

**A NARRATIVE ANALYSIS OF A PRIMARY SCHOOL TEACHER'S MATHEMATICS IDENTITY****\*Kenan Yıldırım**

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## ABSTRACT

The purpose of this study is to analyze the mathematics identity of a primary school teacher who has negative mathematics experiences. His mathematics identity was separated into five periods (primary school, secondary school, high school, university, and math teaching) and examined afterwards. Narrative research was used because his mathematics identity was examined through his self-narratives. In this context, data were collected by asking a primary school teacher to tell his life story about mathematics. Through narrative analysis, three themes appeared from his identity experiences. In addition, discourse analysis emerged four interpretive repertoires. The identified themes pointed to four positive and ten **negative factors for the teacher's mathematics identity**. As a result, it was found that the teacher himself and his teachers during his school years were the most effective components that result in these factors.

Keywords: *Primary School Teacher, Identity, Mathematics Identity, Teacher Mathematics Identity, Narrative Analysis*

## INTRODUCTION

Because mathematics has a considerable contribution to science and social development, it has an important place in education and instruction. Mathematics, which is viewed as a difficult field, causes various attitudes and behaviors. However, focusing only on emotions such as attitude, anxiety or belief would be unfair in trying to make sense of these behaviors (Sfard & Prusak, 2005). A more holistic approach is vital in revealing the underlying cause of human behavior.

Attitudes, beliefs, and values, which are subject to change, are gained through various life processes. They can occur either positively or negatively in an environment or event. However, examining only one emotion does not allow us to make a full decision about any person. To explain feelings and behaviors towards mathematics, research has had a different trend especially since the beginning of the 21<sup>st</sup> century (Darragh, 2016). These studies view the identity as a multi-faceted concept.

*Identity*

Identity, as a multi-faceted concept, has been used in different meanings by social sciences. Identity which is multidimensional and a different discipline, deals with each dimension. For instance, psychology, philosophy, sociology, and many other disciplines present their own definitions by putting

their disciplines in the center. Therefore, it is impossible to find a common definition of identity. However, they commonly emphasize that this concept is very broad and contains many meanings.

There are various theoretical frameworks to explain identity phenomenon. In particular, related literature focuses on four theories (e.g., discursive, positional, psychoanalytic, and narrative theories). In the view of Foucault (1982), discursive (post-structural) theories of identity define identity as an unstable, striking, and fragmented discourse related to sociocultural contexts. In this approach, power structures shape identities (Langer-Osuna & Esmonde, 2017; Stinson, 2013). Spatial (situational) perspectives associate personal participation with social practices (Lave & Wenger, 1991). The positioning theory has strengthened identity-oriented mathematics education (Holland et al., 1998). Spatial approaches defined that identity is created through social interactions within social contexts. As people interact with each other, they try to position themselves to exhibit certain qualities or roles (Engle et al. 2014). Psychoanalytic theories try to reveal how identities relate to emotions, anxieties, defense mechanisms, spiritual realities, and subconscious desires (Bibby, 2010). As for narrative theories, Sfard and Prusak (2005) argue that identity should be defined as the stories we tell about ourselves and other people. **They emphasize the following quotation: "No, there is no mistake here: We did not say that identities are what they are expressed in stories, we said they were stories (p. 2)." Identities are human-made and shaped by society, and may vary according to time, context, and narrator. People see themselves as heroes in different stories and develop their identities. Also, they organize their actions in series and connect them to a character (Ricoeur, 1992).**

Identity is seen as a non-stationary and continuously reproducible process created by individual daily life experiences (Lutovac & Kaasila, 2014; Sfard & Prusak, 2005; Vignoles, Schwartz & Luyckx, 2011). Identity process necessitates a long period instead of a certain one. Individuals may have different identities (e.g., race, cultural, religion etc.) **according to various environments and situations (Askin, 2007). As mathematics is intertwined in today's world, it calls for inevitably having a math identity.**

