International Journal of Education in Mathematics, Science and Technology (IJEMST)

www.ijemst.com

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**ISSN:** 2147-611X

**To cite this article:**

Hatisaru, V. & Murphy, C. (2019). "Creature" Teachers "Monster" Mathematicians: Students' Views about Mathematicians and Their Stated Attitudes to Mathematics. *International Journal of Education in Mathematics, Science and Technology (IJEMST), 7*(3), 215-221.

International Journal of Education in Mathematics, Science and Technology
Volume 7, Number 3, 2019 ISSN: 2147-611X

# "Creature" Teachers "Monster" Mathematicians: Students' Views About Mathematicians and Their Stated Attitudes to Mathematics

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**Article Info**

***Article History***

Received:
18 February 2019

Accepted:
26 June 2019

***Keywords***
Image of mathematics
Views about mathematicians
Stated attitudes about mathematics

**Abstract**

The present study aimed to examine lower secondary students' images of mathematics comprised of stated attitudes to and perceived needs for mathematics, and their views about mathematicians and their work. A group of 1284 lower secondary students drew a picture of mathematicians and described their drawings. The students' drawings fell into two distinct groups: drawings where students depicted a mathematician at work, and drawings where students depicted a mathematician as a mathematics teacher. In both cases students drew both negative ("creature" or "monster") depictions and positive ("smiley") depictions. This article presents the data on "creature" teachers or "monster" mathematicians in relation to the students' stated attitudes to mathematics. Trends that emerged for this sample suggested that more students who represented creature teachers disliked mathematics or had mixed feelings related to the need to learn mathematics.

## Introduction

A previous research, led by the first author, explored a large group of lower secondary students' images of mathematics through examining students' drawings. The image of mathematics has been conceptualized in different ways. For example, Sam and Ernest (2000) operationalized the image of mathematics to include eleven components including stated attitudes, feelings, descriptions or metaphors for mathematics, views about mathematicians and their work, beliefs about the nature of mathematics, mathematical ability, and sex differences in mathematical ability. Wilson (2011) proposed an operational construct to define the factors that might influence individuals' engagement in mathematical activity which coincided with the image of mathematics construct. Wilson (2011) used the term 'disposition' composing of beliefs, values, and identities, affect and emotions, behavioral intent and motivation, and needs. In this conceptualization the needs element is accepted as a contributory factor influencing people's disposition. That is, an individual might value learning mathematics, despite a lack of interest or enjoyment, because the subject is seen to be useful. Combining the definitions of Wilson (2011) and Sam (1999), Lane, Stynes, and O'Donoghue (2014) defined the image of mathematics as "a mental representation or view of mathematics, presumably constructed as a result of past experiences, mediated through school, parents, peers or society." (p. 881). According to Lane et al. (2014), the term image of mathematics is composed of three domains: the affective domain (attitudes, emotions, and self-concepts relating to mathematics and mathematics learning experiences), the cognitive domain (beliefs relating to mathematics and mathematics learning experiences), and the conative domain (motivation relating to mathematics learning).

In the previous research, the first author examined lower secondary students' (grades 6 to 8) images of mathematics drawings chiefly on the theories cited above and focusing on three particular aspects of the image of mathematics: students' stated attitudes (Lane et al., 2014; Sam & Ernest, 2000; Wilson, 2011), perceived needs for mathematics (Wilson, 2011), and views about mathematicians and their work (Sam & Ernest, 2000). In this article, we report on the connections between students' views about mathematicians and their stated attitudes to mathematics.

## Views about Mathematicians and Attitudes to Mathematics

A review of literature shows that some students perceive mathematics as difficult and complicated (e.g., Markovits & Forgasz, 2017), and other students find mathematics important (e.g., Markovits & Forgasz, 2017),

useful, relevant, or worthwhile (Stiles, Adkisson, Sebben, & Tamashiro, 2008) but did not enjoy learning it much (Markovits & Forgasz, 2017) or describe mathematics as boring (Stiles et al., 2008). In addition, many students hold narrow, limited, and sometimes erroneous perceptions about mathematicians. For instance, students sometimes associate negative or aggressive behaviors to mathematicians. In their research, Picker and Berry (2000) found seven themes appearing in the students' drawings including "mathematics as coercion", "the foolish mathematician", and "the mathematician with special powers" in which mathematicians were drawn respectively as large authority figures, as crazy men, or as people who have some special power. Some students have a perception of the mathematicians sitting in a room and working in isolation for hours, possibly proving a theorem. Ucar, Piskin, Akkas, and Tasci (2010) found that students viewed mathematicians as lonely, unsocial, intelligent but weird people and described mathematics teachers as angry and unfriendly. In Picker and Berry (2000), some of the participant students portrayed mathematics teachers that appeared intimating, violent, or threatening. Even in a few, the teacher was pictured pointing a gun at the student(s).

