

AN INVESTIGATING OF EIGHTH GRADE STUDENTS' CAUSAL ATTRIBUTION OF SUCCESS AND FAILURE IN MATHEMATICS

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Abstract

Teaching and learning in the classroom are a complex process characterized by intense cognition of the causal nature of student and teacher behaviour. Students' perceptions of whether they are successful and their analysis of why they are successful or unsuccessful can have an impact on their future performance. The study aims to reveal eighth grade middle school students' causal attribution of success and failure in mathematics. To collect data, a semi-structured interview was developed by the researcher. Interviews with students were recorded using a voice recorder. These audio recordings were deciphered and analysed. The participants of the study consisted of 15 students who were in the 8th grade of a middle school (13-14 aged). The results of the study revealed that effort is one of the most frequently cited causes for explaining success or failure in mathematics. While the reasons that refer to ability are not very popular, especially solving or not solving more questions is one of the obvious causes. This is thought to have a conclusion of teaching conception based on question-solving intensively in order to prepare the national high school entrance exam.

Keywords: Middle school students, mathematics education, causal attribution theory, eighth grade level

1. INTRODUCTION

Mathematics is not just about cognitive skills; emotional factors and attitudes are also important. It has been determined by many researchers that emotional factors have a significant effect on mathematics achievement (Baloğlu & Koçak, 2006; Hembree, 1990; Miller & Bichsel, 2004). Teaching and learning in the classroom are a complex process characterized by intense cognition of the causal nature of student and teacher behaviour. Students' perceptions of whether they are successful and their analysis of why they are successful or unsuccessful can have an impact on their future performance. In everyday life, the "why?" question comes to the top of the questions we mostly ask ourselves. Because by our nature, it is unthinkable for us to be insensitive to the events around us and not think about their causes and consequences (Försterling, 2001; Wong & Weiner, 1981). We are often not satisfied with just reacting to the events that happen to us. We also want to know why things happen to us and how people who experience similar situations react (Baron, 1998). It will be easier for people to perceive the world as more consistent and controllable if it can be explained why they behave in a certain way and how they will behave afterwards (Kağıtçıbaşı, 1999).

It is often not possible to determine the cause of many events by observing. For this reason, people attribute causes to the occurrence of events by establishing some causal relationships. According to Bar-tal (1978), causal attribution is an individual's obtaining a result from the process of making sense of the causes of his own and others' behaviour. When the individual knows how the events around him work, it becomes easier to increase the expectation of success while forming her/his future behaviours and goals. Causal attribution theory investigates how and why the human causes his own and others' behaviours, what the variety of attributed causes is, and what the effects of these attributions on subsequent emotions, motivations and behaviours are (Beck, 2003).

As Dai and Wang (2020) stated, early causal attribution theory accepted that the causes of behaviour were caused by external environments and individual internal factors. With the attribution control point theory, individuals began to be divided into two as internal controlled and external controlled (Xie & Wang, 2020). While individuals with internal control believe that the control of events in their lives is the result of their own abilities and efforts, individuals with external control believe that they cannot control the events in their lives and that the consequences that come to them may depend only on luck or others (Wang et al., 2020).

Researchers interested in attribution theory initially focused on how individuals perceive, interpret, and give meaning to social events (Weiner, 1972). However, over time, it has been observed that some researchers such as Weiner, Frieze, Kukla, and Reed have turned to the reasons students attribute to success and failure and their relationship with their learning performance. Of these, Weiner et al. (1979) considered causal attributions in three dimensions: internal/external, stable/unstable, and controllable/uncontrollable. For example, if a person attributes the causes of successful events to internal, stable, and controllable factors, or if s/he attributes his failure to external, unstable, and uncontrollable factors, s/he will insist on her/his action (Gatewood et al., 1995).

As stated early, Weiner (1985) classified the attributed causes from internal to external, stable to unstable, and controllable to uncontrollable. To illustrate, if a person explains his/her success in a job as 'I have many talents and I work hard', there are internal reasons, if s/he explains his failure as 'I was unlucky' or 'it was too hot', there are external reasons. In explaining success in terms of ability or effort, talent is a stable cause, and effort (if it is only for an exam) is an unstable cause. In cause references such as 'I had difficulty in the exam because the questions were difficult' or 'in exam there were questions from subjects I did not study', in the first case there is a stable reason for which the difficulty of the job was mentioned, and in the other, there is an unstable reason that can change from time to time, such as the luck factor. On the other hand, lack of effort and being sick are internal and unstable causes for failure. However, the nuance between the two situations should not be overlooked. Effort is under our control, but the same cannot be said for disease. Therefore, whether a cause can be controlled does not depend on whether it is internal/external and stable/unstable.

Studies show that successful students tend to explain their academic success with talent and effort, and their failure with lack of effort. So, if a student explains that the underlying reasons for success are talent and effort, it is clear that this will help him feel proud of himself and maintain the expectation of success. If failure is attributed to lack of effort, increasing the level of effort is under his control, and this understanding will enable the student to have a positive image about himself (Cortés Suárez, 2004). On the other hand, there are studies reporting that explaining successes to internal causes and failures to external causes increases future success expectations. For example, unemployed people who explain their inability to find a job by attributing to external reasons have a higher chance of finding a job (Schaufeli, 1988). In the same context, positive thinking, which connects defeat to bad luck and believes that it can be overcome with effort and talent, brings with it more success, health, and good mood (Seligman, 1991).

