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The Students' and Lecturers' Viewpoint about Efficiency of Mathematics Teaching Style

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Abstract: The technological and industrial advances in any country depend primarily on the interactive academic developments. Indeed the basis for technology has been constructed by science such as mathematics as a top priority. In the present study, along with inspecting five distinctive educational psychology theories, various teaching styles of mathematics were scrutinized. For this purpose, a special questionnaire was developed in which every question includes one of fundamental characteristics of these theories. The participants in this survey were ninety B. Sc. students of mathematical sciences in University of Zabol. According to the statistical analyses, the heuristic problem-solving teaching and speech-based styles were the most interesting and least attractive methods respectively for the survey participant while the speech-based style is the most prevalent teaching style for them.

Keywords: Educational psychology theories, Friedman nonparametric tests, Kolmogorov-Smirnov test, Chi-square test, Kruskal-Wallis test

Introduction

A periodic review of teaching methods is commonplace. The crucial problem in this field is when and how these changes should be made. Although the answer to this question is a separate issue, it seems that conducting international standard tests and the comparison of the statistical results with global measures can be very supportive about the necessity or the need for such changes. In the 1999 TIMSS test performed for the eighth grade students in Singapore, 94% of Singaporean students taking the test scored above the global average. These scores were 82%, 83%, and 80% for students in South Korea, Japan and Hong Kong respectively. While, the levels of the balance were 48%, 45% and 36% for the United Kingdom, the United States and Spain respectively. According to the report, the TIMSS balance of the students in the Islamic Republic of Iran at the same educational grade was less than 25% (Mullis et al., 2000). This international standard test shows a significant difference in student's educational level. In the more recently timeframe, according to the data for 2011, the Islamic Republic of Iran rate equals to 25% similar to students' results in Qatar, Bahrain, Jordan and Palestine. While South Korea, Singapore, Hong Kong and Japan had the highest levels. The necessity of the review in the educational methods can be clarified by considering these facts. It is necessary to adopt a teaching methodology that meets both the sociological and academic community requirements.

The main learning theories can be divided into six general philosophies, each of which naturally has its own perspective on teaching mathematics. First of all, the theoretical foundations of some of these philosophies were reviewed. Then, the thoughts of the founders of these philosophies are discussed. Eight different methods will be introduced based on these philosophies.

The first method of teaching mathematics is the practice-oriented approach. This method is influenced by the philosophy of behaviorism or functionalism. One of the founders of this philosophy is Thorndike. From Thorndike viewpoint, a class is arranged with clear and predetermined goals (Schultz, 2014). Learning at Thorndike's philosophy goes from simple to complex issues. The student is encouraged if the answer is correct and the wrong answer should be corrected quickly to prevent it from being repeated. Thorndike followers prefer individual and private tutoring over lecture-style education (Sha'bani, 2008). The most important features of this teaching style are the pointless memorization of concepts and algorithms, dividing all the exercises into a series of smaller steps, and finally solving a large number of exercises and homework. Thorndike believes that practice is a "PREREQUISITE" of learning should be done by students' satisfaction and happiness.

In this philosophy, we must inevitably refer to Skinner's theories. In Skinner viewpoint, natural responses are important. But if this does not lead to the appropriate solution, the teacher should provide the required conditions in order to reaching the solution. Skinner designs a separate curriculum for each student, according to his abilities and disabilities. Overwhelming encouragement has a thriving role, but there is no punishment. There isn't no place for lectures at this philosophy.

In moderation behaviorism philosophy, it has been accepted that students have different levels of learning skills. Students with different levels of learning must therefore trained in different ways. This style of teaching is called talent-improvement interaction (Romberg, 1993). Modern schools should assign different teaching styles to different student groups with different talent levels.

Gestalt's theory emphasizes on meaningful contents and understanding of concepts. Understanding the question is the first comprehensive task. In this theory, the components should be linked to the whole so as to be meaningful to the learner. Solving the problem is significant for solver as a good meal for a hungry person. Teacher helps students to understand the relationships between concepts and organize their experiences in meaningful patterns. Planning a learning experience involves starting with something familiar and step-by-step progress, so that each step is based on the previous step. Pointless memorization of contents assumes undesirable. It's only through getting familiar with the principles of a learning experience that learners understand the fundamental points correctly and thoroughly (Schultz, 2014).