Students' views about mathematicians have been perceived as one factor related to negative attitudes to mathematics. Mathematics teachers are found one of the resources on which students alienate themselves from mathematics or choose to pursue it (Boaler, 2006; Grootenboer, 2001; Leder & Forgasz, 2010). Indeed, mathematics teachers were "often mentioned as reasons for having liked or disliked mathematics at school." (Leder & Forgasz, 2010, p. 334), or cited by students as their main influence on attitudes to mathematics (Lane et al., 2014; Yazlik & Erdogan, 2016). While such a connection has been widely reported in prior research (e.g., Boaler, 2006; Grootenboer, 2001), no previous research has been carried out to investigate, in detail, connections between students' views about mathematicians and their attitudes to mathematics. In this article, we report on the connections between these two variables. Identifying the connections between them may be one way of understanding students' negative attitudes to mathematics.

## The Study

The study was primarily qualitative in which a version of Draw a Mathematicians Test- DAMT (Picker & Berry, 2001) was used (with permission) to collect data by a research team led by the first author. Combining drawings with written responses, the DAMT consisted of a task and two open-ended questions (Q) (see Figure 1). The task required participants to draw a mathematician at work and then explain their drawing. The purpose of the descriptive narrative was to clarify or expand the information contained in the drawings, and thereby assisting in coding. Q1 asked students' views about why we would need mathematics and mathematicians aiming to seek their views about perceived needs for mathematics and mathematicians. Q2 aimed to examine students' attitudes, feelings, or emotions (in this paper, we use these terms synonymously) to mathematics. In this study, we focused on the student drawings and statements in Q2.

In the space below draw a mathematician at work.

Look back at the drawing you made of a mathematician at work, and write an explanation of the drawing so that anyone looking at it will understand what your drawing means and who the persons are in it.

Q1. If you have a leaky faucet, you need to hire a plumber; if you break your leg, you need the services of a doctor. With this views in mind, to you:

a. Why would we need to hire a mathematician?

b. Why would we need mathematics?

Q2. Please complete this sentence:

To me, mathematics is:

Figure 1. The version of DAMT used in this study

A convenience sample of 1284 students in grades 6 to 8 enrolled in twenty different lower secondary schools, with a mix of private and public, in Ankara participated in data collection under the auspices of the Republic of Turkey Ministry of National Education. The schools were co-educational metropolitan schools located in the centre of the city, in Cankaya district, with a relatively middle or high socioeconomic population based on family income. Students' ages ranged from 12 to 15 years. DAMT was sent to schools by the respective district Directorate of National Education to maximize the response rate. To eliminate a possible mathematics teacher effect, in schools, teachers other than mathematics teachers provided directions to and collected data from the students. It took students approximately thirty minutes to complete the DAMT. The schools sent the data in a sealed envelope to protect participant confidentiality.

## Data Analysis

Instead of seeking the meaning behind each of the drawings, data analysis focused on identifying patterns in the drawings (Haney, Russell, & Bebell, 2004). The patterns were documented using excel spreadsheets. These patterns were then quantified. The students' drawings fell into two distinct groups: drawings that depicted their view of what a mathematician at work would look like (n = 288), and drawings that depicted a mathematician who was clearly a mathematics teacher (n = 905). Six elements in students' drawings have emerged through prior research (e.g., Blake, Lesser & Scipio, 2004; Aguilar, Rosas, Zavaleta, & Romo-Vázquez, 2014; Losh, Wilke, & Pop, 2008): (1) the gender of figure, (2) the physical environment, (3) the activity of the figure, (4) the content area, (5) the tools of the profession, and (6) attractiveness feature.

Relevant to this current article is the attractiveness element corresponding to the perceived image of the figure. The drawings were coded according to whether the student's depiction appeared to be some kind of positive rendering such as a "smiling" figure, neutral rendering such as a "serious" or "thinking" figure, or negative rendering such as an "angry" or a "frustrated" figure. When the figure was turned away, thereby obscuring its face and there was no any other evidence either in the drawing or writing, it was coded as undefined. In this article, borrowing from Losh et al. (2008), we grouped the "smiling" mathematicians and mathematics teachers as "smiley" teacher and "smiley" mathematician; "angry" "frustrated" mathematics teachers as "creature" teacher; and "mad" "silly" mathematicians as "monster" mathematician. In Appendix A, we present typical examples of student drawings and descriptions to illustrate these themes.