The effect of identifying attributions in eliminating some of the negative effects of failure is undeniable (Forsyth & McMillan, 1991; McMillan & Forsyth, 1991). Efforts of changing students' current attributions can help them break the cycle of self-blame and eliminate their future failure, and poor performance expectations (Wilson et al., 2002). The study aims to reveal middle school students' causal attribution of success and failure in mathematics. We think that this will enable us to understand the nature of students' attributions and shed light on future studies on how to change attributions. At the same time, we hope that the results obtained within the scope of the study will give us the opportunity to discuss what may be behind these attributions. It is clear that the way to increase the academic success of students is to determine the causes that prevent this. In this context, attributions and their dimensions are a good starting point for teachers (Shores & Smith, 2010). In general, the 'hard lesson' perception of mathematics in the eyes of society makes attributions even more interesting for mathematics teachers and researchers. Shores and Smith (2010) underline that the number of attribution studies in mathematics is insufficient and should be continued by considering their vital importance on students' success in mathematics.

2. METHOD

In this study, case study, one of the qualitative research methods, was used. In such studies, the events to be investigated are observed and interpreted as they are. In the current study, data were collected with the help of a semi-structured interview form. Case studies are an empirical research method that deals with a current phenomenon in its real-life conditions, where the boundaries between the phenomenon and its content are not clear-cut, and where more than one evidence or data source is used (Yin, 2018).

Descriptive data analysis was used within the scope of the research. Descriptive analysis is used to process data that does not require in-depth analysis. The answers given by the students to the semi-structured interview questions were processed using content analysis. Thus, it was provided to examine the data more closely and to reach the concepts and themes that explain them (Yıldırım & Şimşek, 2018).

2.1 The participants of the Study

The participants of the study consisted of 15 students who were in the 8th grade of a middle school (13-14 aged). Participation in the research was based on volunteerism. The majority of students at this grade level prepare intensively for the national high school entrance examination. As in countries such as Japan, Taiwan and Korea, there is a fierce competition among students, including parents and teachers, to enter prestigious high schools in Turkey. Anxiety about preparing for such exams also affects the education of the lower classes and peaks especially in the eighth grade.

The distribution of participant students by gender was 5 girls and 10 boys. In order to obtain consent from the parents in order to carry out the study, a form containing the information about the research was prepared and sent to the parents through the school administration and their consent was obtained. In addition, the purpose of the study was explained to the children participating in the study, and their consent was obtained. It has been stated that care will be taken at the point of sharing self-explanatory information, and a code will be given to each participant to ensure anonymity. In our study, this is A1, A2, A3 etc. form is preferred. They were also told that they could leave the study whenever they wanted.

2.2 Data Collection and Procedures

To collect data, a semi-structured interview was developed by the researcher from his experiences in mathematics education area, the review of the relevant literature (e.g., Baştürk, 2012, 2016; Hamann et al., 2020; S. Y. Lee & Hall, 2020). In a middle school, the interviews were carried out one by one with the students in a quiet classroom environment and recorded with the permission of the school administration, the teachers, and the participants.

Each one lasted approximately 15-20 minutes. The purpose of the research was explained, and the data collection forms prepared were administered to the students who agreed to participate in the research.

In the interview form, there were 7 open-ended questions. The first question aimed to find out the demographic characteristics of the students such as grade, age, success in math class, parenting profession etc. In the next two questions, the students were respectively asked to indicate the reasons why a student succeeds and fails a math class. The third question asked students to indicate how they feel when they solved a math problem correctly, what they think, and to whom or what they give the greatest share in this success. In the next question, the students were asked to answer the same questions for the case of failure. The sixth question asked them to say what they do when failing to solve a math problem. In the last question, they had to indicate what a student who fails math should do.

2.3 Data Analysis

Interviews with students were recorded using a voice recorder. These audio recordings were deciphered and turned into written documents. After the transcription of the audio recordings, participant control was carried out in order to eliminate the problems and deficiencies that may occur during the transcription process. The decrypted interviews were analysed. The transcript of the data consists of 19 pages and 3557 words. The students' responses were qualitatively analysed to characterize patterns and categorize answers.

In the research, the answers of the students were analysed by using content analysis. Content analysis is an analysis method used to analyse and interpret the content of various forms of communication such as written, verbal, and visual. It is a process of summarizing and describing the basic contents of the information and the messages they contain (Cohen et al., 2018). After the coding process of the students' answers was completed, systematic content themes and categories were obtained from the codes through the sessions held in panels. The panel consisted of the researcher and two people with a PhD in mathematics education. In order to achieve a high level of common agreement, the conflicts encountered were tried to be resolved through discussions (Lincoln & Guba, 1985).

3. RESULTS

In this section, the findings obtained from the analysis of the answers of the middle school students participating in the research are included. Some typical responses are included in order to provide a better understanding of the quantitative data and to ensure the (internal) reliability of the research.

3.1 Reasons for a student being successful in mathematics

We thought that it would be appropriate to ask such a question, considering that determining the reasons why students predict a student's success would be the same as the reasons they predicted for their own success. The results reveal that the most important reason for success is the student's effort (15 students). The fact that the lesson was listened to carefully (10 students) and the regular repetition (8 students) are two other important reasons. The teacher's good teaching (2 students), student's mathematical ability (1 student) and high motivation level (1 student) are other reasons that are mentioned, albeit a little. Here are some typical answers given by some students during the interview:

It is likely that s/he solved many questions, repeated his lesson on a daily basis, and s/he listened well (A7).

Working is very important, but for me, people are divided into two groups as those having numerical intelligence and verbal intelligence. Everyone's ability is different. There are also people who have both. For example, me, I am successful in verbal tasks, but not in numerical tasks. A student can be successful by working, but if s/he doesn't understand, that doesn't mean anything.

Because, in my opinion, it must be someone who teaches the subject. It should also not be forgotten that everyone's work and learning methods are different (A2).

