A STUDY ABOUT ATTITUDES TO MATHEMATICS IN PRIMARY SCHOOL

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Abstract

Student attitude and its impact on education has been an object of study for a number of academics in recent years. The main purpose of this study has been to corroborate and verify how students’ attitudes towards mathematics deteriorate as they progress through academic courses. A positive attitude towards the subject can be observed in the early years of primary school; however, this positivity starts to slightly decrease in subsequent years. Furthermore, it can be argued that attitude, as a factor affecting educational outcomes, is more influential than the cognitive factor. In the wide-ranging concept of attitude, there are range of components that contribute to its origin and construction such as the strong influence of the context; including the school, family and the social context of the individual. In the same way, the existence of variation within the teacher’s perception of their students’ attitude as they progress in the educational system impacts upon learner's attitudes.

Keywords: Innovation, technology, research projects.

1 INTRODUCTION

The main reason for the selection of this topic relates to the importance of mathematics in modern society. This results in a disturbing rate of academic failure suffered among students. Both TIMSS tests (Third International Mathematics and Science Study; [1]) and PISA project (Program for International Student Assessment; [2]), are highly valued international programmes due to the influence and repercussion of their results. According to the last PISA report in 2015, only 10.9% of students obtained results that they considered as ‘excellent’ in at least one subject. The results suggest that, for many students, mathematics is only a set of meaningless rules and techniques that is not related to daily life. This systematical failure in the promotion of mathematics makes us reflect and necessitates research on the possible causes of this failure.

Obviously, mathematics is an essential element in our daily life because they help students to acquire certain knowledge with the objective of managing daily life in modern society. Muñoz and Mato [3, p. 82] stated in their Ministry of Education and Science curriculum proposal that “it is indispensable that teachers are aware of the importance of this (attitudinal) content as learning itself and that others such as the conceptual and procedural type are also acquired”. In mathematics, the factor that is becoming gradually more visible in research is the affective one. This is demonstrated by Pérez-Tyteca [4], finding in [5] that, gradually, the affective field is becoming ever more evident in investigations since previously there was greater focus on the cognitive aspects of mathematics.

2 FOUNDATIONS

2.1 Theoretical framework

“Attitude” as a concept is a term with an extensive history. In his paper, Allport [6] points out the year 1862, when Herbert Spencer first used this term in the field of what was Social Psychology. In the last decades, attitude has been a widely studied concept among numerous authors (see [7], [8], [9], [10], [11], [12]). From all of the suggestions for a definition that these various authors offer, the most precise may be the one Eagly and Chaiken [7] proposed, defining attitude as “a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor.” (p. 269).

In the complex process of forming an attitude towards the achievement of a behaviour, the most complete theory would be the Theory of Reasoned Action presented by Ajzen and Fishbein [13]. This theory establishes that the intentions of behaviour are the combination of attitude towards behaviour and normative beliefs (see Figure 1). It is even considered that behavioural beliefs and norms influence attitudes directly and subjective norms through external variables. The elements in the following diagram are linked to each other, so that in the case of any of variance between them, the
other elements will also be modified. In addition we can confirm that if the behaviour is habitual, it can be stated that it is a habit.

**Fig. 1. Theory of Reasoned Action, [13]. Own adaptation.**

Ubillos, Páez and Mayordomo [14] point out in their paper that [15] introduced the behaviour controllability perception component as a way to overcome the deficiencies of his earlier theory. In his later theory he aimed to both predict voluntary and involuntary behaviours.

According to Guitart ([16], [17]), there are 3 agents that affect the process of forming attitudes: 1) the apprentice, the attitude object and the individuals that interact directly or indirectly around the attitude object; 2) personal, internal factors (age, sex and personal needs, level of moral and personal development, etc.); 3) external factors (social pressure, subjects that intervene in the attitudinal process, etc.). According to this author, an individual acquires or modifies their attitude from a direct experience after examining the harmful or beneficial results of their actions.

In the previous paragraph we expounded the process of forming behaviours and what other factors affect the formation of an attitude, and now we will move on to explaining which components form an attitude. With regard to this topic, many authors agree on the existence of two different models: 1) one-dimensional model ([18]); 2) multidimensional models ([19]). This last model is the most accepted and quoted by the majority of authors (e.g. [20], [21], [22], [23]).

According to Breckler's model, attitudes are made up of three components: cognitive (knowledge of the subject on the attitude object), affective (subject's feelings and emotions regarding the attitude object) and behavioural (behavioural intentions and actions of the subject). The behavioural component is a combination of the other two (affective and cognitive) according to [22]. Of all these three elements, the affective component is the most important ([16], [23]).

In this research, cognitive and affective variables have been analysed since, as we mentioned before, the behavioural component is nothing more than the combination of the other two. The objective that has been pursued with this is to corroborate if both variables change in the same way or, on the contrary whether the affective variable presents a greater importance than the cognitive one, as suggested by the majority of authors say.