Table 1. Schema for classifying students' responses to Q2 (adapted from Itter & Meyers, 2017)

| Criteria | Descriptors | Representative statement |
|---|---|---|
| Positive | Passionate about mathematics. Appreciation or unconditional liking of mathematics. Consistent positive statements. | "Enjoyable" "The best school subject" "Necessary" "Very important" "Like my favorite food" "A hobby" "The life itself!" "Superior" "In every part of the life." |
| Somewhat positive | Conditional liking of mathematics. Positive feeling is qualified as mostly or fairly. Mostly positive statements. | "Challenging" "Sometimes difficult but very important." "Difficult but enjoyable." "Except for difficult questions, I enjoy a lot." |
| Mixed | Mixed feelings about mathematics. Some positive and some negative statements. | "Sometimes difficult and tedious, sometimes enjoyable." "Neither good nor bad, just in between. I sometimes love it, sometimes don't." |
| Somewhat negative | Dislike of mathematics. Mostly negative statements. | "Not enjoyable anymore!" "Sometimes enjoyable but mostly difficult and boring." "Important but very complicated" |
| Negative | Strong dislike or hatred of mathematics. Consistent negative statements. | "Disgusting, I hate it!" "Boring and dull." "Nightmare." "Nonsense; what is the point in learning equations and circles?" "I wish it never existed" "Very bad, hateful, a curse." |
| Neutral | Neutral feelings about mathematics. | "A lesson" "Four operations" "Numbers" "Calculation" "Technology" |
| Not clear | Ambiguous or vague statements. | "There is no other course." "Three non-linear points." |

We classified students' responses to Q2: "To me, mathematics is…" (see Figure 1) to identify their stated attitudes to mathematics by using a schema adapted from Itter and Meyers (2017). Table 1 provides the schema and examples of representative statements regarding the criteria. In this article, we focus on depictions of

mathematics teacher or mathematician coded as "creature" teacher or "monster" mathematician (n = 91) to identify the impact of students' negative views about mathematicians on their stated attitudes to mathematics.

## Results

The analysis of students' depictions (see Table 2) revealed that most students drew smiling figures: nearly half of the students pictured either a smiley teacher (35.51%) or mathematician (7.00%). The attractiveness of the depicted teacher or mathematician could not be defined in, respectively, 28.58% and 13.94% of drawings. However, nearly one-thirteenth (7.85%) of student drawings represented negative images of mathematicians or teachers. Students associated negative views to teachers more often than to mathematicians: whereas more than one-fifteenth of the students depicted a "creature" mathematics teacher (6.38%) only few drew a "monster" mathematician (1.47%).

Almost three quarters (71.57%) of the students' statements "What mathematics means to me" included positive or somewhat positive feelings to mathematics. Many of these students' descriptions showed that they perceive mathematics very important both in their everyday and school life. Statements such as: "Very important, we need mathematics in every part of our life.", "For our future, because mathematics is life.", "To enrol in a good high school.", "The key to university entrance exam." were often present. Feelings about mathematics in almost one-twelfth of the student statements (8.64%) classified as "Other", including neutral and not clear statements. The remaining almost one-fifth of the students' responses revealed mixed (4.04%) or negative or somewhat negative attitudes (15.73%) to mathematics. Here we explore the responses of students whose depictions of the teacher or mathematician grouped as "creature" or "monster" (underlined in Table 2) to determine the views about mathematician factor that gave rise to mixed or negative attitudes to mathematics.

Table 2. Attractiveness of the depicted figure and stated attitudes to mathematics

| Depicted figure | Attractiveness | Stated attitudes | | | | |
|---|---|---|---|---|---|---|
| | | Positive or Somewhat Positive | Mixed | Somewhat Negative or Negative | Other | Total |
| Teacher | Smiley | 346 (75.87%) | 20 (4.38%) | 50 (10.96%) | 40 (8.77%) | 456 (35.51%) |
| | "Creature" | 33 (40.24%) | 8 (9.75%) | 34 (41.46%) | 7 (8.53%) | 82 (6.38%) |
| | Other | 272 (71.11%) | 13 (3.54%) | 61 (16.62%) | 21 (5.72%) | 367 (28.58%) |
| Mathematician | Smiley | 66 (73.33%) | 2 (2.22%) | 11 (12.22%) | 11 (12.22%) | 90 (7.00%) |
| | "Monster" | 11 (57.89%) | 1 (5.26%) | 4 (21.05%) | 3 (15.78%) | 19 (1.47%) |
| | Other | 128 (71.50%) | 6 (3.35%) | 28 (15.64%) | 17 (9.49%) | 179 (13.94%) |
| Undefined | Smiley | 24 (88.88%) | 0 (0.00%) | 3 (10.34%) | 2 (6.89%) | 29 (2.25%) |
| | "Creature" | 6 (54.54%) | 0 (0.00%) | 4 (36.36%) | 1 (9.09%) | 11 (0.85%) |
| | Other | 33 (67.34%) | 2 (3.92%) | 7 (13.72%) | 9 (17.64%) | 51 (3.97%) |
| | Total | 919 (71.57%) | 52 (4.04%) | 202 (15.73%) | 111 (8.64%) | 1284 |