Listening the lesson well, working, and using time well are important for successful. Because a student understands better and succeed by making correct planning and working regularly (A4).

This student learns the lesson well in class. S/he repeats what s/he learned and solves many test questions related to the taught topics. Namely, s/he works well (A12).

In the first comment, we see that three causes were put forward by the student: solving numerous questions, repeating the lesson daily, and listening well. The second interpretation draws attention to the importance of effort, that is, working, and emphasizes talent by classifying people in terms of having numerical or verbal intelligence. In the next comment, the student associates good listening, effort, and good use of time with success. It also adds regular work and proper planning. The last comment highlights the importance of learning in the classroom. It also considers effort, repetition of what has been learned, and solving numerous test questions (i.e., multiple-choice questions) on the subject as causes for success.

As a result, the students consider working, that is, effort, as the most important cause for success. So, in their opinion, if a student is successful, the most important cause for this is her/his effort. Listening carefully to the lesson and regular repetition are also among the important reasons. On the other hand, causes such as solving a large number of questions, ability and good planning are emphasized by some students.

3.2 Reasons for a student being unsuccessful in mathematics

This time, we asked the students to answer the previous question by considering the case of a student who had failed in mathematics. We wanted to see if the causes they predicted for successful student changed in the case of failed student. The results obtained from the analysis of the answers are as follows: lack of effort (14 students), not listening carefully to teacher (8 students), not repeating the lesson (7 students), considering mathematics as difficult (4 students), being prejudiced against mathematics (2 students), being indifferent to mathematics (2 students) and math anxiety (1 student).

It can be that the student does not understand or not work. For example, me sometimes although I study, I do not succeed. It may be that the student makes stress and mixes everything (A1).

I understand the lesson, in class. Someone who failed in mathematics may not have listened to the lesson in class. The failed student does not solve test questions. I don't think math is a difficult lesson. It is likely that this student does not understand mathematics or does not like maths or has prejudice against maths (A9).

The student probably does not solve questions, and not know question types (A15).

It is probably that the student doesn't exactly concentrate on the lesson, s/he doesn't solve enough questions by repeating the topics, and s/he doesn't go to the teacher to ask questions that s/he couldn't solve (A6).

In the first comment, student's failure is attributed to not understanding or not working. Moreover, it is stated that even if sometimes the student works, s/he may not be successful due to a number of causes such as anxiety. The second comment mentions the causes for failure such as not listening well in class, not solving enough test questions, not understanding mathematics, not liking it, and being prejudiced against it. In the next comment, the student associates not solving enough questions and not knowing the question types with failure. In the last comment, the lack of concentration in the lesson, not solving enough questions by repeating the subject, and not asking the questions the student couldn't solve to the teacher are took as failure causes.

Consequently, some of the causes stated by the students for the successful student are also valid for the unsuccessful student. Reasons such as lack of effort, not listening well and not repeating the lesson are the most important reasons for the failure of the student. However, an interesting result is that some reasons were mentioned that were not in question for the successful student. It is seen that the causes related to the attitude towards the mathematics lesson (disliking, indifference, anxiety, prejudice, etc.) have emerged as the reasons for failure. On the other hand, not solving enough test questions also continues to be among the reasons for the failure of some students.

3.3 Feelings When Solving a Math Question and Those Who Have a Share in This Success

We asked such a question to students to see how they felt when they solved a math question (or problem) and to whom or what they gave the biggest share of their success. The findings reveal that most of the students feel good (14 students) and they give the biggest share in this success to themselves (14 students). A significant part of them gives the biggest share of success to their teacher (13 students), and this success gives confidence to some of them (5 students). On the other hand, there are also those who give the biggest share of success to their families (5 students). This is supported by the interview comments, as illustrated below:

First of all, my self-confidence increases. I think that I can solve other questions. I'd be happy. My faith in myself increases. I connect the greatest share of this achievement with the teacher's good teaching, and the fact that I understand math well (A9).

I am so happy. I think that I did and solved it. I connect this a little bit to both my mother and my listening to the lesson. Because my mother helps me with planning and scheduling (A4).

As I could solve the question, I am happy. I think the role of my teacher when solving the question. The teaching of teachers is also important, but it is useless if you don't understand. That's why I give more share to myself in my success (A10).

When I solved a question, I am proud of it. Because solving a math question is great for me. I feel very good if I solve a question because I often don't it easily. I connect this to that I solve many questions and I work hard on the topic. My teachers also help me (A2).

In the first comment, the student states that he is happy, her/his self-confidence has increased and s/he has begun to think that s/he can solve other questions, and that the biggest share in success belongs to her/his teacher. While the feeling of happiness comes to the fore in the next comment, the biggest share in success is given to the mother, and to listening to the lesson carefully. In the third comment, the role of the teacher and one's own effort are expressed as factors behind this success. In the last comment, the student states that s/he will be proud of solving the question and that this success is due to her/his own effort and solving numerous questions on the subject.

As a result, students feel good when they are successful in solving a math problem and they give the biggest share of this success to themselves, their teachers, and their mothers. Understanding mathematics, listening to the lesson well, making an effort and solving numerous questions are among the reasons for success.

3.4 Feelings When Not Solving a Math Question and Those Who Have a Share in This Failure

With another question, we wanted to find out how students felt when they failed to solve a math problem, and to whom they gave the biggest share of this failure. Our goal was to see both their feelings of failure and their attributions to why it happened. We also wanted to see how their assessment of success and failure changed in relation to the previous question. The results of the analysis reveal that a significant number of students state that they are unhappy and think that they do not work hard enough (12 students) in such a situation. While 9 students say that they would give the biggest share to themselves in this failure, 3 students state that they would think that they did not understand the subject.