Some elite scholars of this philosophy believe that the meaning of the impact of the field on the learning process is not just the context of the place or culture, but also contain the personal and internal context of individuals (Van Oers , 1998). Brunel believes that even children who are taught in an educational system with similar facilities , have a different understanding of numbers and the ways of employing them (Kilpatrick, 1977). He also believes that even a lesson like numeral theory has two functions: 1) a function as a part of mathematics; 2) social function! In addition to teaching this lesson as a part of mathematics, children's intelligence is gradually rising and, during the learning process, children learn how to solve problems in a variety of ways that come into their daily lives (Kilpatrick, 1977). It should be noted that in comparison with the behaviorists, the place of meaning is the special interest of these psychologists.

According to the above mentioned points, eight mathematical education styles can be expressed as follows:
1) Lecturing Approach: An approach which it is better to call it a patriotic approach. The teacher prepares for everything and, ultimately, the assessment and testing of students is based only on the teacher's oral presentations in the classroom, and students only have the role of retaining the information.
2) Interactive Speech Approach: The approach that a teacher, presents a lecture, and tries to interact with students about the arguments of the theorems or the necessities of the definitions provided.
3) Practical approach: The teacher demonstrates the algorithms, definitions, and sentences by presenting various exercises during the presentation of the lesson and their collaborative solution. This approach is based on the Thorndike's functionalistic viewpoint.
4) Algorithmic Approach: An approach in which the teacher introduces hundreds of algorithms for various problems, and the overall task is to address one of these algorithms without the need to know why it is working efficiently. It can also be called the minecraft approach.
5) Problem-Solving Approach: An approach that transforms the classroom into a problem solving workshop. This approach is based on the Gestalt's cognitive philosophy. According to the NCTM's standards, "Solving problems is not only a goal of learning mathematics but also a major means of doing so. ... In everyday life and in the workplace, being a good problem solver can lead to great advantages. ... Problem solving is an integral part of all mathematics learning "(Pehkonen, 2008).
6) Creativity-Oriented Approach: Ability to understanding mathematics is directly related to individual creativity. By developing creativity skills, teacher could help them learn mathematics.

7. Cognitive approach: This approach is the same as Piaget's epistemological approach. Since the people living in a region have more cognitive similarities, the teaching method can be considered based on the area. Student failure in mathematics is not only based on the external factor, such as the teacher's inability or the inadequacy of the teaching style, but also the cognitive and intrinsic factors can be plotted as internal factors.
8) Discovery Approach: This approach is the Socratic approach that regards knowledge as "hidden" in the essence of human beings. The teacher should guide the classroom with appropriate questions and directions to discover knowledge.

Research Questions

1. What kind of teaching methods do students like the most and do they approve the commonly used booklet-based method?
2. Does the type of gender affect mathematics learning style? In other words, should girls and boys be involved in separate teaching methods?
3. Piaget's cognitive factors are effective in the learning of empirical sciences. Are these internal factors effective in how to learn mathematics?
4. How much does personal experience affect the individual thinking and attitudes towards mathematics teaching styles? This question is based on the theory of constructivism.

Method

In this study, the target community is the undergraduate students in mathematical sciences in Zabol University (case study). Statistical analysis of data is descriptive-analytic. Based on the predefined fundamental concerns, a questionnaire with 48 questions was prepared and used. The number of questionnaires, which consisted of 99 respondents who were filled personally. Preliminary data analysis (data screening) extracted from completed questionnaires showed that no variable has enough lost data to be removed (Tabachnick, 1996). EM algorithm method was used to replace the lost data (Tabachnick, 1996). In this manner Missing data is replaced by the response pattern of individuals with other questions.

Results and Discussion

The validity of the questionnaire was verified by experts in the field and the reliability of the questionnaire is almost well established the Cronbach's Alpha coefficient of 0.75.
We present statistical analysis in descriptive and inferential parts. To begin with, we first performed a non-parametric Chi-square test to measure the imbalance the responses to each question between the answer options if respondents differentiate between the options and do not answer five options in a balanced manner. Otherwise, no result cannot be obtained from that question. The imbalance with the relevant test was confirmed for all questions except for a question. (Spreat, 2001)

Table 1. Chi-Square statistic and sig

Indicator	**Response Frequency**					**Chi-Square**	**Sig**
	Very Low	Low	Ineffective	High	Very High		
Lecture App.	1	4	48	29	5	96.161	0.000*
Interactive Speech App.	0	2	4	64	17	115.529	0.000*
Practical App.	0	4	14	59	11	85.364	0.000*
Algorithmic App.	1	3	27	45	9	82.353	0.000*
Problem-Solving App.	0	1	7	34	44	60.140	0.000*
Creativity App.	0	0	0	40	48	0.727	0.394
Cognitive App.	2	3	21	35	26	48.345	0.000*
Discovery App.	0	3	30	45	8	57.429	0.000*

As you can see in Table 1, except for the Discovery method, in the remaining cases, the difference between the options for the respondents is significant. Regarding to the frequency of responses in the Discovery method, respondents clearly choose the higher choices. Of the respondents, 50.7% were male and 49.3% were female. The relationship of gender with the main indicators is based on the Kolmogorov-Smirnov test (Gibbons, 2003), at the alpha level of 5% in Table 2.

