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A COMPARATIVE STUDY OF LEARNING STRATEGIES USED BY ROMANIAN AND HUNGARIAN PREUNIVERSITY STUDENTS IN SCIENCE LEARNING

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Abstract: Development of pupils' deep learning approach is an important goal of education nowadays, considering that a deep learning approach is mediating conceptual understanding and transfer. Different performance at PISA tests of Romanian and Hungarian pupils cause us to commence a study for the analysis of learning approaches employed by these pupils. Analysis of empirical data did not reveal any significant difference in learning strategies of the two groups. Interpretation of z tests analysis of empirical data revealed a larger variance in learning approaches of Romanian pupils comparing to Hungarian pupils.

Key words: high school pupils' learning, surface learning approach, deep learning approach, strategic learning approach, Science learning

1. Introduction

1.1 Framework for Teaching Science in Romania and Hungary

In all European countries Science is taught as a generic subject in primary schools. Many countries maintain the same policy for teaching Science even in the first two years of secondary school, and only in the final years are Biology, Chemistry and Physics taught as separate subjects.

In Romania the Science subjects (Biology, Physics, and Chemistry) are taught in the regime of 2h / week, from Vth to VIIth grade for Biology, from VIth to VIIIth grade for Physics and from VIIth to VIIIth grade for Chemistry. Regarding the number of Science hours taught in class at High School level, a larger number of classes of Science subjects are taught to pupils enrolled for a Natural Sciences specialization than to those enrolled for Human sciences specialization. Teachers select the textbooks used in their teaching from a list of textbooks approved by the Ministry of Education. The competencies which are expected to be acquired by pupils are related to the ability to use inquiry as sciences' fundamental approach, to communicate by using scientific language, to use algorithms, to transfer and integrate working methods and knowledge into new contexts.

In Hungary Science is taught as a general subject during Vth–VIth grade (2h / week). Starting with seventh grade, Biology, Physics and Chemistry are taught as separate subjects (1.5h / week each, in VIIth–VIIIth grades). At High School level, minimum 1.5h / week of Physics and Biology respectively 1h / week Chemistry is mandatory for all kinds of sections; however, the number of classes and the difficulty level might vary depending on the type of High School and the profile of studies. During Science classes pupils use materials (textbooks, practice notebooks, exercise books) selected by teachers from a list of materials recommended by Ministry of Education and Research. The philosophy of teaching Science in Hungary is that at the end of teaching units, students should be able to understand the purpose and importance of phenomena in science and technology. Students should be able to apply methods and algorithms, to formulate hypotheses, to think and create an experimental setup, to observe the occurrence of phenomena, to record the experimental data and to analyse the results of experimental data (Revákné Markóczi, 2011).

1.2. Approaches to learning

Rote memorising is a well-known issue in education. The aim of teaching personnel is not to instruct, but to facilitate the development of pupils for having the capacity to learn (Coombs, 1971; Kiss, 1973)

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and to use self-regulating and metacognitive strategies (Schraw, 2001:3). Skinner (1973, p.107) suggested long ago that teachers should create conditions for pupils to be able to solve problems and to be able to take decisions in an independent way. A possible solution for the poor performance of the students could be the creation of appropriate conditions for pupils to approach deep learning. Deep learning represents "a complex personal development process involving the change of perceptions, learning habits and epistemological beliefs" (Wingate, 2007, apud Donnison & Penn-Edwards, 2012: 11). Pupils who adopt a deep learning approach aim to understand the concepts which must be learned. The learning goals of these pupils are aligned with their interests and hence, they are motivated to learn. Activities involving inquiry and argumentation processes facilitate understanding of causality of phenomena. It has been noticed that pupils who employ an active learning approach are able to remark the relationship between the contents presented in different lessons, subjects and life experience (Lublin, 2003). Some pupils who employ an active learning approach are organising data by structuring it in a logic way (the serialist style) while other pupils are interested from beginning to have an overview through making connections between concepts, by using images, diagrams and examples (holistic style) (Pask, 1976). By contrast, a surface approach to learning involves rote memorising of details and reproduction of exact content in a short time. The aim of pupils employing a surface approach to learning is to solve the assessment tasks (Kozéki, & Entwistle, 1986; Lublin, 2003; Donnison & Penn-Edwards, 2012). Pupils who adopt this learning strategy are not able to remark the relationships between concepts presented; the information they acquire is fragmented. Pupils who adopt a surface approach to learning have an extrinsic motivation; their intentions are only to memorise the information (Entwistle, 2012:77).

