Concept of E-Learning Reflected in Mind Maps of University Students
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Abstract
Mind mapping as a research method provides a multi-dimensional insight and discovers deeper levels of learner’s preconcert. The research focuses on the problem how university students understand the phenomenon of e-learning. Respondents worked with the eight-dimensional model of e-learning by Khan, both making changes in the model or constructing their own concept. The research group included 104 respondents, students of IT study programed at the Faculty of Informatics and Management, University of Hradec Králove. The results were analyzed according to four criteria and showed that students of informatics understood e-learning not only as the (future) IT experts but also as the educational tool.

1. Introduction
Searching for new approaches to evaluation which would enable to provide teachers deeper reflection of students’ knowledge calls for crucial efforts towards improving the educational process. Receiving realistic and objective feedback is the key problem of each educational concept. There exist various approaches to taking it, and the mind mapping (mental mapping, semantic mapping, concept mapping) is one of them. First, the term appeared in 1970s in the concept introduced by Buzan (2001), Canadian psychologist, who searched ways of remembering experience and concluded they were saved in individual’s memory in the form of clusters showing mutual interrelations. In the field of education the mind mapping relates to developing meaningful learning, i.e. a new piece of knowledge becomes meaningful to learners if in-built in their existing knowledge structures which he understands to be are identical with mind maps.

The mind map as a research method was first applied in late 1970s by Novak (1998). In his concept mind maps are understood as diagrams expressing significant relations between terms in the form of statements. These are represented by links between terms which describe their mutual relations. This concept was later adapted by Åhlberg (2004). Buzan (2010) says the mind maps thus can be understood as external expressions of knowledge.
integrated in individual’s mind. He emphasizes the mind map is not either "correct", or "incorrect", but it is always accepted in a certain context, while it could be rejected in another one.

The mind maps can be used in different phases of instruction, e.g. for revising, practising and fixing the knowledge, and as a means of feedback. Novak (1998) distinguishes four ways how the mind maps can be used, i.e. as learning strategies, teaching strategies, means to forming concept and content of single subjects and the instruction as the whole, and a means of collecting information about learner’s understanding of the learning content. He also mentions other ways, e.g. strategies towards acquiring (mastering) new learning content, evaluation etc.

If we really aim at making changes in the educational system, it means that not only objectives, learning content and methods of instruction should be changed but also strong attention should be paid to the feedback process and the means applied within. Innovations in each subject are always connected to searching for, discovering, introducing, piloting and testing new means of evaluation which will enable teachers to penetrate the learner’s understanding of terms and their individual structure of knowledge. The information and communication technologies can be used for this purpose as well, e.g. electronic applications for creating and analyzing the mind maps, which are available on web pages of iMind-Map (2011), brainstorm and mind map online (2011), Edraw Mindmap (2011) etc.

2. Mind-mapping as a research method

The research applying the mind mapping was held at the Faculty of Informatics and Management, University of Hradec Kralove in 2012. The research objective was to monitor how students understand the term of e-learning. The method of mind mapping was not used in the traditional form, i.e. when learners create the mind map themselves, but they were provided the eight-dimensional schema of e-learning designed by Khan (2006, 25) and 17 terms Khan used for the definition of e-learning. Students were to match the terms to the eight dimensions reflecting their individual concept of e-learning, or in case of total disagreement with the concept provided, they drew their own schema. The reason why research participants worked with the pre-prepared map was they were not experienced enough to design the whole map by themselves. The research sample included 104 respondents, the 1st-year students (aged 18 - 20 years) of the Faculty of Informatics and Management who in 2011/12 enrolled in the Applied Informatics and Information Management study programme.

The Khan’s multi-dimensional schema replies to the question what is required for the open, flexible and distributed learning. The schema is presented in two versions which differ in graphic presentation. In the middle of the schema the figure of the human being is presented but Khan does not explain how this symbol should be understood. Thus two basic approaches can be applied:

• e-learning as a learner-oriented process, or
• e-learning as such a way of learning which enables/provides highly individualized approach to learning which is defined by each learner and is reflecting individual learning style preferences and other didactic-psychological characteristics (i.e. requirements-oriented learning).

