Multimedia learning material in pedagogical methodology and problem solving strategies

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Abstract: Problem solving is a reasoning process oriented to reach the final state which usually means the solution. To reach the final state certain mental steps are required. More precisely the process of problem solving can be described as the systematic sequence of cognitive steps toward the solution or conclusion. The sequence itself is the strategy. Regarding the kind of the problems or its nature diverse problem solving strategies can be applied. In the present literature the problem solving strategies are described as reasoning strategies. The application of multimedia learning materials and good practices are confirming their benefits. The students using multimedia learning materials achieved better results than students learning from the textbook and/or attended regular lectures. They are also more successful in the application of the reasoning strategies. In the teaching of pedagogical methodology the application of reasoning strategies is important in achieving higher level of understanding and successful implementation of statistical outcomes in the education. The article will present the results of research in assessing the influence of the multimedia learning materials to the application of reasoning strategies.

Keywords: reasoning strategies, problem solving, multimedia learning materials, pedagogical methodology, statistics

Introduction

Facing with the problem is inevitable connected with solution quest. Despite if the problem is simple or complex corresponding mental effort is required to gain the solution. The solution itself is a kind of final state which can be achieved either directly or indirectly following certain patterns. Finding the solution differ on the individuals’ problem perception, level of knowledge, state of mental development and age. For solving many complex or specific problems the most important factor is the level of knowledge and familiarity with the area problem is coming from. Both define the direction or pattern on which the salvation is to be developed in achieved. Problem solving is therefore a series of mental steps in process of finding solution. Steps and patterns are more exactly described as cognitive strategies. Regarding to the cognitive strategies the problem solving process comprehends particular cognitive strategies as analysis, comparison, evaluation, conclusion and interpretation enabling the processing and the application of acquired information. The cognitive strategies in problem solving are described as reasoning strategies. In the area of pedagogical
methodology we have to deal with many specific problems and their solutions. The solution can be achieved by selecting the appropriate strategy. Due to the complexity of the area the advantages of multimedia learning materials was taken into consideration to enable more efficient learning process. Consecutively the learning material for teaching pedagogical methodology was developed and tested for efficiency. Empirical tests confirmed its efficiency as learning material. From the aspect of reasoning strategies the possible influence of multimedia learning materials to the application of particular reasoning strategy was investigated. The results are showing that using of multimedia learning materials can influence the application of reasoning strategies on specific problems in the area of pedagogical methodology.

**Problem solving strategies**

*The problem*

The problem itself can be in form of physical or mental situation which person is trying to find the appropriate solution. The solution can be the certain method or procedure to achieve the final state. The final state is usually the present problem’s solution itself. However the practical problem solution is mostly practical like constructional solution and sometimes mental when theoretical problem is present. Despite of many problem definitions we have to deal with three basic components, the initial and final (desired) state with certain obstacles between them. In many cases the initial goals are not yet defined precisely but they are simultaneously developed during the problem solving process. (Bakračevič Vukman, 2000) However the situation where manners and means of achieving the goal are to be defined may also be considered as the problem itself. Where chosen manners are representing the particular operations enabling to achieve the final state. (Chi & Glaser, 1985) Meeting the certain criteria problems are classified as well-defined and ill-defined. Well-defined problems comprehend precise instructions and defined goals against inaccurate and inexact instructions and goals in ill-defined problems. (Jaušovec & Jaušovec, 2000) Considering the obstacles between initial and final state the problems can be situation based and hindrance based with their own characteristics.
Problem solving
We are facing different theories about the problem solving procedures. Kausler (1991) divides the solving into three segments like preparation phase, production phase and evaluation phase. Where each of the phases can be repeated until problem is solved.

There are also field specific problems with their level dependent solving procedure. Simple or more known as “puzzle problems” requiring less specific knowledge to be solved regarding to more complex problem where extent amount of knowledge is necessary. Like the problems in physics.