Historically, the concepts of deep and surface approach to learning were first introduced in 1976 by Marton and Saljo, as a result of empirical studies. Further the research in this area was extended (Entwistle & McCune, 2013; Entwistle & Ramsden, 1981; Biggs, 2012; Ramsden, 1992; Entwistle, 2012). Hence, Entwistle (2012:77) identified a third approach to learning named strategic approach. The strategic approach concerns the organisation and the control of learning events in such a manner to influence the quality of learning. The pupil who adopts this type of learning is acting strategically: is analysing the task and is choosing the type of learning to be approached (deep learning or surface learning) necessary in order to solve the task. For this reason the pupil is organised in his / her approach to learning, is monitoring and regulating the time used for the task to be solved, his / her efficiency and motivation for achievement (McCune & Entwistle, 2000 apud Donnison & Penn-Edwards, 2012:12).

2. Purpose and Research Questions

2.1 Aim of Study

Results of Hungarian and Romanian pupils at Science tests at PISA 2012 were below the OECD average value, with the results of Hungarian pupils being closer as value to the OECD average value and superior to the results of the Romanian pupils (OECD, 2014a: 5). It has been shown that the results of Romanian pupils are "steadily changing", exhibiting positive annualised changes. The results of Hungarian pupils showed no significant annualised changes. Hence, it was considered that an investigation of strategy of learning science at High school pupils from Romania and Hungary might provide information regarding the possible reasons for such differences in PISA results of Romanian and Hungarian pupils.

2.2. Research Questions and Hypotheses

Our research was based on three questions:

1. To what extent are the learning strategies employed in learning Science by Romanian and Hungarian School pupils different?
2. To what extent are the learning strategies employed in learning Science by Hungarian pupils different within the group?
3. To what extent are the learning strategies employed in learning Science by Romanian pupils different within the group?

The submitted hypotheses have specified the existence of some differences between: the learning strategies employed in learning Science by Romanian and Hungarian School pupils (1st question); the learning strategies employed in learning Science by Hungarian pupils (research question 2) respectively by Romanian pupils (research question 3).

3. Methods and Design of Study

3.1 Participants

It was envisaged that subjects would be from Romania (from schools where teaching was undertaken in Hungarian) and Hungary, from secondary schools and high schools and different geographical area.

In Table 1 are presented the demographic information of the subjects of this study. From the data analysis, it is observed that the pupils chosen for this study have similar characteristics in both countries. The majority of the subjects live in the city and the schools they are attending are located in the city. 60.57% of the pupils are studying at high school level. 57.4% of the participants are in Mathematics − Informatics specialized classes, 30.9% in Natural Sciences specialized classes and the rest of 11.7% in classes of Humanistic studies, Economy, Technology specialization.