In this sub-sample (n = 91), there are six combinations of negative views about mathematicians and stated attitudes: drawings that include a "creature" mathematics teacher and either positive or somewhat positive feelings (Combination 1- C1), or mixed feelings (Combination 2- C2), or somewhat negative or negative feelings (Combination 3- C3); drawings that represent a "monster" mathematician and either positive or somewhat positive feelings (Combination 4- C4), or mixed feelings (Combination 5- C5), or somewhat negative or negative feelings (Combination 6- C6). Table 3 shows the frequency of responses corresponding to these six combinations and sub-categories for stated attitudes to mathematics. Borrowing from Sam & Ernest (2000), to present the richness of the data, we coded each response into more than one subcategory. For instance, the statement: "Since I don't like my teacher, I hate it [mathematics]." was coded into two sub-categories into negative attitude category: 'due to teacher' and 'hate it'.

The results showed that, in the cases of combinations of depicting a "creature" teacher or a "monster" mathematician and expressing positive feelings (C1 and C4), most students expressed their attitudes to mathematics in the form of describing the importance or necessity of mathematics (f = 32), while some students found mathematics enjoyable (f = 13) or rewarding (f = 1) or challenging (f = 1). Some representative responses

included: “Important, necessary”, “It is the life, it is in every part of the life.”, “Life insurance”, “An important term”, “The most important subject” “Everything”, “Essential”.

Table 3. Combinations of having negative views about mathematicians and stated attitudes range from positive to negative and frequency (f) of corresponding responses

| Combination 1 (C1) | Combination 2 (C2) | Combination 3 (C3) |
|---|---|---|
| “Creature” teacher (n = 33) and positive or somewhat positive feelings | “Creature” teacher (n = 8) and mixed feelings | “Creature” teacher (n = 34) and somewhat negative or negative feelings |
| Sub-categories:<br>important/necessary (24)<br>enjoyable (9)<br>rewarding (1)<br>challenging (1) | Sub-categories:<br>due to teacher (7)<br>sometimes enjoyable sometimes boring (2)<br>sometimes good, sometimes bad (3) | Sub-categories:<br>awful/nightmare (9)<br>boring/unenjoyable (9)<br>difficult/confusing (8)<br>due to teacher (7)<br>unimportant/unnecessary (7)<br>don’t like/hate it (7)<br>important/necessary (4)<br>nonsense (4)<br>enjoyable (3) |
| **Combination 4 (C4)** | **Combination 5 (C5)** | **Combination 6 (C6)** |
| “Monster” mathematician (n = 11) and positive or somewhat positive feelings | “Monster” mathematician (n = 1) and mixed feelings | “Monster” mathematician (n = 4) and somewhat negative or negative feelings |
| Sub-categories:<br>important/necessary (8)<br>enjoyable (4) | Sub-categories<br>difficult (1)<br>enjoyable (1) | Sub-categories:<br>difficult/awful/boring (3)<br>unnecessary (1) |