The sort of problems everyone is facing on the daily bases are the common or everyday’s problems. Their successful salvation depends on the person’s age. Researchers are discovered greater success in everyday’s problem solving when persons age was between 20 and 78 years. However the other sort of problems was more successfully solved by persons until the mid age. After the mid age the rate of success was decreased. (Cornelius & Caspi, 1987)

The findings were confirmed by later researches where problems were adapted to the persons of specific age. The best achievements were again found by the persons of mid age when by older persons achievements are decreased again. (Denney, 1974)

Problem solving as reasoning process
Problem solving is commonly described as reasoning process oriented to achieve the specific goal where the goal means the problem’s salvation. During the problem solving process the formerly adopted rules, formulas or procedures are often overruled by some new or modified ones. Many experts are defining the problem solving process as the combination of reasoning operations, schemes and structures. (Musek & Pečjak, 2001)

The problem solving process itself is based on the reasoning process revealing the new relations between information delivered by perceptions, representations or conceptions. From the perspective of the problem solving the reasoning process is distinguished into the convergent and divergent form of reasoning. The convergent form of reasoning comprehends the intellectual activity in finding the single solution of the problem based on former experiences and low level of creativity. In the opposite the convergent reasoning comprehends the intellectual activity to find several possible problem solutions including creativity and imagination. (Sriča, 1999)

Regarding the direction and/or sequencing in finding the solution the lateral and vertical reasoning form of reasoning process can be distinguished. Vertical form of reasoning process
comprehends the successive steps toward the solution. The main characteristics of vertical form are the constant and willfully controlled direction in finding the solution without direction changes. To achieve the best possible solution well structured problem is required. The lateral form is less directed and comprehends many direction changes. It is prone to the associational influence. In fact we have to deal with instantaneous idea based decisions. (De Bono, 1992)

All the mentioned convergent and divergent or vertical and lateral forms of reasoning are playing the vital role in developing creativity and capability of innovating and less in problem solving strategies. The cognitive science also puts the problem solving process more toward individual’s creativity not regarding the problem solving strategies. (Isaksen, 1995)

Depending of the sort of problem the individual’s perception is crucial. The problem solving process can be described as systematic sequence of steps toward the solution or conclusion. The chosen sequence in problem solving process is the strategy. More precisely the strategy in reasoning is a systematic sequence of elementary mental steps that an individual follows in making an inference. (Van der Henst, Yang, & Johnson-Laird, 2002)

**Reasoning strategies**

The problem solving comprehends cognitive strategies enabling the processing and the application of acquired information (Phye, 1997). Regarding to the individual’s problem perception and information about the problem itself diverse strategies are applied. In the present literature cognitive strategies in problem solving are described as reasoning strategies. (Gerlič & Udir, 2006)

The reasoning strategies comprehends four particular problem solving strategies or approaches

- analysis
- comparison
- conclusion and interpretation
- evaluation
- combination of strategies

The characteristics of particular strategy are briefly presented in the following topics:

Analysis – breaking down into significant parts and understanding the relations between parts and the whole

Comparison - the recognizing of similarities or differences and their understanding
Conclusion and interpretation – the application of different forms of inductive and deductive reasoning including thinking patterns and solving methods.

Evaluation – decision or judgment making based on defined criteria and proofs

*Combination of strategies* – the special form of strategy not directly corresponding to the theory. It comprehends the simultaneous application of two or more strategies and represents the higher form of strategies application and higher cognitive level

The particular strategy’s detailed characteristics are described in the chapter related to the assessing of strategy application and assessments methods.

**Multimedia learning material and reasoning strategies**

Multimedia learning material is a combination of text, picture, audio and video to achieve maximum efficiency. It is also prepared for the self learning and training purposes.

Multimedia learning materials should sometimes but not always provide the possibility to use them instead of regular lectures in cases of student’s absence.