Table 1. Subjects' Demographic and Study Information

Aspects	Hungary	Romania
Subjects	32 (100%)	72 (100%)
Gender	Male: 13 (40.62%)	Male: 30 (41.7%)
	Female: 19 (59.37%)	Female: 42 (58.33%)
Place of living	Village: 4 (12.5%)	Village: 25 (34.72)
	Town / City: 28 (87.5%)	Town / City: 48 (66.66%)
Place of studying	Town: 32 (100%)	Town: 72 (100%)
School Type	Secondary School: 3 (9.37%)	Secondary School: 1 (1.38)
	High School: 27 (84.37%)	High School: 60 (83.33%)
	Vocational School: 1 (3.12%)	Economical High School: 6 (8.33%)
	No answer provided: 1 (3.12%)	Vocational School: 5 (6.94%)
Grade	Grade 6-8: 4 (12.5%)	Grade 6-8: 4 (5.55%)
	Grade 9-10: 13 (40.62%)	Grade 9-10: 15 (20.83%)
	Grade 11-12: 12 (37.5%)	Grade 11-12: 48 (66.66%)
	Grade 13: 3 (9.37%)	-
Teaching Language	Hungarian: 31 (96.87%)	Hungarian: 72 (100%)
	Hungarian and German: 1 (3.12%)	-
Specialization	Mathematics–Informatics: 12 (37.5%)	Mathematics–Informatics: 26 (37.5%)
	Natural sciences: 7 (21.87%)	Natural sciences: 20 (27.77%)
	General curriculum: 2 (21.87%)	Vocational Specializations: 6 (8.33)
	Bilingual / English: 2 (6.25%)	Natural sciences, bilingual: 1 (1.38%)
	Arts & Sports: 2 (6.25%)	Economy: 1 (1.38)
	Other: 2 (6.25%)	Other: -
	No answer: 5 (15.62%)	No answer: 4 (5.55%)

3.2 Materials and Procedures

The instrument used for testing the learning strategy was adapted from the Likert-type instrument of Christensen (Dahms, 2005). The organisation of items was as follows: items regarding demographic information (5 items), items regarding study information (3 items), and items regarding the learning strategy (20 items, 10 items related to Deep Learning Approach and 10 items related to Surface Learning Approach). Testing was conducted with the help of science teachers from the two countries.

For research purposes, the average scores per participant and per item were calculated. The analysis of the average scores for each participant was made for items related to Deep and Surface Learning Approach.

Quantitative data was analysed using descriptive statistics, including mean, standard deviation, frequencies and percentages, skewness and kurtosis to determine trends in the data and its pattern of distribution. Also, Shapiro–Wilk test was used to check for the normality. A Z-test analyses of data was performed with Microsoft Excel.

