Increasing Freshmen's Expectations, Beliefs, and Achievement of Mathematics

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Abstract: This study aimed to increase the achievement level of college students on math by providing a high level of expectancy, value, interest, and motivation toward math. To be able to achieve this aim, action research was used instead of exploratory studies. Action research is a group of people's identifying a problem, doing something to solve the problem, seeing how successful they were and if they weren't satisfied by the results their retrying, and in short learning by doing and living. 150 freshmen of a university in Turkey participated in the study. The researcher and a math teacher implemented to the study. Results of the study showed that students' negative beliefs and expectations can change if they get support. According to the beliefs and expectations, grades of students also change and improve since positive perception makes life positive.

Keywords: action research; expectation; belief; achievement

0 Introduction

A student is expected to be successful for all of his or her courses. However, it is not easy for an individual to be successful without having interest, motivation, and expectancies from the courses. Many studies and researches are agreed that a successful learning-teaching process is based on providing student's achievement value and motivation. Higgins defined value both in terms of the relative worth of a commodity, activity, or person and also as the psychological experience of being attracted to (or repulsed by) an object or activity[1]. Valuing something means wishing to attain it; and Higgins define value as a motivational force and not just a belief. Atkinson defined incentive value as the relative attractiveness of succeeding on a given achievement task and also stated that incentive value is inversely related to the probability for success. Eccles *et al*. defined different components of achievement values: Attainment value or importance, intrinsic value, utility value or usefulness of the task, and cost[9]. Students' achievement values are crucial for expectancies and values. Thus, for Atkinson, expectancies and values were linked to particular tasks or activities, rather than being general dispositions.

Motivation is another component of being successful and achieving things. In a specific context, individual's achievement motivation can be explained by relating individual expectations and perceived value[3,4]. A chance of displaying a behavior can cause low motivation level toward the behavior due to lading low value or negative values[5]. Motivation is defined as "a theoretical construct used to explain the initiation, direction, intensity, and persistence of behavior, especially goal-directed behavior"[5]. Motivation is a central component of education. Motivation is one of the strongest determiners of academic success[7]. Some of the behaviors observed in a student whose motivation level is high are as follows:

- Be insistent on succeed/do difficult tasks,
- Data processing in depth,
- Strong collaboration between teacher and student,
- Liking school and finding it satisfactory[8].

Some of the behaviors observed in a student whose motivation level is low are as follows:

- Not being ready to learn of to do tasks,
- Tendency to alienation from learning environment,

- Wish to wasting time on activities unrelated to education such as watching TV and phoning,
- Thinking tasks as boring and not valuing responsibilities[8].

According to educational theorists[3,9], expectations and values determine individual's motivation. Thus, it can be said that expectancies and values are important in students' motivation and achievement on courses as well. Many theories have been discussed on this issue. In the following section, some of the key points of these theories will be explained as a trigger of achievement and motivation.

0.1 Expectancy-value-belief-interest

There are quite enough theories on the effects of expectancies, values, and beliefs on achievement. Theorists in this tradition argue that individuals' choice, persistence, and performance can be explained by their beliefs about how well they will do on the activity and the extent to which they value the activity[9-12].

Eccles *et al*. expectancy value theory is one of the most common and accepted theories on expectancy, value, and achievement theories. Expectancy-value model of Wigfield and Eccles proposes that these constructs are the most immediate or direct predictors of achievement performance and choice and are themselves influenced by a variety of psychological, social, and cultural influences[4]. Eccles *et al*. have focused on how expectancies, values, and their determinants' influence choice, persistence, and performance. Furthermore, they defined values with respect to the qualities of different tasks and how those qualities influence the individual's desire to do the task and hence the term task value[9,12,13]. This definition stresses the motivational aspects of task value. Most of the theorists believe that expectancies and values influence directly achievement choices. They also influence performance, effort, and persistence. Task-specific beliefs such as ability beliefs, the perceived difficulty of different tasks, and individuals' goals, self-schema, and affective memories influence expectancies and values. These social cognitive variables, in turn, are influenced by individuals' perceptions of their own previous experiences and a variety of socialization influences[14].