Researching has shown that studying persons who used the learning materials with the combination of textual and visual interpretation were more effective than those who used only textual interpretation. The reason is in the simultaneous stimulation of many senses and consequently higher brain activity. (Gerlič & Jaušovec, 1989)

Empirical testing of the multimedia learning material for teaching pedagogical methodology confirmed the efficiency of multimedia learning materials. The results have shown that students learning from the multimedia learning material achieved better results than students learning from the textbook and attended regular lectures. (Bratina, 2008) From the aspect of reasoning strategies we assume that the usage of multimedia learning materials may influence the application of particular reasoning strategy.

**Problem solving strategies in pedagogical methodology and multimedia learning materials**

*Problems in pedagogical methodology*

In learning the pedagogical methodology the students have to deal with many problems.

Starting with the determination of the researching problem, data acquisition down to the data processing, interpretations and creating final report. The interpretation of SPSS data processing outcomes requires not only the certain level of knowledge and understanding but also the different patterns of problem solving.
Therefore the contents of pedagogical methodology and statistics are very appropriate to research the applications of different problem solving strategies. To solve the present researching problem the individual has to choose various quantitative data processing methods. Therefore the problem solving process in learning of pedagogical methodology should also comprehend the usage of particular reasoning strategy or the combination.

We assumed that usage of developed multimedia learning material provides better score influencing the application of particular reasoning strategy. Even the preferring of one particular strategy may be influenced by the multimedia learning material. (Duh & Krašna, 2009)

**Assessing the usage of reasoning strategies**

To assess or diagnose in medical term the reasoning strategies many different approaches are used. The indication itself is more often described in medical literature. Therefore the term diagnostic is frequently used instead of assessing. But despite of whether the area is medicine or social sciences the assessment procedures are similar. In the diagnostics reasoning strategies of nurses the researchers prepared different test for two groups of students. As the preparation, the learning materials including video and simulations were used. (Tanner, Padric, Westfall, & Putzier, 1987)

To assess the reasoning strategies in pedagogical methodology the approach was similar. The guidelines were found in performing of the problem specific teaching of physics. (Gerlič & Udir, 2006) However the physics tests stimulating reasoning strategies are not directly applicable in pedagogical methodology. Therefore appropriate modifications were required.

Our approach to assess the usage of reasoning strategies and possible influence of the multimedia learning material is described in the following chapters.

**Methodology**

To assess the reasoning strategies applied in solving the problems of pedagogical methodology and multimedia material influence we performed the pedagogical experiment. The experiment comprehends the pretest to gain the initial level of knowledge and the main test with the sets of methodological and statistical problems from the area of the pedagogical research. There are four sets containing problems regarding to the application of particular strategy. The problems are the combination of real life data and the theoretical knowledge gained during the lessons. The statistical methods presented in tests are the same as presented
during lessons and included in multimedia learning material. In general there are problems of inferential and descriptive statistics. (Čagran, 2004)

The 120 students were divided into two groups where one group of 55 students learned from the traditional textbooks and attended regular lessons. The second group of 65 students used multimedia learning material instead of attending regular lessons. The students of both groups were of different age from 1st and 3rd year of study respectively.

In the subsequent text the term “controlling group” will be used to describe the group of students attended regular lessons. The term “experimental group” will be used to describe the group of students using the multimedia learning material instead of regular lessons.

The results were analyzed by using of descriptive and inferential statistical methods in SPSS.

The multimedia learning material
The multimedia learning material is the combination of sample data, instructional videos (Krašna & Bratina, 2006)(Krašna, 2010), brief textual explanations of the selected methods and printouts preferably in the problem based structure. Printouts we made are in form of Portable Data Format (pdf) files and original SPSS outputs. The multimedia learning material is also accompanied with the printed material for additional, more detailed explanations of presented methods. But using of printed material is not mandatory. The brief description of the multimedia learning material is as follows:

Sample data
Sample data are included in the multimedia learning material and the user can perform their own analysis. If the student get the same results as they are presented in videos and printed outputs he/she is correct in the exercise. This is very important for training, testing and self evaluating of the user himself. Sample data are stored in SPSS and MS Excel formats in order to make analysis possible even for the users without SPSS. User is free to choose the type of the sample data he/she wishes to download.