4. Results and Discussion

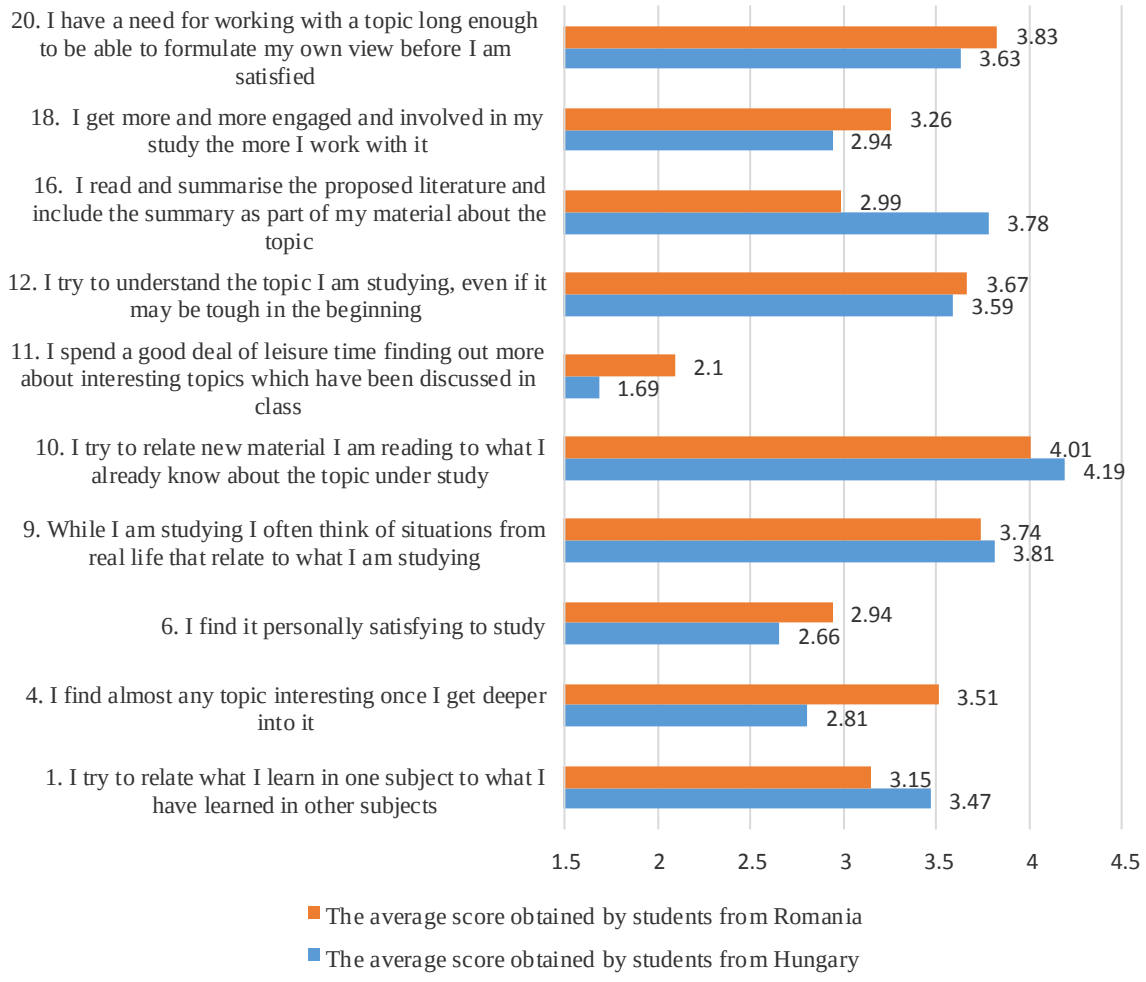
For Shapiro–Wilk tests the p-value is greater than 0.05 so we would accept the null hypothesis.

4.1. Intergroup analysis

Results of Z-test analysis have shown that among the population studied (N=104), there was not a statistically significant difference between the learning strategies used by the two groups: pupils from Hungary (N=32, m=3.28, SD=0.19) and pupils from Romania (N=72, m=3.20, SD=0.35): $z=1.26 < z_{crit}=1.96$, $p=0.21>0.05$).

Average scores obtained by the two groups of participants with regard to Deep Learning Approach and Surface Learning Approach are presented in Figure 1 and Figure 2.