#### *Construction of Mathematics Identity and Teacher*

One of the main components of identity arises from spiritual willingness which emerges self-identity as a social phenomenon. From this point of view, identity is related to how a person sees him/herself and how (s)he looks around and reflects his/her characteristic outside. This is valid for defining the mathematics identity. Needless to say, previous feelings and behaviors may give some clues of the past, **present and expected future situations for understanding mathematics identity (Yildirim, 2019).**

Lutovac and Kaasila (2011) stated that mathematical identity emerged through narratives as an interaction process between the individual and social mathematical context. Past, present and future mathematical identities deeply reflect self-assessment process that provides awareness of the tension between the state of the present and ideal (expected) mathematical identity through narratives. Math identity, as a contextual concept similar to teacher identity and other narrative identities, can be obtained via various contexts or social relationships (Kaasila, 2007).

**A person's math identity can be expressed as part of his/her narrative identity, such as identity in social life.** A person's mathematical identity emerges when telling stories about his/her experiences of learning mathematics or teaching mathematics. Teachers' negative thoughts about mathematics may stem from **their earlier experiences with mathematics (Trujillo & Hadfield, 1999; Uusimaki & Nason, 2004; Yildirim, 2019).** Thus, this study, which sees identities as narratives, is unique to examining teachers' mathematical identities. Lutovac and Kaasila (2012) stated that people build their mathematical identities via stories consisting of their mathematics-related experiences. In other words, they suggest that telling stories facilitates and re-builds math identity (Darragh, 2016; Ricoeur, 1992). Therefore, investigating how teachers' experiences shape their narratives is very crucial for mathematics education. Also, mathematics-related identities will enable teachers to understand how they themselves define their own mathematics identities (Lutovac & Kaasila, 2018).

If we, as teachers and math educators, realize our own mathematical identities, an effective mathematics teaching may be accomplished in the classroom environment. Indeed, such an effective math teaching equips students with a positive identity and motivates students to engage in out-of-school mathematics activities (Leatham & Hill, 2010).

In any educational process, teachers should be a good model for their students as well as teaching their lessons. The purpose of primary school curriculum is to equip students with basic skills and knowledge, and train them to be a good role model for each **lesson and life. This increases primary school teachers' responsibilities of mathematics lesson.** Primary school teachers, who are very effective in making sense of mathematics, may increase students' educational levels and create their positive/negative math identities. Because primary school constructs mathematics learning and its underlying concepts/principles, primary school **teachers play a significant role in shaping students' math learning according to other factors (Gürbüz & Yıldırım, 2016).** For this reason, this research specifically selected a primary school teacher. A teacher, who has negative feelings about mathematics, has difficulties at promoting positive emotions about mathematics for his own students. In considering this, it was hypothesized that the primary school teacher would create a positive mathematics teacher identity by **reviewing his attitudes, thoughts, and behaviors about mathematics (Yıldırım, 2019).**

Some researchers have only examined professional identities of prospective mathematics teachers (Akkoç et al. 2014; Dede & Akkoç, 2016). In these studies, the identities of why mathematics teaching was chosen were examined with stories. Among these stories, it was determined that mathematics achievement, love of mathematics and teacher factors was effective in choosing to teach mathematics. **No study was conducted on seeking a primary school teacher's math identity In Turkey. This means** that this study is the first in mathematics identity research in Turkey. In addition, earlier studies about identities (Boaler & Staples, 2008; Hossain, Mendick & Adler, 2013; Izadinia, 2013; Kaasila, 2007; Lutovac & Kaasila, 2011; Owens, 2008; Solomon, 2007) examined school periods under a single term. Apart from these studies, the current study concentrated on four periods (primary school, middle school, high school, and university) to better identify which periods affect his mathematics identity. Also, we aim to examine teachers' math teaching period with these four periods. Thus, examining teachers' math identities will give more insights about how to train qualified teachers and how to achieve a better math learning. Therefore, the results of this study will shed more way towards future research.