Additional to expectancies and values, beliefs about one's ability play a prominent role in different motivation theories. Self-efficacy researchers also tend to focus on individuals' beliefs about how confident they are they can complete different tasks rather than asking them to compare their efficacy to that of others[15,16]. In sum, ability and expectancy beliefs are crucial to the expectancy-value theory of motivation. According to the theorists even when previous performance is controlled, children's beliefs about their ability and expectancies for success are the strongest predictors of subsequent grades in math[17].

Another predictor of achievement is interest. When individuals have well-developed interests, they seek to engage in the activity frequently, feel self-efficacious about it, value their engagement with the activity, and can regulate their engagement in effective ways[17]. Hidi and Renninger stated that ''the student values the opportunity to reengage tasks for which he or she has a well-developed individual interest and will opt to pursue these if given a choice''[18]. Thus, in this tradition, individuals' interest (particularly individual interests) drives their valuing of different activities and the goals they set for the activities. Interest is defined as "an interest of a student toward a subject including an activity or task or enjoyment of the student while working on that task"[19]. Schiefele noted that students are likely to become more interested in domains in which they have a higher self-concept of ability than others[20].

Hidi and Renninger proposed a four-phase model of interest development[18]. The first phase is triggered situational interest, which is sparked by a particular task, activity, or situation. The second phase of interest development is maintained situational interest, which involves continuing to experience engaging experiences with a task or tasks. The third phase, "emerging individual interest," occurs when the person begins to generate the interest and seeks to continue to do an activity or set of activities. Finally, the fourth phase is well-developed individual interest. In this phase, there are even stronger links between the task, effective, values, goals, and beliefs. In this context, in research application of this study, this four-phase interest development will be used to develop interests of students toward math course.

0.2 Mathematics

For some students, mathematics is boring, unloving, fearful[21,22], unknown of the usage of this course, an obstacle that should be cross over to be graduated, even far from daily life, unreachable, unfathomable, and only profession of scientists. For some other students, it is

different and mathematics is not only a course at school but also an enjoyable interest which makes life easier. However, in Turkey, many students are not on good terms with mathematics[23] that tests measuring math level of students are generally at low levels.

There are many factors, in which there is a complex interaction among them, on forming mathematical beliefs. According to Pajares,[24] beliefs are formed in early ages and continue to develop through time, school, and experiences lived in conflicting situations; furthermore, it affects individual's behaviors strongly. Since students' beliefs on mathematics are one of the important factors affecting math achievement[25], some negative beliefs developed by the students toward math effecting students' learning, anxiety, and manner[26]. In literature, studies done on beliefs toward mathematics show that students' negative beliefs and manners are increasingly continued from primary school years to secondary school years[27].

Negative attitude experienced in the 1st year of school mostly continues toward secondary even graduate years bouncily. Thus, in some cases, students' math perception can be changed over time, and in some cases, this perception can remain unchanged and can be reflected on through graduate years. Duatepe and Cilesiz[28] stated that students, who are unsuccessful on compulsory math course at the 1st year of graduate schools, have negative beliefs about this course. Considering the reasons of being unsuccessful on math stated by the participants, it has seen that they were influenced by negative beliefs obtained by the previous experiences.

There are many studies supporting his idea. For example, Başar et al.[29] stated that, within the 1st year of the primary school teacher's negative approach, student's self-anxiety and math fear due to this self-anxiety have negative effect on the achievement of this subject. In addition, according to Doğan and Barış[30] and Tasdemir[31], students' self-efficacy beliefs affect achievement in a positive way.

In Hulleman et al. study, students' intrinsic and utility value mediated the effects of mastery-approach goals on both subsequent interest in the course and final grade; values did not mediate the effects of performance-approach goals on final grades. Interest and mastery goals predicted students' intrinsic and utility value for academic courses and sports activities. According to the results of Hulleman et al.'s study, interest triggers students' value, goals, and expectancies[32]. To be able to successful in a course, it is important to develop students' ability, value, and expectancy by increasing the level of interest in that specific course. In this respect, this study aimed to increase the achievement level of college students on math by providing a high level of expectancy, value, interest, and motivation toward math.