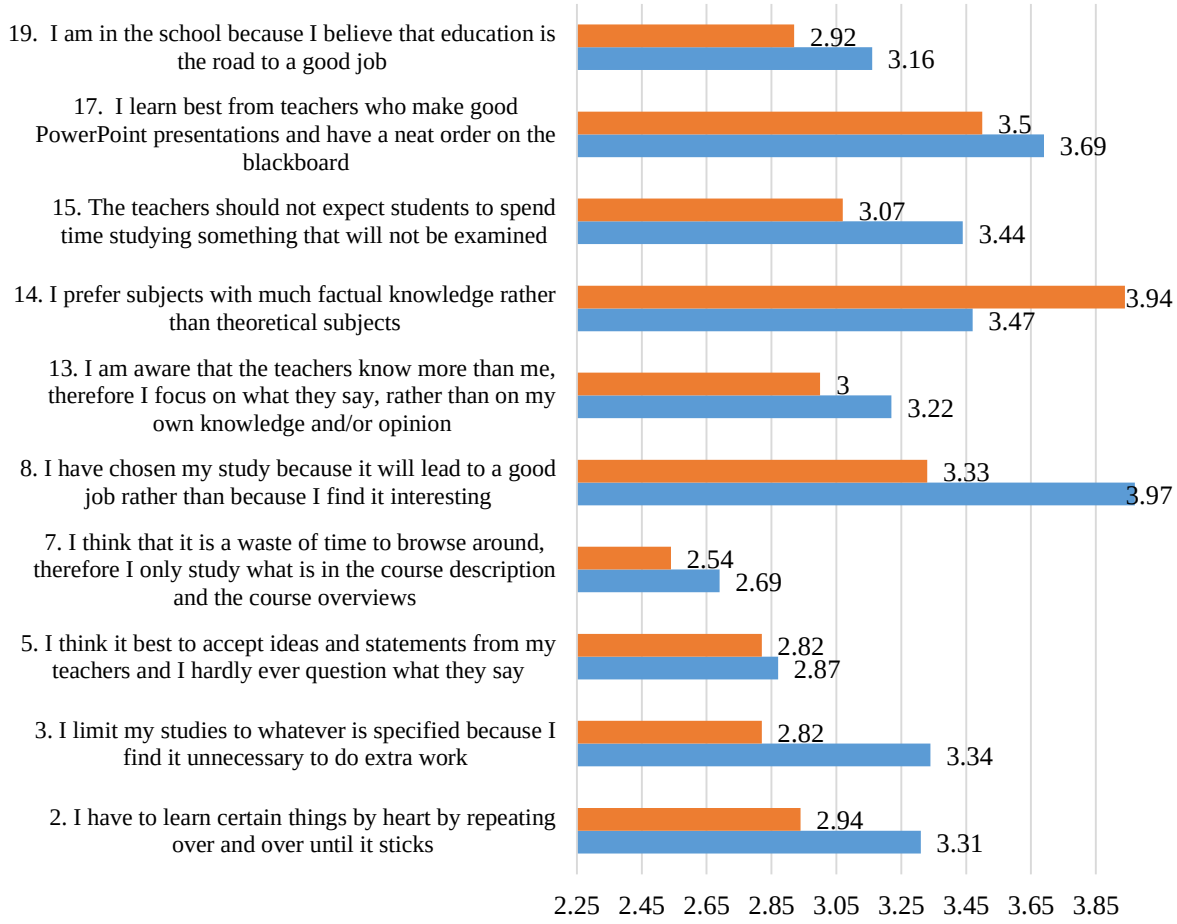
Figure 1. Average scores for items related to Deep Learning Approach



The analysis of the average scores obtained by the two groups of students for the items related to Deep Leaning Approach have shown that, for half of these items, the average score exceeds 3.5 (and only for one item, the average scores of the two groups are higher than 4).

The Z-test analysis have shown that, in case of Deep Learning Approach, there is a statistically significant difference between average scores obtained by Romanian and Hungarian students ($z=0.48 < z_{crit}=1.96$, $p=0.628 > 0.05$).

Figure 2. Average score for items related to Surface Learning Approach



The analysis of Figure 2 shows that, for the majority of items, the average scores obtained by Hungarian students are higher than those of their colleagues from Romania.

In case of Surface Learning Approach, there is a statistically significant difference between average scores obtained by Romanian and Hungarian students ($z=-2.06 > z_{crit}=1.96$, $p=0.39>0.05$).

4.2. Intragroups analysis

A Z-test analysis of the results obtained by the subjects from Hungary (N=32) revealed that there was not a statistically significant difference between the results (m=3.26, SD=0.62) concerning the Deep Learning Approach and the results (m=3.31, SD=0.52) referring to Surface Learning Approach ($z=-0,415 < z_{crit}=1.96$, $p=0.68>0.05$).