On the other hand, there are students who say that they would be upset because they could not solve the question (2 students) and that they find the math lesson difficult (2 students). All this is reflected in the following comments:

I feel sorry for the failure. I think that as I didn't do regular repetition of topics, it occurs. I give the biggest share in the failure to myself (A11).

I feel sorry that I cannot succeed, and my morale is broken. I think that I did not study enough or understand the topic (A1).

First, I feel sorry. This means that I did not work the topic very well. I think I am responsible. How, when I succeed, if I see myself well, when I fail, I consider myself as responsible. At least, it should be at this way (A10).

In this case, I think that I do not repeat the topic enough, so I say to myself I do not know anything. I give the biggest share to myself in this failure. If I listen to the teacher well in classroom, but if I do not repeat the relevant topics at home, and if I cannot solve this question, I consider myself as the responsible of this failure. Because I did not repeat (A12).

In the first interpretation, sadness is expressed as the dominant emotion. While not doing regular repetitions is suggested as the reason, the greatest responsibility is given to the student himself. While a similar feeling is expressed in the second comment, not working enough and not understanding the subjects are stated as the reason. In the next comment, sadness is the dominant emotion and the student states that s/he is responsible in case of failure, just as s/he sees himself responsible in case of success, and that s/he will experience such a situation because he has not worked hard enough. In the last comment, the student says that the biggest share of failure will belong to her/him, and not listening well to the teacher and not doing regular repetitions will be the reasons for this.

As a result, when the students fail to solve a problem, they get upset and give the biggest share to themselves. The most important reasons for this are not studying enough, not doing regular repetitions, and not listening to teacher well. In case of failure, the teacher and mother, who are actors who are given a share in the case of success, disappear, while the student continues to take part.

3.5 Strategies Followed in The Face of Unresolved Questions

Since we think that the nature of the strategies may be related to the causes attributed to success or failure, we posed a question to the students to reveal the strategy they adopted in response to an unsolvable question. The results reveal that the most adopted strategies are asking the teacher to teach the subject again (9 students), working, and solving more questions until the student understands the subject (8 students). There are other strategies such as asking their relatives for help in solving the question (3 students), listening to the teacher more carefully (2 students), insisting on solving the question (2 students), choosing one of the choices randomly if the type of question is multiple choice, not answering if the type of question is open-ended (1 student). The following extracts are typical of such comments:

I ask my teacher directly. It may be because of my carelessness, or the fact that I haven't met that question style before (A14).

I am careful to more understand the topic related to this question and to solve more questions about it. I tell my teachers that I don't understand this topic and I want them to teach it me again. I work it until I understand (A11).

At first, I ask it my parents. I ask my teacher if I completely don't understand it. If I do not understand again, I ask my teacher repeatedly (A5).

In the first comment, the student suggests that s/he would ask her/his teacher directly and considers causes as carelessness or not having solved a similar question before. In the second comment, the student states that s/he made an effort to understand the subject more and paid attention to solving more questions. S/he also says that s/he asked her/his teacher to explain it again and s/he studied until s/he understood. In the last comment, s/he states that s/he first asked her/his parents, and if s/he did not understand the subject at all, s/he asked her/his teacher to teach it again.

As a result, the strategies most highlighted by the students are to ask the teacher, or if they did not understand the topic at all, ask her/him to teach the topic again, and work, and solve more questions until they understand the topic. In addition, there are students who ask for help from their relatives, insist on solving the question until they are solved, or act according to the type of question.

3.6 Advices to a Student Who Failed in Mathematics

Considering that the nature of the advice that students give to a student who is unsuccessful in mathematics will be related to the causes they attribute to their success or failure, we asked them a question in this type. The advices are as follows: to solve more questions (10 students), to focus on what s/he does not understand (7 students), to listen to the teacher more carefully and to ask him what s/he does not understand (6 students), to consult the teacher and apply her/his recommendations (3 students). Some typical student responses are given below:

I think s/he should study mathematics more and listen to her/his teacher well. At the same time, s/he can consult with her/his teacher about what s/he should do and apply what the teacher says to her/him (A4).

He should go to her/his teacher and ask for help. We can ask the teacher to emphasize these topics better. The teacher must solve test questions from easy to hard (A5).

We can ask the teacher to teach the topic again. Teachers may have different styles of teaching. We can ask other teachers. We can make repetitions on the topic (A9).

This student should listen to the teacher very well. S/he has to follow her/his teacher even during the pauses in order to ask questions. S/he should solve many test questions.

When being at home, s/he should repeat the topics (A12).

In the first comment, the student is asked to work harder, listen to the teacher better, and follow her/his advice. In the second comment, the emphasis is on going to the teacher for help, asking her/him to explain the subject by emphasizing it better, and to solve the test questions from easy to difficult. In the next comment, it is recommended to repeat the subject and ask the teacher to teach the subject again, while in the last comment, the student is advised to listen carefully to the teacher, solve numerous questions and repeat the subject.

As a result, the students' advice for a student who is unsuccessful in mathematics focuses more on solving questions, asking the teacher to repeat the subject, listening to the lesson more carefully, and repeating the subject.