1 Method

1.1 Participants

The population of the study was all freshmen at a university in Turkey during the 2017–2018 academic years. At the 1st year of college education, all freshmen should take mathematics as a compulsory course in Turkey. Thus, all of the participants had math course as a compulsory course. Participants of the study were all English as Second Language (ESL) teacher candidates. Participants were selected by non-random sampling which was purposeful sampling. This group was chosen since these students were at language class and they are far from mathematics. 150 ESL teacher candidates participated in the study. 89 of these students were female, and the rest of them were male.

1.2 Procedure

In this study, action research will be used as a method. Researchers discuss about whether action research is qualitative or quantitative research. There are different opinions on that. According to Karasar, since studies take at specific place and provide participant limited results, results of the study are not aimed to generalize and are in local quality, and it can be said that action research is a qualitative study[33]. Huang[35] argues that this understanding is a myth and methods selected for action research depend on researchers' educated level and features of research subjects, and in this regard, action research is both qualitative and quantitative. Bogdan and Biklen presented supporting ideas to this thinking. In addtiion, qualitative research is research about practice, not with practitioners[34].

Then, what is an action research? Often, action research is a collaborative activity among colleagues searching for solutions to everyday, real problems experienced in schools, or looking for ways to improve instruction and increase student achievement[36]. The process of action research assists educators in assessing needs, documenting the steps of inquiry, analyzing data, and making informed decisions that can lead to desired outcomes[36]. Unlike conventional social science, its

purpose is not only primarily or solely to understand social arrangements but also to affect a desired change as a path to generating knowledge and empowering stakeholders[35]. Thus, this study also aimed to change students' beliefs and final grades on mathematics.

Since action research is neither quantitative nor qualitative, many kinds of data collection method can be used. It depends on study and researcher. In action research, most common used methods are taking journals by researcher, observation, interview, document analysis, surveys, and case studies[34,37-39]. In this study, document analysis and interview method will be used by analyzing students' final grades on mathematics for the first term. Furthermore, student interviews will be used as additional data.

Action research should take place in some steps. These steps are as follows:

1. Identification of problem area
2. Collection and organization of data
3. Interpretation of data
4. Action based on data
5. Reflection[35].

In this study, researcher will use these steps as the application of action research.

1.3 Data processing procedures

1.3.1 Identify a problem area

Before beginning a study, it is important to limit the question to one that is meaningful and doable in the confines of their daily work. Huang stated that careful planning at the beginning will limit false starts and frustrations[35]. If a researcher starts with a too broad or too limited study question, he or she will face many difficulties throughout the study. Is it something of interest and worth the time and effort that will be spent? At the beginning of this study, the researcher saw the problem of achievement problem of college students in Math and English courses. Students mostly complain about how these courses are unnecessary, time-wasting, and hard and also they talk about their low grades. Thus, the researcher wanted to find the reasons of this situation. Why these students are not good at English or math and why their grades are low? Since these questions are too limited, the researcher thought that after finding out the reasons of this situation will not help or provide anything. Thus, the researcher decided to do action research to try to solve the problem since there is a problem. By

deciding the research method and the problem, the researcher started to gather data to determine what can be done or how will this problem be solved? The researcher also decided to deal with mathematics since two courses will be too broad for the study.

1.3.2 Gather data

The collection of data is an important step in deciding what action needs to be taken. According to Huang, multiple sources of data are used to better understand the scope of happenings in the classroom or school[35]. There are many vehicles for the collection of data: Interviews, portfolios, diaries, field notes, audio tapes, photos, memos, questionnaires, focus groups, anecdotal records, checklists, journals, individual files, and logs of meetings, videotapes, case studies, surveys, records-tests, report cards, attendance, self-assessment, and samples of student work, projects, and performances.

It is not easy for the researcher to determine the collecting data method since the most appropriate method should be determined to get a well-organized data. Select the data that are most appropriate for the issue being researched. Are the data easy to collect? Are there sources readily available for use?

To gather data, researcher decided to use interviews with students and document analysis for final grades of students on math course. For interviews, semi-structured interviews will be used. Semi-structured interviews are the ones that the researcher prepares 4–5 questions for the interview, but interviews are not limited to these questions. Some additional questions can be raised during the interviews according to the participants' answers. Since it is not possible to interview with 150 students, the researcher selected 30 students from the whole group who are willing to participate in the study directly. Interviews took place in empty classes of the faculty during students' available times. Most of the interviews lasted ½ h or 25 min. During the interviews, audiotape was used. Furthermore, the researcher took notes during the interviews. Participants were assured that their original names will not be used and they will be anonymous. Additional to the interviews, all of students' first semester final grades on math were taken from the students' affairs to analyze the grades.