Videos
The instructional videos included in the multimedia learning material are the real-time screen captures with the teacher spoken explanation of method itself and the way to get the analysis results in SPSS. Video can be paused and/or repeated at any time. The meaning of the videos is also to recall the students’ memorized model of knowledge achieved during the exercises. This is very helpful for the self training purpose enabling student to follow the same steps made by the teacher during the lesson.
Brief textual explanations

Every procedure and method is briefly explained on the base of already present knowledge from previous lessons and exercises and from accompanying textual material. Explanation is instantly displayed after choosing the method from the menu. The meaning of the explanations is to get the quick recall and to understand the basics of the following statistical procedure.

Printouts

Printouts can be chosen from the buttons for the appropriate version. There are two version of the same printout for every method in SPSS version and portable data format (pdf) version for the users without SPSS installed. It is well known that many persons have problems reading large amount of text from the computer screen. Those persons also feel reading of printed versions much more comfortable and easier to study. All the printouts are already formatted for best printing results.

Menus

Initial menus are divided into groups where any of groups have subgroups with their own submenus. Main menus consist from menu for statistical methods, entering data, transforming data and sample data files menu. The menus are sequenced by following the learning steps made during the learning process This enables the student to get the full overview of the past learning process. He/she can also understand the growing complexity of statistical methods from the simplest to more complex ones, where some of them are the combination of them.

The assessments

The original research comprehends two sets of problems regarding the particular strategy and the achievements in total were evaluated. In the following chapters the particular problems of each strategy and their characteristics will be described emphasizing the strategy assessing. After each problem presented the results in total of the entire set of particular strategy will be presented.

Assessing the analysis strategy

The analysis strategy is the mental process of breaking down the whole into significant parts and understanding the internal relations between parts and correlations between parts and the whole. (Gerlič & Udir, 2006) In the pedagogical methodology the analysis strategy is often used in preparing the interpretations of the outcomes of some complex statistical analysis. The
statistical method of testing the significance of the difference between two groups of populations is the t-test. The outcome from the SPSS software delivers the amount of values. The identification of the significant values, understanding the relations and influence between them is essential prior to provide the correct interpretation.

To assess the analysis strategy the question presenting the outcomes of the SPSS statistical analysis by the t-test method () is presented to the students. The students have to indentify the values in both tables of the t-test outcome which are required to be written down into the table. Afterwards the interpretation of the outcome has to be written.

**Fig. 1 : Assessment the analysis strategy**

Only certain values from the amount of all outcome values are required to fill the specified cells in the table. The amount of outcome values is representing the whole, as necessary values are down broken significant parts. To provide the correct interpretation the attention to some certain values is necessary. First the homogeneity of variances has to be considered, next the level of the statistical significance of the t-test value and as third the difference between the average values is to evaluate. According to the equality of variances and to the level of the statistical significance of t-test value, the meaning of the difference between the both average values is assumed in the interpretation text. Writing the interpretation expresses the understanding of the relations between parts and the whole.
The results of the analysis are showing that differences in achieved results in total between the controlling and experimental group of students is statistically significant (F=8,115, P=0,005). The students belonging the experimental group achieved higher average results as those belonging the controlling group ($\bar{x}_{EG}=3,336$, $\bar{x}_{CG}=2,269$). Analyzing the achievements between the students of different ages indicates no statistically significant difference (F=0,443, P=0,507). The age did not influence the achievements. No interaction was discovered between the age and learning material form. The students using the multimedia learning material were more successful in solving problems regarding analysis strategy.

Assessing the comparison strategy
The comparison strategy comprehends the recognizing of similarities or differences and their understanding. In statistics the average measures can be expressed in three different ways as Mean, Mode and Median. The relation between their values expresses the shape of the distribution which can be symmetric or asymmetric either to the left or to the right.

Recognizing the difference between the average measures, understanding their relations and the impact of each value, allows the student to indentify the shape of the distribution. The example of the question covering the mentioned requirements is shown in the Fig. 2.