4. CONCLUSION AND DISCUSSION

This study investigated eighth grade middle school students' causal attributions of success and failure in mathematics. Attribution theories are based on the concept of getting explanations and creating insights about the underlying causes of a person's successful or unsuccessful activities (Soriano-Ferrer & Alonso-Blanco, 2020). They relate these concepts to subsequent behaviours that govern our motivational tendencies in our future actions (Banks & Woolfson, 2008; Fishman & Husman, 2017; Hansen & Mendzheritskaya, 2017; Vuletich et al., 2019). Being aware of the nature of students' attributions, thinking about their reasons, and trying to replace negative attributions with positive ones will affect the motivation of their future behaviour positively, and ensure to improve their expectations for success in mathematics. In this context, we conducted this research with 15 middle school students and obtained the following results:

It can be asserted that the participant students consider working, that is, effort, as the most important cause for success. That is a cause internal, unstable, and controllable. So, in their opinion, if a student is successful, the most important cause for this is her/his effort (i.e., his/her hard work). Listening carefully to the lesson and regular repetition are also among the important reasons. Moreover, causes such as solving a large number of questions, ability and good planning are emphasized by some students. It is seen that the ability, which is an internal, stable, and uncontrollable cause, is expressed by very few students. However, it is quite interesting and open to discussion that this reason comes to the fore prominently in studies conducted with both teachers (Baştürk, 2012) and student teachers (Baştürk, 2016). Generally, studies report that teachers and students express different qualities for student academic difficulties. The first ones perceive this situation as more serious, permanent, and uncontrollable by students, while the second ones tend to view students' personal failures as temporary and controllable (H. Wang & Hall). This has been interpreted as an effort to get rid of the feeling of guilt given by the responsibility given to those charged with teaching when things don't go as planned. The fact that teachers tend to punish their students who show low performance due to lack of effort despite having high ability, than those who have made effort despite low ability, shows that the degree of reward vs. punishment administered by teachers change according to attributions type (effort vs. ability), and therefore they do not have much expectation for students with lack of ability (Reyna & Weiner, 2001; Weiner & Kukla, 1970).

On the other hand, some of the causes stated by the students for the successful student are also valid for the unsuccessful student. Reasons such as lack of effort, not listening well and not repeating the lesson are the most important reasons for the failure of the student. The last two of these are internal, unstable, and controllable causes. However, an interesting result is that some reasons were mentioned that were not in question for the successful student. It is seen that the internal causes related to the attitude towards the mathematics lesson (disliking, indifference, anxiety, prejudice, etc.) have emerged as the reasons for failure. Many studies have shown that emotional factors, especially math anxiety, play a very important role in math achievement (Ho et al., 2000; Ma & Kishor, 1997; McLeod, 1992; Miller & Bichsel, 2004). On the other hand, not solving enough test questions also continues to be among the reasons for the failure of some students.

In many countries and cultures, there are no grand differences in attitudes towards mathematics, such as the tendency of young children to love mathematics and the worsening of attitudes with increasing age (Dowker et al., 2012; Ma & Kishor, 1997). However, national differences emerge not only in actual mathematics achievement, but also in the context of whether their citizens attribute mathematics to ability or effort and how much they attach importance to mathematics (Stevenson et al., 1990). Differences between countries can affect math anxiety, although the direction cannot be predicted exactly. In countries with a high level of education, students may have low math anxiety because they are good, or because success in math is overemphasized, failure may become more threatening and anxiety level may therefore be high (Dowker et al., 2016). In countries such as Korea and Japan, where the preparation process for national entrance exams is quite overwhelming and similar to Turkey in these aspects, students have high math anxiety despite being successful, and countries with high education levels such as Finland, Netherlands, Liechtenstein, and Switzerland students have low anxiety despite their high success (J. Lee, 2009). Although the reason for the differences is not entirely clear, we, like Tan and Yates (2011), think that the pressure to be successful in exams in the Asian countries and in our country increases math anxiety, and even ends up many students' math life. In the study conducted with Turkish senior high school students (18-19 aged) preparing for the university entrance exam (Baştürk & Yavuz, 2010), where test anxiety is much higher, the results that emphasize the effect of negative thoughts towards mathematics on success or failure in mathematics confirm the continuity of the problem. Students' showing themselves as the underlying reason for their success was interpreted as showing more effort. This is an internal, unstable, and controllable cause.

In addition of themselves, they give the biggest share of success to teacher, and mother (i.e., family effect) which are external, stable, and uncontrollable causes. The fact that the students link success to external causes such as teachers and mothers, and link failure to not working enough, lack of repeating, etc. internal causes, are similar to the results of studies conducted with Japanese and Taiwanese students (Mori et al., 2011). Mori et al. (2011) explained this by connecting with some cultural codes among students, such as students' high respect for teachers and a tendency to self-criticism in Asian culture. In case of failure to solve a mathematical problem, the strategies most highlighted by the students are to ask the teacher, or if they did not understand the topic at all, ask her/him to teach the topic again, and work, and solve more questions until they understand the topic. In addition, there are students who ask for help from their relatives, insist on solving the question until they are solved, or act according to the type of question.

Pan et al. (1994) state that thoughts, beliefs, and values can act as “behaviour principles that function as standards of desirable ends and of the means to achieve those ends” (p. 20). Although causal attribution theory provides an adequate framework for classifying attribution factors, the issue of differentiation of attributions is open to debate, as some researchers question (Bishop & Cao, 2001). When people have different cultural backgrounds, cultural factors play a role in differences as well as personal factors. People’s beliefs, self-efficacy, attributions, and values can change in the context of their cultural groups. For instance, Scholz et al. (2002) reported that persons from collectivist cultures (e.g., Far East countries) have lower self-efficacy than those from individualistic cultures (e.g., western countries). For this reason, as Turkish students have different beliefs and values from their peers in other countries culturally and in the context of the expectations of the society they live in, the way they make judgments such as attribution may be different. In this context, the students’ loud emphasis on solving more questions as a reason for both success and failure makes us think that this issue should be discussed in the context of our country's conditions. It is an undeniable fact that the social environment of the individual, her/his teachers, parents, close environment, and peers will have a significant impact on the formation and placement of attributions.