When it comes to the point of measuring an attitude, Schwarz and Bohner [24] consider that attitude is a non-direct observable hypothetical construct but despite this it can be analysed from an individual point of view, by consulting behavioural reports or behavioural scales of the subject. Corroborating [24], Guitart [17] who also concluded that attitude would not be directly observed, posited that attitude should be understood depending on what the answers of the person are, which can be cognitive, affective or behavioural. This is the reason why there is a vast bibliography of a wide range of instruments and questionnaires to measure the attitude towards mathematics.
2.2 Previous research about attitudes in education

Students can often become frustrated when learning mathematics due to its lack of connection to the real world ([25]). This section will begin by reviewing some of the investigations done to analyze children’s attitudes towards mathematics. To begin, it is necessary to note that during the initial research of this investigation, it was found that leading authors stated that there is far more research on secondary and higher learning than on primary education.

In the United Kingdom, research is available from Dowker, Bennet, and Smith [26] that shows children have positive attitudes towards primary education. Another study done by Umanzor [27] also shows that students, in both Central America and the Dominican Republic, who performed better had a more positive attitude than those who performed worse. The investigation also showed the direct influence that the style of teaching has on students. Umanzor also pointed out that parents’ attitudes towards mathematics can affect their children’s attitudes.

In their primary study on childhood education in Spain, Hidalgo, Maroto and Palacios [28] found that attitudes towards mathematics were not fully developed at this age. They found that attitudes appeared to be very generic. However, the teacher was shown to have a significant impact on the performance and the attitudes of the students.

Through analysis of references on primary education a very limited amount of research was readily available on the first stage of school. Due to the lack of research regarding this age group it was necessary to include it in this study. The research on primary education done by [26], [21] and [29] found that children tend to have a more negative attitude towards mathematics as they grow older. However, it should also be noted that students’ attitudes towards both the teacher and the utility of the subject are positive ([29]).

Once students reach secondary school there appears to be a continuation of this tendency and even a more drastic decline in positive attitudes towards mathematics, (e. g. [30], [31], [32], [33], [3], [34], [35]). Turner and Meyer [36] attribute this change to the shift in adolescents’ interests from academic life to life outside of school. This change in priorities becomes even more detrimental when combined with the increased difficulty level of the mathematics. This proves to be another example of how teachers using engaging teaching styles and displaying a positive attitude towards their subject can play an important role in influencing students. This helps them to have a better attitude and performance ([37]).

It is necessary to note two key elements that have been proven to affect children’s attitudes towards mathematics: performance and gender. Authors such as [21], [33] and [12], found a correlation between positive attitude and better performance.

Both primary ([38]) and secondary ([31]) education research show that women are more inclined towards negative attitudes regarding mathematics. Meanwhile, men show more motivation and suffer lower stress levels in relation to mathematics. Likewise, the academic year is shown to be a variable which influences these attitudes for both genders. ([32]).

3 METHOD

3.1 The sample

Before analysing the sample of this study it is necessary to clarify how the education system in Spain works. The system is divided into three stages of two years each. Generally, the first stage is from age 6-7, the second stage from 8-9, and the third stage from 10-11 years of age. The participants in this study are students at a primary school and a secondary school in the town of Huétor Vega, located in Granada (Spain) which is an area which has an average level of education and socioeconomic level. These two institutions were chosen based on their proximity to each other and the fact that the majority of students that attend the primary school continue their education at this particular secondary school. The sample includes students at all levels of the primary school but only those in their first year at the secondary school. The primary school consists of two classes of students (A,B) in each of the six year grades, while the first-year students who study at the secondary school are made up of four groups (A,B,C,D). Initially, this study included a sample of 350 students. However, after eliminating some of the questionnaires due to invalidities, the final analysed sample consisted of 345 students.
3.2 The instrument

The measurement tool used in this part of the study was based on components of attitudes, specifically the cognitive and the affective, which combined form the behavioral. Scales used in previous studies, which were mentioned in Section 2, were used to form the questionnaire. Given the emphasis that the authors, in general, place on the usefulness of mathematics, it was important to include a question that revealed the students’ own attitudes regarding their usefulness. The final survey included a total of nineteen items.

Two questionnaires were used with the students. The first was administered only to the youngest students or those in their first year of primary school. This questionnaire was constructed of simpler and more comprehensible questions. The second was distributed to the rest of the sample and used a Likert scale to measure frequency of both positive and negative attitudes. These scales are frequently used to measure attitudes and also allow for measurements of the subjects’ diligence in completing the survey. In both questionnaires, positive and negative form items were included in order to avoid answer biases. In the scale, ‘Always’ and ‘Almost always’ represent an overall positive attitude. ‘Sometimes’ represents a neutral attitude. ‘Hardly ever’ and ‘Never’ reflect an overall negative attitude.

4 RESULTS

The study that has been carried out with the students from the first and the second year of primary education reveals that the results are mostly positive regarding the questions of both affective and cognitive variables.

Focusing on the other stages of primary education, Figure 2 shows the results of the cognitive variable. Almost 50% of the students in the second stage show a positive cognitive component given their positive answers in relation to the cognitive factor. However, there is a 17% decline in the answer ‘always’ as well as a rise in impartiality in the students from the third stage. Finally, there were no other substantial differences concerning the rest of the questions in these two stages.