In the case of Romanian subjects (N=72), the null hypothesis is rejected. The Z-test analysis has shown that there was a significant difference between the results (m=3.32, SD=0.65) concerning the Deep Learning Approach and the results (m=3.09, SD=0.51) referring to the Surface Learning Approach ($z=2.38 > z_{crit}=1.96$, $p=0.017<0.05$).

It could be concluded that, although no difference in the learning strategies employed by Romanian and Hungarian pupils was found, a larger variance in learning approaches of Romanian pupils (Deep Learning 0.42 / Surface Learning 0.26) comparing to Hungarian pupils was observed.

4.3. Discussion

Following this analysis of the means of Romanian and Hungarian groups for the items which were related to the deep learning, the following observations can be made:

1) Item **11 [**"I spend a good deal of leisure time finding out more about interesting topics which have been discussed in class"] has the lowest mean for deep learning ($m_{HU}=1.69$; $m_{RO}=2.1$). The fact that both Romanian and Hungarian pupils are not willing to invest time for thorough study and broaden of the knowledge acquired in the classroom, is no new information for teaching practitioners.

2) Item **10 [**"I try to relate new material I am reading to what I already know about the topic under study"] has the highest mean for depth learning ($m_{HU}=4.19$; $m_{RO}=4.01$). These high averages suggest that both Romanian and Hungarian students are aware of the importance of knowledge integration.

3) The highest difference between the means of both groups is at item **16** which refers to processing of the new lesson content through summarizing or extracting the important ideas from textbooks ($m_{HU}=3.78$; $m_{RO}=2.99$). The lower average obtained by the Romanian group of pupils could be explained by the fact that, usually, most science teachers do not encourage pupils to self-study during class time.

4) The lowest difference between the means of both groups have items **9** ($m_{HU}=3.81$; $m_{RO}=3.74$) and **12** ($m_{HU}=3.59$; $m_{RO}=3.74$). (Item **9**: "While I am studying I often think of situations from real life that relate to what I am studying" and Item **11**: "I try to understand the topic I am studying, even if it may be tough in the beginning").

Referring to item **9**, it is worth mentioning that both Romanian and Hungarian teachers are being trained to ask the students to relate their new knowledge to the previously acquired knowledge and to their life experiences (Ciascai, 2001; Ciascai & Marchis-Zsoldos, 2015; Ciascai, Haiduc & Felezeu, 2014; Fătu, 2008; Marinescu, 2010; Marchis, 2012). Furthermore, many of the textbooks facilitate the inductive approach (OECD, 2014b). Regarding the scores obtained for item **12**, these reveal that students from both countries find Science subjects to be difficult and most tasks to be carried out seem difficult to them in the beginning.

Following the analysis of the means of Romanian and Hungarian groups for the surface learning, it could be concluded that:

1) The highest level of agreement is obtained in the case of item **8** (Item **8**: "I have chosen my study because it will lead to a good job rather than because I find it interesting") in the case of the Hungarian students ($m_{HU} = 3.97$; $m_{RO}=3.33$) and in the case of item **14** (Item **14**: "I prefer subjects with much factual knowledge rather than theoretical subjects") in the case of the Romanian students ($m_{HU}=3.47$; $m_{RO}=3.94$).

2) The lowest agreement level is obtained in the case of item **7** ($m_{HU}=2.69$; $m_{RO}=2.54$) (Item **7**: "I think that is a waste of time to browse around, therefore I only study what is in the course description and the course overviews").

3) The largest difference between the mean values is obtained in the case of item **14** and the smallest difference in the case of item **5** (Item **5**: "I think is best to accept ideas and statements from my teachers and I hardly ever question what they say") (m_{HU} = 2.87; $m._{RO}$=2.82).

5. Conclusions

The reason for the observed larger variance in learning approaches of Romanian pupils comparing to Hungarian pupils could not be stated at the end of this study. If there is a direct relationship between the learning strategies employed by Romanian and Hungarian pupils and the results at PISA or other national or international competence assessment, this could be clarified after additional, comprehensive studies.

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