Many variables are effective in the selection of the concepts to be taught in schools. These are the type of society, the form of government, the state of the education system, technological development level, teacher training policy, etc. can be sorted. In the context of the didactic transformation theory, Chevallard (1985) calls the place where the education system, where these educational objects are selected, and its social environment meet, “noosphere”. Therefore, national exams that have such an impact on the society (university entrance exams, high school entrance exams, etc.) are also an effective variable in the selection of the concepts to be taught in the noosphere (Baştürk, 2006). The scope of such exams is often not in harmony with the curriculum in schools and requires special and intensive preparation (Baştürk, 2010). It affects the teaching given in schools, and this effect can be negative most of the time (e.g., encouraging practical but mathematically weak solution methods) (Baştürk, 2011). Our study group in this research consisted of 8th grade students at middle school. Since these students were generally preparing to the national high school entrance exam (a competitive exam comprising of only multiple-choice questions to study at the most preferred high schools by the society), themselves, their teachers, and their families live the pressure of this exam. Therefore, it is not hard to estimate that these students have heard from many stakeholders the advice that they often have to solve too many questions in multiple choice form, in order to be successful in the exam at almost every opportunity. Consequently, we can state that a variable in the noosphere (national entrance exams) is effective in shaping students' success and failure attributions.

On the other hand, the advice given by the students to the one who is unsuccessful in mathematics supports their attributions in other questions. It is possible to cite these as solving more questions, asking the teacher to teach the subject again, listening to the lesson more carefully and repeating it.

These are similar to the causes for and strategies to be developed against student's mistakes expressed by mathematics pre-service teachers in Baştürk's (2009) study. This study reveals that when the causes for the mistakes are seen as the learner, the strategies developed against them are learner-centred (such as listening again, completing the missing knowledge, studying enough, etc.). Considering that the influence of teachers in the formation of student causal attributions is undeniable, this similarity is not surprising. As C. M. Clark and Peterson (1986) stated, teachers' most important beliefs about their students are those related to their perceptions of the causes of their behaviour. These beliefs, perceptions, attitudes, and expectations have a role in determining the behaviour of teachers towards their students, especially towards low-achieving students (Brophy, 1985). In this context, it is highly likely that teacher attitudes towards a particular student will guide the teaching methods and strategies to be chosen each time (Ainscrow, 1998). As stated in the recommendations section, examining this with future studies will provide a better understanding of the relationship between students' causal attributions and teachers' classroom instructions.

5. RECOMMENDATIONS

The current research has revealed important research topics for future studies. These can be briefly summarized as follows:

- Since a qualitative approach was adopted in the present study, the number of students in the study group is limited. Therefore, it is not possible to generalize, and this is not intended. However, closed-ended questions can be prepared based on the categories determined within the scope of the research, and generalizable results can be obtained by applying them to a larger number of students.
- Although the effects of the nature of mathematics in schools, and the expectations of teachers are seen in the causal attributions of the students, this situation is limited only to the answers they gave to the interview questions. In-class practices can be examined with research designed in different patterns, and the extent of their impact on attributions can be revealed more clearly.
- The participant students considered solving numerous questions as an important cause for success or failure. This made us think that these questions should be examined at different variables or in the context of different theoretical frameworks to be adopted by considering their type, mathematical qualifications, contributions to learning etc. At the same time, investigating the content of the national high school entrance exams in terms of their impact on teaching in schools can provide a better understanding of the nature of students' and teachers' attributions.

REFERENCES

Ainscrow, M. (1998). Would it work in theory? Arguments for practitioner research and theorizing in the special needsfield. In C. Clark, A. Dyson, & A. Millward (Eds.), *Theorizing special education*. London, UK: Routledge.

Baloğlu, M., & Koçak, R. (2006). A multivariate investigation of the differences in mathematics anxiety. *Personality and Individual Differences*, 40(7), 1325–1335. <https://doi.org/10.1016/j.paid.2005.10.009>

Banks, M., & Woolfson, L. (2008). Why do students think they fail? The relationship between attributions and academic self-perceptions. *British Journal of Special Education*, 35(1), 49–56. <https://doi.org/10.1111/j.1467-8578.2008.00369.x>

Baron, R. A. (1998). Cognitive mechanisms in entrepreneurship. *Journal of Business Venturing*, 13(4), 275–294. [https://doi.org/10.1016/S0883-9026\(97\)00031-1](https://doi.org/10.1016/S0883-9026(97)00031-1)

Bar-tal, D. (1978). Attributional analysis of achievement-related behavior. *Review of Educational Research*, 48(2), 259–271.

Baştürk, S. (2006). Üniversiteye giriş sınavı sorularında fonksiyon kavramı [Function concept in university entrance exam questions]. *Ege Eğitim Dergisi*, 7(1), 61–83. <https://dergipark.org.tr/en/pub/egefd/issue/4916/67286>

Baştürk, S. (2009). Mutlak değer kavramı örneğinde öğretmen adaylarının öğrenci hatalarına yaklaşımları [Approaches of pre-service teachers to student mistakes in the example of absolute value concept]. *Necatibey Eğitim Fakültesi Elektronik Fen Ve Matematik Eğitimi Dergisi*, 3(1), 174–194.