## METHODOLOGY

This study used narrative research to **examine a primary school teacher's mathematics identity.** Narrative research aims to examine people's experiences about a topic or situation through their self-stories/experiences (Clandinin & Connelly, 2000; Creswell, 2007). A narrative study needs a **chronological order (Cortazzi, 2014; Elliot, 2005).** This research defined a **primary school teacher's math identity and used narrative identity through narratives.** Given Ricoeur's (1992) and Sfard and Prusak's (2005) definitions, teachers' identities are collections of stories they have told about themselves. Thus, these stories are important to understand their identities (Singer, 2004). This study tried to determine **a primary school teacher's math identity via self-stories and mathematics experiences.** In fact, because different situations and/or experiences may emerge different identities, identity should be handled within a context (e.g., a primary school teacher with negative math experiences). That is, identity has a contextual role rather than a constant case (Hodgen & Askew, 2007; Kaasila et al. 2012).

### *Study Group*

The study used purposeful sampling, which selects a suitable sample to respond to the main research problem(s) or research questions (Creswell, 2013). The current study administered a questionnaire with open-ended questions to 16 primary school teachers to unveil their mathematics experiences. Then, the authors selected a primary school teacher given his responses and the purpose of this study.

Narrative studies suggest that the study group should consist of one or more people in order to determine their detailed stories or life experiences (Clandinin & Connelly, 2000; Creswell, 2007). The

current study chose a primary school teacher to express his specific experiences through the enriched narrative data instead of general expressions. The authors employed a pseudo name (Sinan) because **of ethical concerns and keeping his name in confidence. Sinan's parents possessed a low education level** and a weak socio-economic status. He was 42 years old and has been working as a primary school teacher for 16 years. He started his first teaching at a school in the Eastern Anatolia region of Turkey and worked at this school for three years. Later, he moved to the Southeastern Anatolia region of Turkey and has been working at a school in this province. He does not have a post-graduate degree. In addition, Sinan was very good at painting. Furthermore, Sinan is married with two children.

The second author, as a teacher, worked with Sinan for six years at the same school and noticed his negative math experiences and offered him to participate in the study. Sinan, who openly expressed himself, voluntarily participated in the study to address his troubles and share his experiences.

#### *Data Collection Tools*

Narrative studies use data collection tools such as autobiography, journal, researcher field notes, letters, interviews, interviews, family stories and biography (Clandinin & Connelly, 2000; Czarniawska, 2004). This study conducted narrative interviews with the primary school teacher to elicit his mathematics identity (Andersson, 2011; Graven, 2011). The narrative interview sessions asked the teacher to tell his life stories about mathematics and explain more specific experiences instead of general expressions. Through semi-structured interview questions, the authors asked teacher to explain his positive and negative disposition, and milestones in self-mathematics experiences. This study mainly focused on four educational levels (primary school, middle school, high school, and university) since he might have different variables and stories. In addition, because the study was conducted with the teacher, it also explored his math teaching period. Overall, the study examined his experiences within five periods (primary school, middle school, high school, university, math teaching).

After preparing questions accordingly, the authors conducted separate interview sessions for each term and informed the teacher beforehand. Such a procedure was purposed to make sure that the teacher would remember each period separately and avoid confusion. In addition, after completing all interview sessions, the authors carried out another session to elicit his general mathematical views and experiences as well as any missing issue that was not addressed in previous interviews. In other words, the data collection procedure lasted a total of six interview sessions. During each interview session, the authors also exploited follow-up questions to elaborate his responses through the narratives.

The interview duration covered a 15-month period approximately. The authors tape recorded interviews and conducted short-term interviews (1-2 minutes) to deepen some narratives. These short-term interviews helped to eliminate some unclear/missing points in the teacher's narratives. For example, the teacher stated his low math scores in nation-wide high stakes exams (named the KPSS and ÖSS), and the short-term interviews determined the number of his correct answers. Again, short-term interviews clearly clarified some cases of two themes.

#### *Data Analysis*

Narratives are a way to determine teacher identity clearly (Hodgen, 2011). The current study employed narrative analysis to yield themes and interpretive repertoires related to identity experiences. In the first stage of narrative analysis, the authors read Sinan's narratives many times to identify factors (own, family, teacher etc.) that have positive or negative effects on his experiences in regard to the five periods.

Within narrative analysis, the authors determined the themes and narratives about Sinan's mathematics **experiences via interpretative repertoires. McCulloch, Marshall, DeCuir - Gunby, J. T. and Caldwell's (2013) study framed the current study's themes of identity** experiences. Moreover, the authors produced a variety of themes, which are different from those suggested by McCulloch et al. (2013).

