Comparison of learning strategies in successful and unsuccessful students

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Abstract

Introduction: The main purpose of the present research was to compare learning strategies used by successful and unsuccessful students.
Material and methods: Six hundred and five third-year students were randomly selected from all-girl high schools in Tehran based on their level of academic achievement. The students were enrolled in one of three groups: the Mathematics group (which included Math and Physics), the Experimental Sciences group (Biology and Chemistry), or the Humanities Group (Sociology and History). The very highest and lowest achieving students in each of these groups were compared (using t-tests and discriminant analysis) for their use of four learning strategies: Rehearsal, Elaboration, Organization, and Comprehension Monitoring.
Results: In each of the three groups, there were significant differences between the successful and unsuccessful students in the use of learning strategies. In all three groups, high achieving students relied more than low achieving students on Comprehension Monitoring, but there was no difference in the use of Rehearsal. There was a difference between groups in the use of Elaboration or Organization. In the Mathematics and the Humanities groups, high achieving students relied more than low achieving students on Elaboration, whereas in the Experimental Sciences group, high achieving students relied more on Organization. Moreover, discriminant analysis showed that the use of Elaboration by students in the Mathematics and Humanities groups and Comprehension Monitoring by students in the Experimental Science group contributed most to educational achievement.
Conclusions: Learning strategies make a difference for academic achievement. Therefore, we must familiarize ourselves with a variety of learning strategies, learn them and teach them to our students, and we should attempt to change the idea that students can discover strategies by themselves in order to help our children grow to their fullest potential and prosper.

Key words: learning strategies, successful and unsuccessful students, academic achievement.

Introduction

The interest in learning strategies is the result of a change in emphasis from Behaviorism to Cognitive psychology [1, 2]. Cognitive theories of learning intend to define and study complicated cognitive activities, such as comprehension [3], recall and learning strategies. In these approaches,

what is highlighted is how learning is executed, how input is processed and then stored in memory [4, 5].

One of the fundamental orientations of the cognitive approach is the theory of "information processing". This theory defines mental processes as receiving stimulus input and based on this formulating a response [6-8]. Studies in recent years indicate the importance of learning strategies for facilitating the learning process, storage, and recall, and these studies demonstrate the role of cognitive change through the use of rehearsal, elaboration, organization and comprehension monitoring. In fact, the results indicate that cognitive approaches are the most influential determinants of the students' learning process [9], and there is a positive and meaningful relationship between learning strategies and the average score measuring achievement at the university level; for example, there is a significant relationship between learning outcomes and online access [10]. Comprehension has been shown to be better when students used summarizing and questioning in their learning process than if they did not [11, 12]. Moreover, learners who used methods of memorizing and organizing and communicating points improved their performance [13, 14]. In addition, those who underlined the important points and took notes were able to recall more data and recalled it better [4]. Also in students who had learned to use keywords, learning and recalling information proved to be meaningfully better [13].

Some researchers believe that recalling information which consists of meaningful relationships is easier and facilitates storing information in memory as effectively as happens when students attend self-study sessions. These groups showed better performance than those which hadn't learned appropriate learning strategies and the control group which hadn't been trained at all [9]. Furthermore, students who were more eager to use self-organizing activities like cognitive approaches also more readily learned materials [15, 16].

According to the above-mentioned results, one of the fundamental points in education is to teach a student how to memorize and how to solve problems [17]. Also, students must be aware of the most effective approaches to learning and use them while studying. We normally expect our students to study well, solve problems or memorize a great deal of data, even though proper ways of studying, problem solving and committing data to memory haven't been taught to them [4, 17].

In educational systems, little attention is paid to teaching methods of learning, and it is believed that students will discover the proper ways of studying by themselves and learn essential skills to achieve their education goals, whereas it probably is necessary to teach them proper approaches to learning and problem solving. In order to discover the best methods of learning, one effective way is to study "successful student learning methods". Identifying learning strategies used by successful students and then teaching these to others can promote excellence in learning.

Therefore, the objective of this research is to study the relationship between learning strategies and educational accomplishment in order to provide an answer to the question whether there is a difference between academic programs and the majors in terms of effective learning strategies.