Fig. 2. Percentage of responses (Always (blue), Almost always (orange), Sometimes (grey), Hardly ever (purple), Never (green)) in relation to cognitive variable for second and third stage of primary school.

Taking the affective variable into consideration, Figure 3 shows that more than the half of the students in the second stage answered ‘always’ to this type of questions, thus showing a positive attitude towards affectivity. Nevertheless, that percentage has a significant drop by the end of Primary Education. Regarding the rest of the answers, there is an increase in negativity and impartiality in the third stage in contrast with the second one. The only positive aspect in relation with affectivity that can be noticed is the opinion of the teacher, who is highly regarded by the students.

Analysing the differences between two components, it is important to emphasize that the decline in positive attitudes is slightly more pronounced in the affective rather than the cognitive variable. In the same way, the rise in negative attitudes is more acute in the affective factor than in the cognitive one. Ultimately, these differences highlight a more general fall in the affective component. The students...
show a sharp contrast in relation to their liking or disliking for mathematics but not in terms of the cognitive component. In other words, the diminishment in positive orientation to mathematics is more acute than is perceived by the participants. For instance the diminishment in positive feelings towards mathematics is more pronounced than the perceived increase in the difficulty of mathematics. Despite these variables being interrelated; it can be asserted that one is more influential than the other.

Therefore, it is necessary to point out that the affective variable is more relevant than the cognitive one, which coincides exactly with the results of some of the research discussed in the theoretical frame.

Figure 4 shows the attitude of students in the second and third stages of primary education. It is the combination of the affective and cognitive results which explains the overall attitude of students in the study. On the one hand, there was a substantial drop, all the way from the second stage of primary school to the first stage of secondary school, in the number of participants who answered ‘always’ while there was comparatively little change in the number who answered ‘almost always’ in response to positive attitude. Thus, the general positive attitudes of the students tends to diminish as the year move forward. There is a rise in the students' undecided or neutral attitudes to mathematics as the school years progress.

Finally, Figure 4 shows a slightly increase in overall negative attitudes (‘never’ and ‘almost never’). In conclusion, it could be argued that there is a progressive decline in the students' attitudes towards
Mathematics beginning from the second year of primary education. The inclusion of the first year of secondary school (denoted by SS) results, in the graph, clearly shows the decline in positive attitudes towards mathematics continues into secondary school.

In order to evaluate the average score of the students in each year, qualitative variables ('Always', 'Almost always', 'Sometimes', 'Hardly Ever' and 'Never') have been codified with numbers, where 5 indicates 'Always' and 1 'Never'. Based on the values assignated to the quality answers, the average score of the students per school year has been calculated, obtaining a value in the global calculation of their answer. Figure 5 shows a drop in the attitude in primary (denoted by PS) and secondary education (denoted by SS).

![Fig. 5. Mean by courses in primary school (from 1st A until 6th B) and the first grade of secondary school.](image)

Significantly, there is not a consistent decline in attitudes throughout all of the grade levels. In fact there is even an increase in the 4th year class B and the 5th class A. Another example can be found in the 1st year class D of secondary education, which shows a more positive attitude than the rest of the classes in the same year group. Therefore, Figure 5 points at a variation in attitude depending on the academic year, and this change could stem from the personal, family and educational contexts and the backgrounds of the students.

To conclude, the students’ positivity towards mathematics diminish gradually from the 2nd year onwards, although this decline varies from year to year and class to class. It may be worth noting that ‘help at home’ suffers a significant drop in the third stage of primary education and first year of secondary education. However students in the first and second stages of primary education highlight the substantial help that they usually receive at home. Finally, regarding the usefulness of mathematics, most students express a positive attitude towards this and so acknowledge the importance and usefulness of the subject.

5 FINAL REMARKS

Mathematics is a discipline that has been studied multiple times by numerous researchers. One important factor in this field is students’ attitudes towards the subject. In this study, the attitudes of 345 students, between ages 6 and 13, were analysed. In order to perform the task, a Likert frequency scale was used to obtain data, and a statistical analysis was completed afterwards. The results showed that positive attitudes towards mathematics peak during the first years of primary school, gradually decrease throughout primary school and suffer a major decline at the end of the first year of secondary school. Similar to the findings of other researchers, this study also found that the affective component of attitudes is the most influential.

In conclusion, the results verify the findings of other researchers cited throughout the study. Attitudes towards mathematics depend on context, both familiar and academic. In addition, there is a positive correlation between attitudes towards mathematics and student performance. Given the mentioned results, it is recommended that both teachers and families take these conclusions into consideration in an attempt to help students view mathematics courses as more feasible. More importantly, the knowledge gained in both mathematics and science classes should be not only manageable in school, but also applicable to students’ daily lives and future occupations.
ACKNOWLEDGEMENTS

Project of investigation EDU2013-41141-P and EDU2016-74848-P (AEI, FEDER) and group of investigation FQM126 of Junta de Andalucía.

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