We also framed their interpretive repertoires based on the work of Kaasila, Hannula and Laine (2012). Interpretive repertoires embrace individual texts, such as repeating themes (words), metaphors, displaying and persuasion within a certain grammatical structure (Potter, 1996; Wetherell & Potter, 1988). Kaasila et al. (2012) claim that interpretive repertoires describe people's experiences to enrich the analysis of identity narratives. Thus, we determined extreme statements, repetitions, contradictions, apologies, defense mechanisms and statements that need further explanation/investigation given based on the interpretive repertoires offered by Kaasila et al. (2012).

To ensure code validity and reliability in the coding process, the narratives were coded by two mathematics education experts. The codes obtained were analyzed by considering the encoder reliability formula of Miles and Huberman (1994). In qualitative studies, it was stated that a coding reliability of 80% and above is sufficient (Miles & Huberman, 1994). In the study, it was seen that the reliability was at a sufficient level because the coding reliability was 91%. After determining the themes and interpretive repertoires, they called Sinan to read and check his narratives whether they reflected his responses (Creswell & Miller, 2000). To sum up, the narrative analysis identified the factors that **positively or negatively affected Sinan's mathematics experiences.**

FINDINGS

**"I did 10 maths in my life, six for the ÖSS and four for the KPSS. Mathematics is one hundred percent of intelligence. When I could not do it myself, I thought I had lacked this intelligence. I hated mathematics... I did not understand much. How can I enjoy (math) teaching?"**

This section presents his mathematics identity and experiences obtained from the narrative analysis, and the factors affecting his mathematics identity and interpretive repertoires. Table 1 outlines Sinan's narratives of mathematics identity.

Table 1  
*A Summary of Sinan's Mathematics Identity*

	Primary School	Middle School	High School	University	Math Teaching
Identity Experiences	Negative turning point	Consistently frustrated	Consistently frustrated	Consistently frustrated	Small glitters
Interpretive Repertoires	Victim	Victim	Victim	Fatalist	Fatalist
	Fatalist	Fatalist	Fatalist		Ego-defensive
Factors Affecting Mathematics Identity					Gaining an insight
					Student
	Positive (+)	Own			<b>Student's family</b>
					Negative student experiences

					Own
			Own	Teacher	Student
	Teacher	Teacher	The nature of mathematics	Own	Worked school
Negative (-)	Family	The nature of mathematics	Friend	University	Environment
			Family		Student's family
					Curriculum

From the identity experiences of Sinan teacher, 3 different themes and 4 different interpretive repertoires were identified. In addition, it was found that 4 of the factors affecting the mathematics identity of Sinan teacher were positive and 10 factors were negative.

**Sinan's narratives of mathematics identity revealed that he had a positive identity in the first grade of primary school and was successful in mathematics. A new teacher in the second grade resulted in a turning point in his mathematics life. This change had a negative impact on his mathematics experiences. In other words, Sinan's mathematics identity altered from positive to negative after this new teacher. He emphasized his teacher's ill-treatments (insult, beating) when he remembered a mathematics lesson in his primary school. These situations left negative effects on his mathematics identity. In addition, his mathematics identity was negative in other periods because of the new teacher. Along with the second grade, Sinan's mathematics success also decreased.**

**Despite Sinan's positive narratives of mathematics experiences in the primary school, the second grade turned into a more negative situation against mathematics. Thus, his primary school experiences fell into the theme "Negative turning point." Again, two interpretative repertoires were identified from his primary school experiences on mathematics. The first interpretative repertoire yielded the theme "Victim" based on a lot of overexpression in his narratives. Also, he strongly emphasized the primary school teacher's threat. His negative beliefs of mathematics and weak math skills appeared the theme "Fatalist" for the second interpretative repertoire. In addition, "own" had a positive effect on the mathematics identity of in primary school, but his teacher and his family had a negative effect.**