3. The course of research

Dimensions and their content are identical. Before the research started, the Khan’s schema was explained to the participants. They were provided information on the content of single dimensions (i.e. what terms were included to each dimension by Khan) and how mind maps were created and used. Then, students modified the Khan’s schema and adjusted it to their individual mind concepts by matching 17 terms defined by Khan to the eight dimensions, or removing them from the schema. Each match was described by the appropriate verb. As the final product was of qualitative matter, this approach enabled processing and analyzing the received data by the statistic methods as well. The Khan’s structure of e-learning includes eight dimensions as follows:

1) Pedagogical (P);
2) Technological (T);
3) Interface Design (D);
4) Evaluation (in this research marked as feedback, F);
5) Management (M);
6) Resource Support (R);
7) Ethical (E);
8) Institutional (I).

The course of adjusting (tailoring) the individual mind map to learner’s concept of e-learning followed two steps. 

**Step 1**: Respondents matched 17 terms described below to the eight dimensions:

- analysis of objects, content and media used, analysis of participants (dimenze P);
- organization, methods, strategies used in the environment (T);
- infrastructure design (hardware, software) (D);
- design of e-learning programmed (design of pages, content, navigation, tools for testing) (F);
- management (evaluation of learner’s work during the instruction using the assignments, evaluation of the learning environment (M);
- resource support (learning management, ways of providing and spreading information, online support, maintenance (R);
- social influence, cultural and geographical differences, differences in level of entrance knowledge, differences in accessibility to information, ethical and legal rules (E);
- institutional support in the field of e-learning services for students (I).

If respondents did not agree with matching the term to the dimension, they did not match it. In case of disagreement with including a dimension, they deleted it from the schema. 

**Step 2**: If the Khan’s schema did not reflect learner’s concept of e-learning, they drew a new mind map.

4. The analysis and results interpretation

The collected data were processed by the method of frequency analysis reflecting following criteria:

1. Dimensions used in the respondent’s concept of e-learning.
2. Dimensions not included in the respondent’s concept of e-learning.
3. Levels included in the individual mind map.
4. Defining a new model of the mind map.

4.1. Dimensions used in the respondent’s concept of e-learning.

As defined in step 1, respondents were to match 17 terms to the eight dimensions of the Khan’s concept of e-learning. Results are displayed in figure 1 showing that one third of respondents (33.6 %) did not make any changes in the concept, they used all eight dimensions and matched one term to each dimension at least; 16.3 % respondents worked with seven dimensions; 15.3 % used six dimensions; 14.4 % of respondents matched terms to five dimensions and 17.3 % to four ones; 3 % of respondents used only three out of eight dimensions.
As mentioned above, respondents can match terms to eight dimensions. Results showed that nearly 34 % of them had done it while 66 % of respondents used from three to seven dimensions. Not a student worked with one or two dimensions only. If respondents did not accept any dimension for the concept, they deleted it from the schema; if no term was matched to the dimension, it was accepted as it is. Reasons of such decisions were not analyzed at this phase of research. Results are displayed in figure 2.
The figure shows that the least frequently used dimension, i.e. the one which respondents did not match any term, is the institutional dimension (I) - this result appeared with 39.4 % of respondents. Further on, other rarely used dimensions were the ethical one (E, 30.8 %), resource support (R, 28.8 %), management (M, 22.1 %) and the technological dimension (T, 19.2 %). Remaining three dimensions were the most frequently used ones, i.e. the interface design (D, 2.9 %), pedagogical dimension (P, 6.7 %) and evaluation (F, 16.3 %). Thus the results show that nearly all respondents (97 %) understand e-learning from the point of interface design (D), which relates to the respondents’ study programmed, i.e. Applied Informatics and Information Management. Respondents also consider the pedagogical dimension of e-learning (P, 93.3 %) and its evaluation role (F, 83.7 %), followed by the technological dimension (T, 80.8 %), the dimension of management (M, 77.9 %) and resource support (R, 71.2 %).