Baştürk, S. (2010). *L'enseignement des mathématiques en Turquie : le cas des fonctions au lycée et au concours d'entrée à l'université [The teaching of mathematics in Turkey: the case of functions in high school and in the university entrance examination]* [, Université Paris-Diderot - Paris VII]. theses.hal.science. <https://theses.hal.science/tel-00011441/>

Baştürk, S., & Yavuz, İ. (2010). Investigating causal attributions of success and failure on mathematics instructions of students in Turkish high schools. *Procedia - Social and Behavioral Sciences*, 2(2), 1940–1943. <https://doi.org/10.1016/j.sbspro.2010.03.260>

Baştürk, S. (2011). Üniversiteye giriş sınavına hazırlanma sürecinin öğrencilerin matematik öğrenmeleri üzerine olumsuz yansımaları [The negative effects of the process of preparing for the university entrance exam on students' mathematics learning]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 40(40), 69–79. <https://dergipark.org.tr/en/pub/hunefd/issue/7796/102057>

Baştürk, S. (2012). Sınıf öğretmenlerinin öğrencilerin matematik dersindeki başarı ya da başarısızlığına atfettikleri nedenler [Classroom teachers' causal attributions of student success or failure on mathematics]. *Mehmet Akif Ersoy Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 4(7), 105–118. <https://doi.org/10.20875/sb.70131>

Baştürk, S. (2016). Secondary school mathematics student teachers' causal attribution for success and failure in mathematics. *European Journal of Science and Mathematics Education*, 4(3), 365–379. <https://eric.ed.gov/?id=ej1107834>

Beck, R. C. (2003). *Motivation: Theories and principles* (4th ed.). Pearson Education.

Bishop, A. J., & Cao, Z. (2001). Students' attributions of success and failure in mathematics: Findings in China and Australia. *Numeracy and Beyond: Proceedings of the Twenty-Fourth Annual Conference of the Mathematics Education Research Group of Australasia Incorporated*, 139–146. <https://research.monash.edu/en/publications/students-attributions-of-success-and-failure-in-mathematics-findi>

Brophy, J. (1985). Teachers' expectations, motives and goals for working with problem students. In C. Ames (Ed.), *Research on motivation in education* (pp. 175–213).

Chevallard, Y. (1985). *La transposition didactique du savoir savant au savoir enseigné. Recherches en didactique des mathématiques*. La Pensée sauvage.

Clark, C. M., & Peterson, P. L. (1986). Teachers' thought processes. In M. C. Wittrock (Ed.), *Third handbook of research on teaching* (pp. 255–296). New York, NY: Macmillan.

Cohen, L., Manion, L., Morrison, K., & Morrison, R. B. (2018). *Research methods in education* (8th ed.). Routledge.

Cortés Suárez, G. (2004). *Causal attributions for success or failure by passing and failing students in college algebra*. Florida International University. <https://doi.org/10.25148/etd.fi14061526>

Dai, E., & Wang, Y. (2020). Attribution analysis for water yield service based on the geographical detector method: A case study of the Hengdian Mountain region. *Journal of Geographical Sciences*, 30(6), 1005–1020. <https://doi.org/10.1007/s11442-020-1767-y>

Dowker, A., Bennett, K., & Smith, L. (2012). Attitudes to mathematics in primary school children. *Child Development Research*, 2012, 1–8. <https://doi.org/10.1155/2012/124939>

Dowker, A., Sarkar, A., & Looi, C. Y. (2016). Mathematics anxiety: What have we learned in 60 years? *Frontiers in Psychology*, 7, 508. <https://doi.org/10.3389/fpsyg.2016.00508>

Fishman, E. J., & Husman, J. (2017). Extending attribution theory: Considering students' perceived control of the attribution process. *Journal of Educational Psychology*, 109(4), 559–573. <https://doi.org/10.1037/edu0000158>

Forsyth, D. R., & McMillan, J. H. (1991). Practical proposals for motivating students. *New Directions for Teaching and Learning*, 1991(45), 53–65. <https://doi.org/10.1002/tl.37219914508>

Försterling, F. (2001). *Attribution: An introduction to theories, research, and applications*. Psychology Press.

Gatewood, E. J., Shaver, K. G., & Gartner, W. B. (1995). A longitudinal study of cognitive factors influencing start-up behaviors and success at venture creation. *Journal of Business Venturing*, 10(5), 371–391. [https://doi.org/10.1016/0883-9026\(95\)00035-7](https://doi.org/10.1016/0883-9026(95)00035-7)

Hamann, K., Pilotti, M. A. E., & Wilson, B. M. (2020). Students' self-efficacy, causal attribution habits and test grades. *Education Sciences*, 10(9), 231. <https://doi.org/10.3390/educsci10090231>

Hansen, M., & Mendzheritskaya, J. (2017). How university lecturers' display of emotion affects students' emotions, failure attributions, and behavioral tendencies in Germany, Russia, and the United States. *Journal of Cross-Cultural Psychology*, 48(5), 734–753. <https://doi.org/10.1177/0022022117697845>

Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. *Journal for Research in Mathematics Education*, 21(1), 33–46. <https://doi.org/10.5951/jresmetheduc.21.1.0033>

Ho, H.-Z., Senturk, D., Lam, A. G., Zimmer, J. M., Hong, S., Okamoto, Y., Chiu, S.-Y., Nakazawa, Y., & Wang, C.-P. (2000). The affective and cognitive dimensions of math anxiety: a cross-national study. *Journal for Research in Mathematics Education*, 31(3), 362–379. <https://doi.org/10.2307/749811>

Kağıtçıbaşı, Ç. (1999). *Yeni insan ve insanlar [New people and people] (10. Baskı)*. Evrim Yayınevi.

Lee, J. (2009). Universals and specifics of math self-concept, math self-efficacy, and math anxiety across 41 PISA 2003 participating countries. *Learning and Individual Differences*, 19(3), 355–365. <https://doi.org/10.1016/j.lindif.2008.10.009>

Lee, S. Y., & Hall, N. C. (2020). Understanding procrastination in first-year undergraduates: An application of attribution theory. *Social Sciences*, 9(8), 136. <https://doi.org/10.3390/socsci9080136>

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park: SAGE Publications. [https://doi.org/10.1016/0147-1767\(85\)90062-8](https://doi.org/10.1016/0147-1767(85)90062-8)

Ma, X., & Kishor, N. (1997). Assessing the relationship between attitude toward mathematics and achievement in mathematics: a meta-analysis. *Journal for Research in Mathematics Education*, 28(1), 26. <https://doi.org/10.2307/749662>

McLeod, D. B. (1992). Role of affect in mathematics education: a reconceptualization. In D. A. Grouws (Ed.), *Handbook of Mathematics Teaching* (pp. 575–596).