Table 2. The gender relationship with respect to the the Kolmogorov–Smirnov test

Indicator	**the Kolmogorov–Smirnov test**	**Sig**
Lecture App.	0.569	0.903
Interactive Speech App.	0.805	0.536
Practical App.	0.492	0.969
Algorithmic App.	0.836	0.487
Problem-Solving App.	0.492	0.969
Discovery App.	0.718	0.682
Creativity App.	2.125	0.000
Cognitive App.	1.201	0.112

As can be seen in Table 2, based on the respondents' response, the gender variable only affects the Creativity approach. For more accurate statistical analysis, Friedman's nonparametric test (Hollander, 1999) has been used to compare the indices based on the responses. The results are presented in Table 3:

Table 3. Mean ranks and Friedman's non-parametric test

Indicator	Mean Ranks	Indicator	Mean Ranks	Friedman's Test	
Interactive Speech App.	5.67	Problem-Solving App.	5.83	number	74
Practical App.	3.98	Discovery App.	6.34	Chi-square	147.863
Algorithmic App.	3.36	Creativity App.	4.29	Degree of freedom	7
Lecture App.	2.85	Cognitive App.	3.68	sig	0.000

According to Table 3, since the equal median hypothesis has been rejected for the main indicators, there is no doubt that there is a statistically significant difference between the responses of the respondents to the indicators. Based on the ranks table in table 3, the best indicator for respondents is the discovery method and problem-solving method, and the least indicator is the lecture-based method. Of course, the same results were achieved.by comparing the means.

In Table 4, you will find a descriptive report of the respondents' answers to the main indicators:

Table 4. Descriptive Report

Indicator	**Numbers**	**Mean of Responses**	**Standard Deviation**	**Variance**
Lecture App.	84	3.3908	±0.69922	0.4889
Interactive Speech App.	87	4.1412	±0.50177	0.2518
Practical App.	88	3.7670	±0.58574	0.3431
Algorithmic App.	85	3.5647	±0.68289	0.4663
Problem-Solving App.	86	4.2035	±0.62487	0.3905
Discovery App.	88	4.3466	±0.40370	0.1630
Creativity App.	84	3.7011	±0.96286	0.9271
Cognitive App.	84	3.6446	±0.60548	0.3666

Based on the mean of the answers of the respondents, the discovery method has the most satisfaction from the respondents' viewpoint and the least amount of comments is also devoted to the lecturer-based method. Using the Mann-Whitney non-parametric test, the impact of gender, and student-teacher relationship factors were studied according to 8 main indicators, and the results are presented in Table 5.

According to this table, the gender factor only affects the indicator of creativity and cognitive factors. Regarding the mean of ranks (based on the output of the software for the Mann-Whitney test) for the creativity indicator, we conclude that women are significantly more likely to believe in creativity-based approach of teaching. In addition, women significantly consider the influence of cognitive factors on math learning. The student-teacher relationship factor, is also effective only on the practice-centered and discovery methods, and in fact the students have significantly more confidence in the practice-oriented approach. Teachers are more interested in the discovery method.

Table 5. Mann–Whitney U test and the effect of gender and level of education on criteria

Factor	Indicator	Statistic Test: Mann-Whitney	Sig
Gender	Creativity App.	160.500	0.000**
	Cognitive App.	329.000	0.049*
Lecturer/Student Factor	Practical App.	207.000	0.039*
	Discovery App.	220.500	0.046*

The dependence of the indicators was then studied using Spearmans rho's nonparametric correlation coefficient. (Table 6)

Table 6. The correlation coefficient between indicators

	Interactive Speech App.	Practical App.	Algorithmic App.	Lecture App.	Problem-Solving App	Discovery App.	Creativity App.	Cognitive App
Interactive Speech App.	1	0.33**	0.074	0.012	0.297**	0.416**	0.098	0/212
Practical App.		1	0.366**	0.442**	0.356**	0.245*	0.119	0/363**
Algorithmic App.			1	0.392**	0.228*	0.175	0.204	0/851**
Lecture App.				1	0.233*	0.127	0.234*	0/346**
Problem-Solving App.					1	0.343**	0.027	0/196
Discovery App.						1	0.030	0/162
Creativity App.							1	0/590**
Cognitive App.								1

The highest correlation coefficient (relationship) between cognitive factors and algorithm wais centered, and the least correlation between lecture-centric method and interactive lecture was found. Interestingly, all correlation coefficients are positive for all correlations.