1.3.3 Interpret data

At this stage, the researcher tries to analyze and identify major themes data. Some of the data are quantifiable and can be analyzed without the use of statistics or

technical assistance. Since the grades of the students are quantifiable, the researcher did not use statistics in this study. Furthermore, other data, such as opinions, attitudes, or checklists, may be summarized in table form[35]. Thus, the researcher had tables for grades of the students. For interviews, the researcher first transcripts all recorded audio-taped data. After having words, the researcher reads and rereads all data. After reading data, the researcher tries to find out major themes and categories of students' thinking about why their grades are low or why they do not like math course. As Huang stated that unquantifiable data can be reviewed holistically and important elements or themes can be noted[35]. At the end of the interpretation of the data, the researcher has first semester final grades of math and themes emerged from interviews. These themes are the reasons for low-grade levels and not liking math.

1.3.4 Act on evidence

At this level of action research, using the information from the data collection and review of current literature, design a plan of action that will allow you to make a change and to study that change[35]. The researcher had the analysis of interviews and final grades. According to the grades, most of the students' grades are very low. For the results of interviews, three major issues raised. Students' lack of interest to mathematics, low level of expectations, and negative beliefs about success on math are the results of data evaluation. It is important that only one variable be altered in action research. In this respect, lack of interest and negative beliefs about success on math will be taken into consideration.

To solve the problem of unwillingness and negative beliefs about success on math, the researcher and the course teacher had a meeting and implemented a new technique. According to this new technique, course teacher will talk about the importance of math course and usage o fit in daily lives of students and also the way of succeeding in math for 2 h every week (30 students at each meeting). Besides, the researcher will also have meetings with students (30 of them at each meeting) to watch people who are good at math and people who are in a very good position by the help of math. Totally, 12 weeks of meetings will be held by the researcher and the teacher of the course. While the new technique is being implemented, the researcher continues to document and collect data on the performance of beliefs of students by talking

to them after each meeting. At the end of 12 weeks, the researcher interviewed with the same students interviewed at the beginning and audiotaped again. Additional to interviews, second terms' final grades also added to data.

2 Discussion

This study tried to change college students' beliefs, thoughts, and expectations about math course. In Turkey, even most people think that mathematics has a vital role in life and is an important course for everyone; there are many negative beliefs and expectations about math. To change negative beliefs to positive and herewith increasing final math grades of students was the aim of this study. With implementing action research, most of the students' ideas and grades changed. Thus, this kind of studies should be dome more and more to make changes on students' beliefs. It is not enough to just point out the problem, and solving the problem is more important. Thus, in education, if a researcher sees a problem action, research should be improved and implemented to change the negative situation to better ones. This study did a change on ideas and improved grades. However, as stated above, if this study would have done at early years of education, the results would be more effective and persistent. Future studies can be done for previous years of education.

3 Conclusion

At the last stage of action research, the researcher assesses the effects of the intervention to determine if improvement has occurred. According to the final grades of students, there is an improvement. At the first semester, the mean of math grades were 55 of 150 students; however, at the second semester, the mean of the grades has been raised to 65. This shows that there is improvement. This shows that there is an improvement. Another supporting evidence of improvement was students' change of beliefs about success and increase on interest. At the beginning of the study, many students believed that they cannot be successful at math because math is difficult. However, at the end, most of the students changed their ideas and thought that they can do mathematics and it was not hard to succeed. Their being uninterested in mathematics also changed a bit. Students found math course interesting and enjoyable at the end of the study. Of course, total improvement did not occur since only

one semester action was not enough. In addition, since students had these feelings throughout their education years and had previous experiences, total change cannot be expected. Thus, what changes can be made to the actions to elicit better results? This kind of study should be done in early years of students so as total change can occur. If we start supporting students about mathematics from early years of school, their negative beliefs about success, unwillingness toward math, and low expectations from the course can change.

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