One term at least was matched to the ethical dimension (E) by 69.2 % of respondents and the institutional dimension (I) which was used by 60.6 % of respondents. This result reflects the research sample structure (students of IT study programmed) and confirms the above stated conclusions.

The detailed analyses discovered that 17.3 % of respondents did not match terms to the couple of dimensions, i.e. the institutional and ethical one. This couple (I, E) also appeared in combination with other slightly used dimensions, i.e. resource support (R, 6.7 %) and management (M, 3.8 %), evaluation (F, 3.8 %) and technological dimension (T, 2.9 %). Other rarely used dimension was the ethical one (E) in combination with resource support (R, 15.4 %), evaluation (F, 10.6 %), management and evaluation (M, F, 3.8 % each).

Apart from the above mentioned, the institutional dimension (I) was detected in the 26 combinations of 2 - 4 dimensions.

4.3. Levels included in the individual mind map.

If the presented Khan’s schema is considered to be the first level of the mind map, then 92.3 % of respondents added the second level and 6.7 % of respondents designed the three-level model.

4.4. Defining a new model (concept) of the mind map.

Nine respondents (8.6 %) drew their own, totally different model of the mind map. Eight of them first worked with the Khan’s concept and finally they designed their own schema; one respondent rejected the Khan’s concept at the very beginning and designed a completely new one. Similarly to Khan the human body was situated in the center but it was not defined who s/he is, because the teacher or learner were displayed separately. Several from the above provided terms are included in the schema, others were added according to the respondent’s choice (friendship, calming, stressfulness). In the text below the mind map, other two items are mentioned (motivation, responsibility) being related to all dimensions. The center of the circle is called the system. Within the following interview the respondent explained he had considered the whole schema to be a system, not only the body in the center which is not linked to any other dimension or described by other characteristics.

5. Summary and discussions of results

The results of researching the term of e-learning by the method of mind mapping showed that one third of respondents (33.6 %) had not made any changes in the provided Khan’s schema; respondents had matched at least one term to each dimension; the others adjusted the schema and matched terms to 4 - 7 dimensions. The least frequently used dimension was the institutional one (more than one third respondents did not match any term to it), followed by the ethical, resource support, management and technological dimensions which were not used 20-30 % of respondents. This result proves that 97 % of respondents understand e-learning from the point of design interface, pedagogical dimension (93.3 %) and evaluation (83.7 %), followed by management, ethical and institutional dimensions and group of dimensions, e.g. IER, IEM, IEF, IET. This result reflects the structure of the sample group consisting of students of the Applied Informatics and Information Management study programmes who attend the institution where e-learning and ICT-supported instruction have a relatively long tradition and have become
standard. The mind maps were structured in two levels by most respondents, 7% of them designed three-level mind maps. Respondents matched 17 terms to eight dimensions of the Khan’s concept; in general, they used 6-17 terms. One third of respondents (33.6%) matched all 17 terms to the dimensions, using fewer dimensions step-by-step decreased from 12.5% up to 1%. Nine respondents designed their own mind map; eight of them worked with the provided Khan’s schema first.

It is hardly possible to sum up all the collected data to a single and homogenous conclusion. Results mostly express agreement on the Khan’s concept of e-learning, which can be appreciated because this concept is complex, considering e-learning from the whole width of this phenomenon. On the other side, it should be taken into account that the respondents were students of study programmed focusing on Informatics who relate closer to this field from the point of profession and interest and pay more attention to it. For the future, similar research should be held so that to monitor the e-learning concept of students of teachers’ training and other faculties and check whether it is influenced by their future profession, i.e. whether respondents emphasize the pedagogical dimension of e-learning as the Informatics students do with dimensions closely relating to information technology and how the didactic approach is reflected in the e-learning concept.

Acknowledgements

The paper is supported by the GA CR project N. P407/10/0632 Flexible model of the ICT-supported instruction reflecting individual learning styles.

References

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