supported and gradually developed, as online learning has become standard not only in the tertiary education but particularly in lifelong learning.

V. CONCLUSIONS

Thus it can be concluded that despite the contribution of the learning style theory to the online learning process was not proved within this project, no decrease in learners´ knowledge was discovered in comparison to the traditionally led process of learning which followed teacher´s style of instruction. The above mentioned authors (Gregorc, Mitchell, Honey, Mumford etc.) also described results in their works not verifying the learning styles contribution to the knowledge development and educational objectives within the learning process reflecting individual learning styles; including Felder, particularly focusing on engineering education. The time came to deal with didactic aspects of ICT implementation into the process of instruction. Students have not reached higher but the same level of knowledge in online learning, which corresponds to predefined learning objectives; and both teachers and learners have to develop their knowledge and skills towards studying efficiently being supported by modern technologies. This conclusion and recommendation is natural for engineering students focusing on Informatics and engineering pedagogy, both having close relation to modern technologies. Despite this conclusion, which was rather expected, the question is whether there is, or how close the correlation is between individual learning preferences of IT students (pre-graduate engineers) and the content of the programme they studied, i.e. whether their preference in online study materials is really given by their IT competence only, which definitely is on higher level than with other non-IT students, or whether the variable could be defined by Prensky terminology as "digital natives" [11], i.e. today´s young generation in general which IT/digital competent. This question could be the topic for furher research activities.

REFERENCES

[1] R. M. Felder, "Are Learning Styles Invalid? (Hint: No!)," [Online] 2010. [Cited: 8 22, 2012.] http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/LS_Validity(On-Course).pdf.

[2] K. Kostolányová, "Teorie adaptivního e-learningu," Ostrava: OU, 2012.

[3] I. Šimonová, P. Poulová, "Learning style reflection within tertiary e-education," Hradec Králové: WAMAK, 2012.

[4] C. A. Johnston, " Unlocking the will to learn, " Thousand Oaks: Corwin Press, Inc., 1996.

[5] P. Honey, et al., "Attitudes to e-learning: A national survey 2000 undertaken by the Campaign for learning," Sandford: Southgate Publishers, 2000.

[6] D. P. Mitchell et al., "Learning style: a critical analysis of the concept and its assessment,"London: Kogan Page, 2004.

[7] R. J. Sternberg, L. F. Zhang, "Perspectives of thinking, learning and cognitive styles," Mahwah: Lawrence Erlbaum. 2001.

[8] P. Honey, A. Mumford, "Using your learning styles," Maidenhead: Peter Honey Publications, 2002.

[9] P. Honey, "Learning styles - the key to personalised e-learning," [Online] 2010b. [Cited: 1 13, 2012.] www.bbmatters.net/bb_matters.../Learning%20styles_peter%20honey.pdf.

[10] R. Sternberg, "Mental Self Government, " [Online] 2010. [Cited: 8 22, 2012.] http://web.cortland.edu/andersmd/learning/Mental%20Self%20Government.htm

[11] M. Prensky, "Digital Natives, Digital Immigrants, " [Online] 2010. [Cited: 1 2, 2014.]http://www.marcprensky.com/writing.Prensky