**Sinan's mathematics identity in the middle school period was negative in that he always used negative expressions in his narratives during this period. Sinan's mathematics failure caused a negative effect on his mathematics identity and attributed his math identity to negative teachers. He also emphasized that the teachers taught procedural mathematics and did not enable him to comprehend the logic of mathematics or mathematical reasoning.**

**Sinan's middle school narratives which contained negative expressions/memories and low mathematics success occurred the theme "consistently frustrated". Again, his middle school experiences of mathematics emerged two interpretative repertoires the themes of "Victim" and "Fatalist." The theme "Victim" seems to have connected negative reasons in the middle school narratives to his middle school mathematics teachers. For the theme "Fatalist," Sinan depicted negative beliefs about mathematics and especially weak math skills in the primary school. In addition, Sinan did not have a positive effect on mathematics identity in his secondary school years. That is Sinan, his teachers and the nature of mathematics had a negative effect on his mathematics identity.**

**Sinan's mathematics narrations of high school were negative in that he had low mathematics success and difficulties at comprehending abstract mathematics subjects. This situation negatively influenced his mathematics identity. He also stated that he was unsuccessful in the nation-wide high-stake exam**

(called ÖSS), which is compulsory for placing and enrolling a university. In other words, Sinan's negative experiences resulted in a negative mathematics identity.

**Sinan's negative statements and unsuccessful sentences of his high school narratives appeared the theme "consistently frustrated" and two interpretative repertoires-- the themes "Victim" and "Fatalist." In this period, his negative disposition yielded the theme of "Victim" as the first interpretative repertoire for the high school narratives.** In these years, Sinan frequently used many math expressions as the second interpretative repertoire (Fatalist). Even though Sinan did not have a positive effect on his mathematics identity Sinan, his teachers, family, friends, and the nature of mathematics had a negative effect on his mathematics identity.

Sinan possessed numerous difficulties in mathematics lessons and failed them even though he took these lessons repeatedly during the university period. **Sinan's** mathematics success was low in this period and had a very negative mathematics identity. In addition, Sinan emphasized that the university education did not contribute to his mathematics knowledge. During the mathematics teaching period, many factors affected Sinan's mathematics identity. Some of them had negative effects, while others received positive ones. **Sinan's** all narratives, except for a few positive expressions, contained negative expressions. This period indicated that Sinan still hated mathematics.

**Sinan's negative beliefs, low ability and success, and negative expressions of university education emerged the theme "consistently frustrated." The theme "consistently frustrated" was apparent for Sinan's middle school, high school, and university periods. One interpretative repertoire was identified from his experiences of mathematics and university.** During these years, Sinan used many sentences and extreme phrases about mathematical failures. These negative narratives about mathematics pointed to the theme "Fatalist" as the second interpretative repertoire. In addition, the university period displayed that Sinan had a negative impact on his mathematics identity of the university education.

Sinan stated that he did his mathematics identity without teaching despite the fact that he had difficulties in understanding and explaining mathematics. However, his past-negative experiences sometimes had positive effects on his classroom practices. For example, when his students did not understand, he remembered his past and how he did not understand math and used different methods to enhance his **students' learning capacities. In other words, Sinan had a negative math identity during his math teaching period. Although Sinan's mathematics identity started positively in his first-grade at the primary school, a new teacher in his second-grade turned it into a negative mathematics identity.** This negative math identity continued through all successive periods. He even emphasized that he did not encounter any good mathematics teacher. However, according to the factors determined in his narratives, "own" was found to be an effective factor in having a negative mathematics identity. Sinan has always had a negative view against mathematics. Moreover, it has now been determined to be very negative towards mathematics.