![Fig. 2: Assessing the comparison strategy](image)

The correct answer is marked by the letter B since the Mode value of 68kg is greater than the Median value of 60kg. Both values are greater than the average (Mean) of 54kg. Mode and Median are responsible in shifting the distribution to the right where the longer “tail” remains on the left. The key is obviously in the impact of the Mode and Median values (Sagadin, 2003). The correct answer may assess the application of comparison strategy as the differences between three values must be recognized and their impact to the shape of distribution should be understood.

The difference in the achieved results in total between the controlling and experimental group of students is statistically significant (F=5,129, P=0,025). The students belonging the
experimental group achieved higher average results as the students belonging the controlling group (\(\bar{x}_{EG} = 2,700\), \(\bar{x}_{CG} = 1,892\)). Analyzing the achievements between the students of different ages indicates no statistically significant difference (\(F=0,026, P=0,872\)). The age did not influence the achievements. No interaction was discovered between the age and learning material form. The students using the multimedia learning material were more successful in solving problems regarding comparison strategy.

Assessing the conclusion and interpretation strategy

Traditionally the conclusion is the result of the deductive inference from the general (principles, theories) down to the particular. In the modern logic the logical conclusion inevitably comes out from the premises. (Kompare, Stražišar, Jaušovec, Vec, & Dogša, 2005)

In our case the overview and understanding of the meaning of partial values brings the student to the conclusion about the presented problem. The students have to collect the information from the outcomes of the SPSS statistical analysis and provide the conclusion based on the some essential values. They also have to transfer the conclusion into the real life situation what covers the interpretational part of the strategy. The Fig. 3 shows the example of the question for assessing the application of the conclusion and interpretation strategy.

![Fig. 3: Assessing the conclusion and interpretation strategy](image)
The solution is pretty complex. The first information students have to acquire the value of the statistical significance level which is to be found at the end of the first row in Chi-Square Tests table. Both tables are providing a considerable amount of information but choosing the only right one is the combination of knowledge and reasoning. The knowledge is expressed by the understanding of the text beneath the table marked by the superscript a. The reasoning is assessed in section b where the meaning of the all relevant information in both tables including first one has to be explained and concluded. To emphasize the conclusion next in section c the interpretation in form of “advice to the teacher” should be provided. Expected is the interpretation in form like the pupils of higher grades are feeling significantly more comfortable than those with the lower grade. And the teacher should devote more attention to the pupils with the lower grade to make them feel more comfortable.

The results of the analysis are showing that differences in achieved results in total between the controlling and experimental group of students is statistically significant (F=11,215, P=0,001). The students belonging the experimental group achieved higher average results as those belonging the controlling group ($\bar{x}_{EG} = 4,169$, $\bar{x}_{CG} = 2,866$). Analyzing the achievements between the students of different ages indicates no statistically significant difference (F=0,858, P=0,356). The age did not influence the achievements. No interaction was discovered between the age and learning material form. The students using the multimedia learning material were more successful in solving problems regarding conclusion and interpretation strategy.

Assessing the evaluation strategy

The evaluation strategy is commonly applied in the combination with the other strategies, especially when analyzing or comparison is required. (Gerlič & Udir, 2006) When evaluating many proofs and criteria have to be considered. In our example not only the criteria is important but analyzing and comparison are required too. From the table of the outcomes of the teaching methods efficiency analysis, the students have to evaluate which teaching method is the most successful one. The written argumentation is also required. Many values of the particular teaching method in the table are very similar, some also the same. In most cases the best value or values in the one or more columns of the particular teaching method not necessarily means its best efficiency. The most efficient teaching method can only be discovered by the careful selection of the criteria, comparison of the criteria and understanding the relations between. The criteria are the outcomes of descriptive statistics
analysis where different values have the different impact to the final decision. The question for assessing the evaluation strategy application is shown on Fig. 4.