Conclusion

In this section we study the results of this statistical study. The main results of this research can be divided into two main categories. The first category is the observations that learners prefer the most. The second category is the questions that are considered relevant by the learners.

Learners have less interest in the two common approaches, the lecturer-oriented (pamphlet-oriented) approach and the algorithmic method. On the other hand, the problem-solving approach that makes the classroom a major problem-solving workshop was most endorsed by learners. This approach to the problem-solving can be considered from this point of view, which is an integral part of the secondary education curriculum in countries such as the United States, Australia, Japan, and Singapore (Reyhani et al., 2012). Indeed, the recent survey shows that the common way of teaching and teaching mathematics in Iran is not only inefficient and inadequate, but also the learners are not happy about it. After this approach, Socratic attitude and discovery method have been considered the most. In this preference, the gender factor is not important, that is, both female and male students prefer the problem-solving problem and discovery approaches over the lecture-oriented (booklet) and algorithmic approaches. Ignoring these two teaching methods - which, incidentally, are very similar to each other - interactive lectures are of interest to learners. Learners suggested that this method could be improved by using numerous exercises and solving them by students.

Teachers should encourage the curiosity of students and guide them to solve mathematical problems. This tutorial is very time-consuming and new educational books should be written for. The solving exercises improves student's learning while teaching theoretical debates. Then, by assigning training classes in the educational programs and setting targeted exercises, the class of practice solving transforms from dictation manner to the challenging and interactive class .Learners also believe that the solution to math problems is not unique and naturally expect teachers to accept their various correct solutions.

References

Behboodian, J. (2006). Nonparametric statistics,ShirazUniversity Press,Shiraz.[in Persian]

Bjork, D.W. (1998). Burrhus Fredrick Skinner: The contingencies of a life. In G.A. Kimble and M. Wertheimer(Eds.), Portraits of Pioneers in Psychology, 3, 261-275. Washington, D. C., American Psychological Association.

Gibbons,J. D. and Chakraborti,S. (2003).Nonparametric Statistical Inference, 4th Edition, Marcel Dekker,New York, 645 pp.

Hollander, M. and Wolfe, D.A. (1977). Nonparametric Statistical Methods, 2nd ed. New York: John Wiley & Sons,Inc. 10. Kilpatrick, J. and Weaver, J.F. The Place of William A. Brownell in Mathematics Education. Journal for Research in Mathematics Education, 8, No. 5, 382-384.

Mullis,I.V.S,, Martin,M.O,, Gonzalez, .J., Gregory,K.D., Garden, R.A., O'Connor, K.M., Chrostowski,S.J.,& Smith T.A. (2000).TIMSS 1999 International mathematics report findings from IEA's repeat of the Third International Mathematics and Science Study at the eighth grade. Chestnut Hill, MA: Boston College. Available online at http://www.timss.org.

Pehkonen, E. (2008). Problem solving in mathematics education in Finland, p.3,www.unige.ch/math/ EnsMath/ Rome2008/WG2 /Papers/ PEHKON.pdf.

Reyhani, E, Ahmadi, G. and Karami zarandi, Z. (2012). Comparative study of problem solving process in mathematics teaching programs of United States, Australia, Japan, Singapore and Iran, Quarterly Journal of Education, 105, 116-141.[in Persian]

Schultz, P. D. (2014). Theories of personality. (translated by Y. Karimi et al.), Arasbaran.[in Persian]

Sha'bani,H. (2008). Educational and developmental skills, Samt.[in Persian]

Spreat, P. and Smeeton,N.C. (2001). Applied Nonparametric Statistical Methods, 3rd Edition, Boca Raton: Chapman & Hall/CRC.

Tabachnick, B. G. and Fidell, L. S. (1996). Using Multivariate Statistics. New York: Harper Collins.

Tatto, M. T., Schwille, J., Senk, S., Ingvarson, L., Peck, R., & Rowley, G. (2008). Teacher Education and Development Study in Mathematics (TEDS-M):Policy, practice, and readiness to teach primary and secondary mathematics. Conceptual framework. East Lansing, MI: Teacher Education and Development International Study Center, College of Education, Michigan State University

Van Oers, B.(1998), From Context to Contextualizing, Learning and Instruction. Elsevier Sciences Ltd. 8, 473-488.

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