In this research, learning strategies refer to general designs, methods, and mental skills used to process data and solve problems [16]. Specifically in this research, four different learning strategies will be studied which can facilitate an individual's performance. These are Rehearsal, Elaboration, Organization and Comprehension Monitoring [4]. The strategy of Rehearsal refers to repeating the information so as to store it first in short-term memory and then in long-term memory. Elaboration refers to creating and forming mental images, taking notes and summarizing, as well as looking for applications. The Organization strategy includes grouping the materials to be learned and arranging them based on their similarity and differences in order to determine the main points or create a statement. To engage in Comprehension Monitoring, the student must ask himself/herself questions in order to make sure that the information is perfectly understood. This prevents failure in understanding the subject by the student.

Material and methods

Using the cross-sectional method, learning strategies were studied in successful and unsuccessful girl students in their third year of high school. In this research, success or lack of success in each of three academic programs was determined in order to assess whether there were differences in associated learning strategies. The population of focus in this project consisted of all girl students in their third year of high school. Of this population, 605 were sampled using multi-stage cluster sampling, that is, of all of the 19 educational districts in Tehran, 5 educational districts (1, 5, 8, 11, and 17) were selected. In the second stage, based on a list of all educational districts, 4 educational centers were randomly chosen, and then students from these educational centers were divided on the basis of their major and their grades in two technical courses taken during their 5th term. Those whose scores were equal or higher than the average plus 2 Sd (M+2Sd) were regarded as successful students, and those whose scores were equal or lower than the average minus 2 Sd (M-2Sd) were

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regarded as unsuccessful students. It should be noted that for students in the Mathematics group, lessons such as Arithmetic 1 and Physics 3 were considered technical lessons, and for students in the Experimental Sciences, lessons such as Chemistry 2 and Biology 2 were considered technical lessons, and for students in the Humanities group, Sociology 2 and History were considered technical lessons.

There were two reasons for selecting students in the third year of high school:
1. Applying learning strategies in advanced levels involves cognitive and meta-cognitive development, and students above 15 years of age should be capable of these [18].
2. Students determine their major by the end of 4th term and are placed in majors of Mathematics, Experimental sciences, or Humanities, so that students in the third year of high school have decided upon their major.

In order to study learning strategies, the "Learning Strategies Inventory" was administered. It is based on the cognitive learning theory by Weinstein and Mayer [11, 16]. This questionnaire contains 26 items which measure learning strategies, namely, Rehearsal, Elaboration, Organization and Comprehension Monitoring. This questionnaire uses a 5-level Likert response scale (always, usually, sometimes, seldom, never). The reliability of this questionnaire was calculated by determining Cronbach's α and found to be good: 0.78 [9], 0.89 [4], and 0.81 (current research).

In this research, the data of the sample were compared to the normal distribution to determine goodness of fit using the Kolmogorov-Smirnov test, and the average point and deviation were calculated, and the total score in each indicator was considered as the level of application of that strategy. Moreover differences in learning strategies used by successful and unsuccessful students in each of the three major groups were compared using independent t-tests, and for determining the contribution of the strategies used in predicting success, "discriminate analysis" was used.

Results

The distribution of successful and unsuccessful students in each of the three groups (Mathematics, Experimental Sciences, and Humanities) is shown in Table I. Out of 605 students, there were 208 (159 successful and 49 unsuccessful) in Mathematics, 200 (149 successful and 51 unsuccessful) in Experimental Sciences, and 197 (63 success and 134 unsuccessful) in Humanities. The results from comparing the learning strategies used by successful and unsuccessful students for all of the major groups together indicated that there were meaningful differences between successful and unsuccessful students in terms of the use of the learning strategies of Elaboration and Monitoring Comprehension (p<0.01), but there were no difference between successful and unsuccessful students in terms of the learning strategies of Repetition and Organizing.