Teachers were discovering which teaching method is more efficient. After the implementation of particular method, pupils were tested solving the different problems. Maximum grade for each solution was 50 points. The statistical analysis returned the following outcomes.

<table>
<thead>
<tr>
<th>Teaching method</th>
<th>Min</th>
<th>Max</th>
<th>Mode</th>
<th>Mean</th>
<th>Std. dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working with the textbook</td>
<td>10</td>
<td>50</td>
<td>30</td>
<td>27.500</td>
<td>12.9368</td>
</tr>
<tr>
<td>Seminars works</td>
<td>10</td>
<td>40</td>
<td>30</td>
<td>31.800</td>
<td>8.6262</td>
</tr>
<tr>
<td>Project work</td>
<td>10</td>
<td>50</td>
<td>35</td>
<td>32.500</td>
<td>12.8800</td>
</tr>
<tr>
<td>Self learning</td>
<td>10</td>
<td>30</td>
<td>30</td>
<td>36.000</td>
<td>4.7020</td>
</tr>
<tr>
<td>Playing roles</td>
<td>10</td>
<td>35</td>
<td>30</td>
<td>26.750</td>
<td>7.2300</td>
</tr>
<tr>
<td>Laboratory work</td>
<td>10</td>
<td>50</td>
<td>40</td>
<td>36.300</td>
<td>7.7300</td>
</tr>
<tr>
<td>Method of short lessons</td>
<td>10</td>
<td>50</td>
<td>35</td>
<td>35.450</td>
<td>7.5360</td>
</tr>
<tr>
<td>Reporting</td>
<td>10</td>
<td>30</td>
<td>25</td>
<td>26.350</td>
<td>4.5590</td>
</tr>
</tbody>
</table>

Fig. 4: Assessing the evaluation strategy

The most efficient teaching method can be discovered by the finding of the highest values considering the relation between the Mean (average) and Mode. The highest Mean value do not always mean the best outcome without regarding the Mode value. In the present example most efficient teaching method is the Laboratory work method regardless to the higher Mean value of the Method of short lessons. We have to consider the Laboratory work teaching method’s Mode value of 40 representing the score of 40 points. So the 40 points were more often scored in the Laboratory work teaching method as in the Method of short lessons. Consequently the Laboratory work teaching method is the most efficient teaching method.

The difference in the achieved results in total between the controlling and experimental group of students is statistically significant (F=4.756, P=0.031). The students belonging the experimental group achieved higher average results as the students belonging the controlling group ($\bar{x}_{EG}=3.418$, $\bar{x}_{CG}=2.784$). Analyzing the achievements between the students of different ages indicates statistically significant difference (F=7.809, P=0.006). The age influences the achievements where older students achieved higher average results. No interaction was discovered between the age and learning material form.

Only the older students using the multimedia learning material were more successful in solving problems regarding evaluation strategy. The reason may be in the higher level of experience against the younger students. The problems involved are requiring certain level of pedagogical experience which can only be gained thru the direct involvement in the
pedagogical process. Due to the study program the direct involvement is not possible earlier than in the 2\textsuperscript{nd} year of study and later.

**Assessing the combination strategy**

In the present theory the combination strategy is not defined. Based on many years of pedagogical experiences we found necessary to implement this form strategy. There are many sorts of problems at the area of pedagogical methodology where simultaneous application of two or more strategies and even experiences is required. In preparation process of the problems regarding particular strategy we found out that final solution depends on simultaneous application of at least two strategies. Regarding the simultaneous application of strategies the combination strategy may be classified as mental process at the higher cognitive level. The simultaneous processes of analysis, application and evaluation are present at this cognitive level. (Gerlič, 2006) Due to the complexity of individuals’ cognitive operations the combination strategy belongs to the area of metacognition. Metacognition refers to higher order thinking which involves active control over the cognitive processes engaged in learning process. (Livingston, 2003)

In the present example the students have to correct the table by filling the cells with the missing descriptions and values. After completing of the table the answer based on the data from the table should be written. The answer cannot be correct or reasonable if the table is not completed correctly.