Almost all his mathematics narratives included negative expressions and a few positive ones in math **teaching period. His negative and positive narratives emerged the theme "Small Glitters" for his teaching experiences.** Three interpretative repertoires were identified from his narratives of mathematics. He used many negative words and extreme phrases as the first interpretative repertoire. Based on his **negative narratives of mathematics, appeared the theme "Fatalist" for this interpretative repertoire.** In the second interpretative repertoire, Sinan made contradictory sentences in some parts of his narratives during his teaching years. These contradictory sentences at the teaching narratives pointed to the theme "Ego-Defensive" as the second interpretative repertoire. In the third and last interpretative repertoire, Sinan especially used his negative mathematics narratives. Sinan tried to create positive experiences for his students by drawing lessons from his negative mathematics experiences. A shift from his negative experiences to positive learning outcomes emerged the theme "Gaining an Insight" as the third interpretative repertoire. In addition, from his narratives it was identified the positive and negative factors affecting his mathematics identity. Students and their families have both positive and negative effects on Sinan's mathematics identities. In mathematics teaching period, his past-negative experiences (when he was a student) had positive effects Sinan's mathematics identity. It was also determined that

the syllabus of mathematics curriculum of the school and primary school he worked at negatively contributed to Sinan's mathematics identity. The teacher had a negative impact on his math identity in that he disliked explaining mathematics and did not do his teaching profession voluntarily.

Table 2 summarizes Sinan's five periods for his narratives and mathematical identities. Sinan's mathematics identity was green in the beginning of his primary school. However, all successive periods were red which carries the meaning of a negative disposition.

Table 2

*Some Expressions from His Narratives and Math Identity with A Coloured Strip*

Primary School	<ul style="list-style-type: none"> <li>- We started rhythmic counting in the classroom, I had no problems with rhythmic counting. I could quickly count two by three back and forth.</li> <li>- Unfortunately my math life upset with the teacher change in the 2nd year. He hit me the greatest blow.</li> </ul>
Middle School	<ul style="list-style-type: none"> <li>- I understood a few things. I did not. So you need to understand, pass by heart, there is no logic.</li> <li>- I have never understood issues such as simplification and factorization in mathematics.</li> </ul>
High School	<ul style="list-style-type: none"> <li>- For example, tangent alpha beta in mathematics in that geometry, I did not even want to hear it when I heard about it. What the hell are these?</li> <li>- When I was in high school, when my condition was weak, I could not get enough mathematics knowledge. We said, we could not do math anymore. We said that we were not someone with mathematics intelligence and we left. We finished the event.</li> <li>- For example, we saw permutation, combination, probability. These subjects were very abstract and difficult for me.</li> </ul>
University	<ul style="list-style-type: none"> <li>- The education I received at the university did not make a contribution to my mathematics.</li> <li>- We went to university, we had no chance to <b>pass again. I could not do it again... I took the math from the first year... We went to the second year. I took the math again because I failed it.</b></li> <li>- There were 45 maths questions in the KPSS, I did 4 maths in 45 minutes. But there was no place left in the question book that I did not draw.</li> </ul>
Teaching	<ul style="list-style-type: none"> <li>- What should I do after this age? I do not think it will add anything to me. I do not even look. I'm already exhausted... I hate from mathematics... I have always had a negative opinion and I'm negative now.</li> <li>- Now, do I like teaching very much, no I do not love it. I'm having a hard time. Especially in mathematics. I do not understand much. I'd like to tell.</li> <li>- I do not get angry with children when I can not understand myself. I'm returning, I'm telling them again.</li> </ul>

## DISCUSSION AND CONCLUSION

This study aims to examine the primary school teacher of mathematics identity via self-narratives. For this purpose, his narratives were divided into five periods (primary school, middle school, high school,

university, and math teaching) and examined. His mathematical experiences were separated into themes for these five periods. Also, the interpretative repertoires in his narratives were determined. In addition, negative and positive factors affecting his mathematics identity were identified.

Three themes were obtained from the identity experiences of Sinan as a teacher (consistently frustrated, negative turning points and small glitters). The first and second themes show similar characteristics with those suggested by McCulloch et al. (2013). The third theme is somewhat a different feature from that of McCulloch et al. (2013), and this theme has been given a new theme name (Small Glitters).

His narratives emerged four interpretative repertoires: Victim, fatalist, ego defensive and gaining an insight. These are in harmony with those of Kaasila et al. (2012).

His narratives also showed the factors affecting his mathematics identity positively and negatively. **Sinan, his students, and the students' family had both positive and negative effects on his mathematics identity.** Apart from these factors, the only positive factor affecting his mathematics identity was his previous negative experiences. Further, **Sinan's** teachers, family, friends, university, school, curriculum, and the nature of mathematics had a negative effect on his mathematics identity.