In the cases of picturing a “creature” teacher and stating mixed (C2) or negative feelings (C3), one-third of the students (n = 14) expressed their attitudes to mathematics in the form of descriptions of teacher-related feelings or emotions. In C2, one student found mathematics “Sometimes enjoyable, sometimes boring.” Other students (n = 7) expressed teacher-related feelings such as: “Sometimes good sometimes bad, the reason is our teacher.”, “Sometimes good, sometimes bad, the times that is bad is when the teacher is angry.”, “If the teacher teaches well it is enjoyable, otherwise it is boring.” In C3, views associated to teacher seemed to result in explicit negative attitudes to mathematics. Statements such as: “Horrible with this teacher!”, “Important, but we have come to hate it thanks to our teacher.”, “The thing I dreaded the most in life, because I don’t like my teacher.” were commonly expressed. Other students within this group (n = 27) found mathematics for instance awful/nightmare (f = 9), boring/unenjoyable (f = 9), difficult/confusing (f = 8), unimportant/unnecessary (f = 7), or nonsense (f = 4). Students’ expressed statements ranged from feelings such as “It is necessary, but I don’t like it” to strong dislike or hatred of mathematics such as “It is very bad, disgusting, a curse.” In five drawings, students depicted a “monster” mathematician and wrote either mixed (C5) or negative (C6) descriptions. Contrary to the “creature” teacher depictions, in none of these depictions mixed or negative feelings were result of views about mathematicians. Students for instance wrote: “Boring”, “Very difficult but necessary”, “Unnecessary”, “Awful”, or “Enjoyable but difficult”.

## Discussion and Concluding Comments

Whilst most students depicted positive figures and expressed positive attitudes, about 10% depicted negative drawings and 16% expressed negative feelings. These students with negative feelings were the minority but are of concern. This concern is further amplified when we consider how these students’ negative views were influenced by their teacher. For example, in this study, the percentage of C4 students who depicted monster mathematicians and expressed positive feelings was 57.89%. The percentage of C1 students who expressed positive feelings when depicting creature mathematics teachers was lower (40.24%), and, even then, many of these students stated positive attitudes because of perceived importance of mathematics. Furthermore, the percentage of C3 students who drew creature teachers and gave negative attitudes (41.46%) was almost double the percentage of C6 students who drew monster mathematicians and had negative feelings (21.05%), and there

were more C2 students with mixed feelings about mathematics who depicted negative teacher drawings than C5 students who depicted negative mathematician drawings (9.75% vs 5.26%).

These findings reflect those of Picker and Berry (2000) but also suggest that views about mathematics teachers may be more influential on stated attitudes than views about mathematicians. The stated negative attitudes from those who drew "creature" teachers were often very intense and showed a strong dislike. Negative views about mathematics teachers have been reported in previous research (e.g., Grootenboer, 2001; Ucar et al., 2010), but what is further indicated in this study is that some students had mixed feelings. They may not have liked mathematics because of their teacher, but they associated importance or necessity to mathematics. Such mixed feelings may be more relevant in Turkey where mathematics is mandatory during the first year of high school and, also, makes up 22% of the high school entrance exams and 33% of the basic proficiency test for university entrance exam (European Schoolnet, 2018). These findings relate to Wilson's (2011) identification of needs as a disposition and suggest a small, but worrying, group of students who see the necessity of learning mathematics but do not enjoy the subject, possibly due to their teacher. The next step of this research would be, following Ernest (2015) and a literature in the image of mathematics (Sam & Ernest, 2000; Wilson, 2011; Lane et al., 2014), focusing on the connections between perceived needs in students for mathematics (Q1-b) and students' stated attitudes about mathematics (Q2).

## Acknowledgements

We wish to acknowledge the students and teachers who participated in, A/Prof Bulent Cetinkaya who showed commitment to, and the Directorate of National Education which supported implementation of the study.

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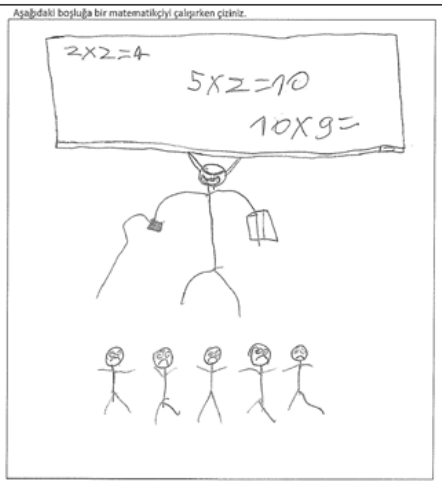
**Appendix A.** Examples illustrates the attractiveness of the depicted figure themes


"She is the mathematics teacher. Always smiling. At the back, there is a whiteboard, board and table."
(a) An example illustrates "smiley" math teacher




"Bad mathematics teacher teaching mathematics."
(b) An example illustrates "creature" math teacher


"In the picture there is a female mathematician and her pinboard. On it, there are secret formulas. She wants to make discovery by these formulas. She even has written a book, titled Mathematics Formulas. The formulas are such secret that she always keeps the book with her."
(c) An example illustrates "smiley" mathematician


"On my picture there is just a mathematician whose brain is exhausted. The pencils scattered over the floor."
(d) An example illustrates "monster" mathematician