<table>
<thead>
<tr>
<th>Answers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>By myself</td>
<td>66.1</td>
</tr>
<tr>
<td>With some help from parents/teachers</td>
<td>26</td>
</tr>
<tr>
<td>Exchanged with colleagues</td>
<td>1</td>
</tr>
<tr>
<td>Partially by myself and partially exchanged with colleagues</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>116</td>
</tr>
</tbody>
</table>

**Fig. 5:** Assessing the combination strategy
To solve the problem at least two strategies have to be applied. To fill the correct column labels the meaning of the data in particular column must be recognized and understand. First empty column represents frequencies and should be labeled with the letter $f$. In the second column the percentages are represented therefore the label should be %. Now the missing values must be calculated in written into the empty cell and the label “Total” in the last row has to be added.

After completing the answer to the question or more exactly the interpretation of the results is obvious. The teacher can be pretty satisfied as more than two third (68.1%) of pupils done their homework by themselves. Still there are about a quarter (22.4%) of them who needed some help. Consequently some additional explanations should be necessary in the future.

There are no statistically significant difference between the controlling and experimental group of students in achieved results in total ($F=0.004, P=0.935$). The students belonging the experimental group achieved similar average results as those belonging the controlling group ($\bar{x}_{EG}=1.709$, $\bar{x}_{CG}=1.676$). Analyzing the achievements between the students of different ages indicates no statistically significant difference ($F=0.556$, $P=0.457$). The age did not influence the achievements. No interaction was discovered between the age and learning material form.

The students’ ob both groups were equally successful in solving problems regarding conclusion and combination strategy irrespective to the form of learning materials.

**Conclusion**

The reasoning strategies as problem solving strategies are divided into four particular strategies. Every particular strategy cannot be considered as a standalone strategy. To successful solving of any problem the particulars strategies are applied simultaneously. In solving of the one sort or form of problems some particular strategy is more applied in higher level than the other ones. The situation changes in solving of another sort or form of problems. The pedagogical methodology covers the area of the various research methods, data acquisition and the statistics. Each area comprehends particular problems which cannot be considered as standalone problems in the area of the pedagogical methodology. Regarding the variety of problems the application of the reasoning strategies is obvious. To support the better understanding and reaching the higher level of knowledge the multimedia learning material was produced. Empirical testing confirmed the efficiency of multimedia learning material. The assumption was made that the usage multimedia learning material has the influence to the application of the particular reasoning strategy. The testing was performed to
assess the applied problem solving strategies. To assess the influence of the multimedia learning material two groups of students were tested. The users of multimedia learning material were grouped into the experimental group and the users attended regular lessons were grouped into the controlling group.

The application of all particular reasoning strategies was successfully assessed. The results are showing that multimedia learning material influence the application of the reasoning strategies. The analysis strategy in solving the problem was more successfully applied by the students using the multimedia learning material. Statistically significant difference in average achievements between the groups was discovered.

The comparison strategy was more successfully applied by the students of the experimental group. The average achievement of the experimental group was higher and the difference between the groups was statistically significant.

In solving problems using conclusion and interpretation strategy students using the multimedia learning material were more successful. The difference in average achievement between the both groups was statistically significant.

Assessing the application of evaluation strategy indicates better achievements only by the population of 3rd year of study which have used multimedia learning material. The difference in average achievements between the both groups was statistically significant. Statistically significant were also the average differences between the students of different ages in favor to older students. The reason may be in the higher level of experience since the problems are requiring certain level of pedagogical experience.

The combination strategy was equally successful applied by the students of both groups. The average achievement of were similar and the difference between the groups was not statistically significant.

The results are showing that multimedia learning materials have certain role in stimulating the more successful application of reasoning strategies. It has to be emphasized that presented problems are only the fragments of the entire assessment problems but the results presented are from the whole. The purpose of this article was to present new approach in assessing the reasoning strategies from the area of the pedagogical methodology.

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