McMillan, J. H., & Forsyth, D. R. (1991). What theories of motivation say about why learners learn. *New Directions for Teaching and Learning*, 1991(45), 39–52. <https://doi.org/10.1002/tl.37219914507>

Miller, H., & Bichsel, J. (2004). Anxiety, working memory, gender, and math performance. *Personality and Individual Differences*, 37(3), 591–606. <https://doi.org/10.1016/j.paid.2003.09.029>

Mori, S., Ming, T. S., Nor, N. F. M., Suppiah, V. L., & Imm, O. S. (2011). Attribution tendency and its relationship with actual and perceived proficiency. *GEMA Online Journal of Language Studies*, 11(3). <https://core.ac.uk/download/pdf/11491795.pdf>

Pan, Z., Chaffee, S. H., Chu, G. C., & Ju, Y. (1994). *To see ourselves: Comparing traditional Chinese and American cultural values*. Boulder, CO: Westview Press.

Reyna, C., & Weiner, B. (2001). Justice and utility in the classroom: An attributional analysis of the goals of teachers' punishment and intervention strategies. *Journal of Educational Psychology, 93*(2), 309–319. <https://doi.org/10.1037/0022-0663.93.2.309>

Schaufeli, W. B. (1988). Perceiving the causes of unemployment: An evaluation of the Causal Dimensions Scale in a real-life situation. *Journal of Personality and Social Psychology, 54*(2), 347–356. <https://doi.org/10.1037/0022-3514.54.2.347>

Scholz, U., Gutiérrez Doña, B., Sud, S., & Schwarzer, R. (2002). Is general self-efficacy a universal construct? *European Journal of Psychological Assessment, 18*(3), 242–251. <https://doi.org/10.1027//1015-5759.18.3.242>

Seligman, M. E. P. (1991). *Learned optimism*. New York, NY: Knopf.

Shores, M. L., & Smith, T. (2010). Attribution in mathematics: A review of literature. *School Science and Mathematics, 110*(1), 24–30. <https://doi.org/10.1111/j.1949-8594.2009.00004.x>

Soriano-Ferrer, M., & Alonso-Blanco, E. (2020). Why have I failed? Why have I passed? A comparison of students' causal attributions in second language acquisition (A1-B2 levels). *British Journal of Educational Psychology, 90*(3), 648–662. <https://doi.org/10.1111/bjep.12323>

Stevenson, H. W., Lee, S.-Y., Chen, C., Stigler, J. W., Hsu, C.-C., Kitamura, S., & Hatano, G. (1990). Contexts of achievement: A study of American, Chinese, and Japanese children. *Monographs of the Society for Research in Child Development, 55*(1/2), i. <https://doi.org/10.2307/1166090>

Tan, J. B., & Yates, S. (2011). Academic expectations as sources of stress in Asian students. *Social Psychology of Education, 14*(3), 389–407. <https://doi.org/10.1007/s11218-010-9146-7>

Vuletich, H. A., Kurtz-Costes, B., Bollen, K. A., & Rowley, S. J. (2019). A longitudinal study of the domain-generality of African American students' causal attributions for academic success. *Journal of Educational Psychology, 111*(3), 459–474. <https://doi.org/10.1037/edu0000299>

Wang, Z., Sun, J., Wu, J., Ning, F., & Chen, W. (2020). Attribution of persistent precipitation in the Yangtze-Huaihe River Basin during february 2019. *Advances in Atmospheric Sciences, 37*(12), 1389–1404. <https://doi.org/10.1007/s00376-020-0107-6>

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review, 92*(4), 548–573. <https://doi.org/10.1037/0033-295x.92.4.548>

Weiner, B., & Kukla, A. (1970). An attributional analysis of achievement motivation. *Journal of Personality and Social Psychology, 15*(1), 1–20. <https://doi.org/10.1037/h0029211>

Weiner, B., Russell, D., & Lerman, D. (1979). The cognition–emotion process in achievement-related contexts. *Journal of Personality and Social Psychology, 37*(7), 1211–1220. <https://doi.org/10.1037/0022-3514.37.7.1211>

Wilson, T. D., Damiani, M., & Shelton, N. (2002). Improving the academic performance of college students with brief attributional interventions. In J. Aronson (Ed.), *Improving academic achievement: Impact of psychological factors on. Improving the academic performance of college students with brief attributional interventions* (pp. 89–108). New York: Academic Press.

Wong, P. T., & Weiner, B. (1981). When people ask "why" questions, and the heuristics of attributional search. *Journal of Personality and Social Psychology, 40*(4), 650–663. <https://doi.org/10.1037/0022-3514.40.4.650>

Xie, R., & Wang, A. (2020). Comparison of ten potential evapotranspiration models and their attribution analyses for ten Chinese Drainage Basins. *Advances in Atmospheric Sciences, 37*(9), 959–974. <https://doi.org/10.1007/s00376-020-2105-0>

Yıldırım, A., & Şimşek, H. (2018). *Sosyal bilimlerde nitel araştırma yöntemleri [Qualitative research method in social sciences]* (10th ed.). Seçkin Yayıncılık.

Yin, R. K. (2018). *Case study research* (6th ed.). SAGE Publications.