Comparing learning strategies in successful and unsuccessful students within each major indicated that there were no significant difference in the use of the Rehearsal strategy, whereas there was a significant difference (p<0.01) in the use of the

Table I. Distribution of Successful and Unsuccessful Students in Three Major Groups

Majors groups	Mathematics (Includes Math and Physics)	Experimental Sciences (Biology and Chemistry)	Humanities (Sociology and History)	Total
N successful (%)	159 (76)	149 (76.5)	63 (31.97)	371 (61.33)
N unsuccessful (%)	49 (24)	51 (25.5)	134 (68.03)	234 (38.67)
N total (%)	208 (100)	200 (100)	197 (100)	605 (100)

Table II. Comparison of learning strategies used by successful and unsuccessful students in all three major groups combined

Strategies	Rehearsal		Elaboration		Organization		Comprehension Monitoring	
groups	s**	u***	s**	u***	s**	u***	s**	u***
M	11.85	11.37	24.17	20.2	10.72	11.06	20.26	18.03
Sd	3.32	3.66	5.66	5.66	3.97	3.63	4.26	4.43
t	1.62		8.41*		1.08		6.13*	

*p<0.01,
s** – successful
u*** – unsuccessful

Table III. Comparison of learning strategies used by successful and unsuccessful students majoring in the Mathematics group

Strategies	Rehearsal		Elaboration		Organization		Comprehension Monitoring	
groups	s*	u**	s*	u**	s*	u**	s*	u**
M	11.25	11.2	24.8	19.5	10.7	10.9	20.3	17.7
Sd	3.1	3.7	5.2	5.8	4.01	3.7	4.2	4.8
t	0.04		6.04		0.39		3.59	
probability of the t-test result	0.96		0.001		0.69		0.001	
discriminant analysis	0.005		0.83		0.05		0.49	

s* – successful
u** – unsuccessful

Table IV. Comparison of learning strategies used by successful and unsuccessful students in the Experimental Sciences group

Strategies	Rehearsal		Elaboration		Organization		Comprehension Monitoring	
groups	s*	u**	s*	u**	s *	u**	s*	u**
M	12.2	11.7	23.03	21.7	10.08	11.4	20.2	18.6
Sd	3.5	3.8	5.98	4.9	4.01	3.7	4.3	3.7
t	0.97		1.42		2.09		2.40	
probability of the t-test result	0.334		0.157		0.038		0.017	
discriminant analysis	0.24		0.36		0.53		0.61	

s* – successful
u** – unsuccessful

Table V. Comparison of learning strategies used by successful and unsuccessful students in the Humanities group

Strategies	Rehearsal		Elaboration		Organization		Comprehension Monitoring	
groups	s*	u**	s*	u**	s*	u**	s*	u**
M	12.10	11.2	24.7	19.4	11.4	10.9	20.3	17.8
Sd	3.35	3.5	5.8	6.3	3.9	3.5	3/4	4.8
t	0.97		1.42		2.09		2.40	
probability of the t-test result	0.106		0.001		0.31		0.001	
discriminant analysis	0.27		0.96		0.17		0.55	

s* – successful
u** – unsuccessful

Elaboration strategy in Mathematics and in the Humanities and in the use of the Organization strategy in the Experimental Sciences (p<0.01). In addition the strategy of Comprehension Monitoring was used more frequently by successful than unsuccessful students in all three majors. In other words, successful students more frequently than unsuccessful students in Mathematics (p<0.01) used Elaboration and Comprehension Monitoring strategies (Table III), and in the Experimental

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Sciences successful students more frequently (p<0.05) used Organization and Comprehension Monitoring strategies (Table IV) and in the Humanities successful students more frequently used Elaboration and Comprehension Monitoring (Table V). In other strategies there were no significant differences between successful and unsuccessful students.

In addition to the above mentioned results, discriminate analysis suggests that in the Mathematics group, the Elaboration strategy contributed the most to academic achievement (r=0.83), followed by the Comprehension Monitoring strategy (r=0.49) and Organization and Rehearsal strategies contributed least (Table III). In the Experimental Sciences, Comprehension Monitoring strategy contributed most to academic achievement (r=0.61) followed by Organization (r=0.53), Elaboration (r=0.36) and Rehearsal strategies (r=0.24) (Table IV). In the Humanities group, the Elaboration strategy contributed most to academic achievement (r=0.96) followed respectively by Comprehension Monitoring strategy (r=0.55), Rehearsal (r=0.27) and Organization (r=0.17) (Table V).

Discussion

Results showed that successful and unsuccessful students differed in terms of the learning strategies they used and in their academic achievement [19]. Of the four strategies, the strategy of Comprehension Monitoring and Elaboration were more closely related to academic achievement.

Successful students more frequently apply the Elaboration strategy and this is associated with an increase in the pace and amount of learning [20]. This means that successful students engage in summarizing, interpreting, and establishing associations between different items of knowledge, experience, and previous beliefs. They also attempt to apply general rules in everyday life, relate information learned to class discussions and different topics. Unsuccessful students either are not aware of these strategies or apply them very poorly.

Moreover, successful students effectively use a Comprehension Monitoring strategy. This means that they become more aware of the nature and cognitive demands of the homework as they become aware of, recognize and revise the materials which they are studying. In the process, the student identifies effective approaches for more accurately learning and reaching appropriate answers and applying these strategies to solving problems or learning situations, thereby enhancing their academic achievement. Despite the importance placed on completion of extra-session homework in cognitive-behavioral therapy (CBT), a review of the available literature suggests that there is much about the nature of homework

compliance that remains to be empirically evaluated [2]. When reviewing, the successful student reviews the learning process and evaluates where the student is in the learning process with questions, such as "What have 1 learned well?", "In what area have I come close to level of being skilled?", "What areas demand more effort?" etc.

Successful students try to provide suitable answers to their questions and to do compensatory activities, while unsuccessful students are not successful in gaining awareness, recognition, and reviewing cognitive activities. This causes them to choose a learning strategy with superficial knowledge of their homework and the cognitive challenges which the homework poses or the processes required to master the homework. Frequently unsuccessful students engage in trial and error as they try to do their cognitive homework, and due to the fact that trial and error is not a reliable method to confront learning situations, the student has little success. In addition, the result indicates a difference between students in terms of their majors. One of the significant results of this research is the similarity of using the Elaboration strategy and Comprehension Monitoring and their contribution to student's academic achievement in Mathematics and Humanities. The results show that successful Humanities students as well as Mathematics students used both strategies effectively. Thus they engaged in summarizing, interpreting and comparing the information presented, and they also gained awareness and recognition as they reviewed the information presented. Yet there is a question to be raised here despite the similarity in this cognitive, learning style approach, namely why is efficiency so low in Humanities students?

To find the answer, attention must be paid to the prevailing cultural atmosphere of the society. Sad to say there is great deal of negative propaganda against the Humanities, and, as a rule, little care is given to students of this major. Natural enough, school and families incorporate this evaluation. Students with the lowest academic performance are steered toward Humanities at our schools. The students are humiliated by their families due to their majors as if they have committed a sin to have chosen this major. That is why only a very small portion of talented and successful students show any willingness to go into this major. (One indicator of this fact is that we have 63 successful students out of 197 in the Humanities vs. 134 unsuccessful students, whereas, based on the same criteria, 159 out of 208 Mathematics students and 149 out of 200 Experimental Sciences students were grouped as successful). As a result, if a student is interested in the Humanities, with this low status of the Humanities and the likely criticism the

person will encounter if he or she were to chose this major, the person is not likely to have the courage to go ahead and major in the Humanities. As a result both the area of Humanities and the benefits which would come from applying knowledge from the Humanities area suffer due to this low status.

Another result of this research is the difference between successful and unsuccessful students in the Experimental Sciences in terms of the use of the strategy of organization. Successful students in this major seem to effectively organize materials, that is, transform the received data into a fathomable framework which requires comprehension and active participation. In the process many different processes of memory are applied, such as classifying, arranging, putting the relevant materials together and relating information on different levels. That is why the successful students are better at recalling data and make more progress in their area of study, whereas unsuccessful students commit the data to their long-term memory in no orderly fashion and thus face trouble recalling them.

Furthermore, a very significant outcome of this study is the finding that successful students in all three majors use the strategy of Comprehension Monitoring, and this had a great effect on their academic achievement.

Conclusions

In the end what can be mentioned as an achievement of this project is the fact that we now know that learning strategies make a difference. Therefore, we must familiarize ourselves with a variety of learning strategies, learn them and teach them to our students. We also must attempt to change the idea that students can discover strategies by themselves in order to witness growth and prosperity of our children.

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