**Given Sinan's** narratives, "own" factor had both positive and negative effects on his mathematics identity. **"Own" factor included such variables as Sinan's mathematics success or failure, their feelings** about mathematics, beliefs, ideas, and interests. In view of Lutovac and Kaasila (2012) and Grootenboer (2013), one's knowledge, beliefs, understanding, attitudes, and emotions play a pivotal role in his/her **mathematical identity. That is, teachers' mathematics beliefs and affective features have great effects** on their professional development and changes (Hodgen & Askew, 2007). This study showed that mathematics-related negative emotions negatively affected mathematics identity. In addition, DeBellis and Goldin (2006) emphasized the importance of mathematical predisposition to develop positive relationships with mathematics. In a similar vein, related literature addresses that mathematics failure greatly affects mathematical identity (Drake et al. 2001; Grootenboer & Zevenbergen, 2008; Leatham & Hill, 2010; Wood, 2013). As **a matter of fact, Sinan's low mathematics achievement levels in all** educational periods seem to have caused his negative mathematics identity.

The related literature states that past experiences affect the development of identity (Grootenboer & Zevenbergen, 2008; Jita & Vandeyar, 2006; Lamote & Engels (2010). Franzak (2002) labeled the factors affecting the development of identity under three groups: before teacher education, during teacher **education and throughout teaching career. People's individual experiences** shape meaningfully their mathematical identities (Black et al. 2009; Kaasila et al. 2008; Kaasila, 2007). Similarly, this study found that many negative experiences in his narrations were pertaining to his past mathematics experiences that affect the development of mathematics identity.

**Sinan's teachers negatively affected his mathematics identity. Socio-cultural perspectives** in various contexts or learning communities make math identity interact with others (Bjuland et al. 2012; Van Zoest & Bohl, 2005). **Given Sinan's narratives, his teachers negatively affected his mathematics identity** during his student years (Boaler, 2015; Brodie, 2011; Drake et al. 2001; Hodgen & Askew, 2007; Wood, 2013). Sinan saw his teachers as a source of his victimization. Nevertheless, Sinan tried not to reflect and/or transmit his negative math identity to his students. His behaviors were observed in other similar studies (Hagger & Malmberg, 2011; Martino, & Sabena, 2011).

**The 'friends' factor affects the development of** identity (Hodgen & Askew, 2007; Lamote & Engels, 2010). McCulloch et al. (2013) found that friends positively and negatively affected their mathematics **experiences. Similarly, Sinan's high school friends negatively affected his mathematics identity. Given the idea of how family affects the development of a person's identity (Lamote & Engels, 2010), Sinan's** family had a negative impact on his mathematics identity. It was observed that this situation was not supported by the family and the use of negative sentences used by family members. McCulloch et al. (2013) **emphasized that students' families might increase or decrease self-confidence** in mathematics.

The nature of mathematics affects attitudes towards mathematics. That is, mathematical difficulties cause **negative emotions (Leatham & Hill, 2010)**. Given Sinan's narratives, the abstract nature of high school mathematics negatively affected his mathematics identity.

Sinan's narratives indicated that his university education did not contribute to his mathematics identity. Interestingly, his university education had a negative effect on his mathematics identity. Similarly, some studies reported that prospective teachers did not have opportunities to develop their math identities and equip them with their needed skills (Chronaki & Matos, 2014; Essien, 2014; Hossain et al. 2013; Neumayer-Depiper, 2013).

**Teachers' positive or negative identities directly affect their teaching processes (Adams, 2013; Clark et al. 2014; Gujarati, 2013; Hobbs, 2012; Ma and Singer-Gabella, 2011; Martino & Sabena, 2011; Van Putten et al. 2014; Williams, 2011)**. Sinan's math teaching experiences revealed that even though his math identity contained his negative experiences, his math identity sometimes positively affected his mathematics teaching processes. He planned some in-class activities to create positive experiences for his students by taking his past-negative experiences into account. For example, this process enabled him to empathize with his students, who did not understand math lessons. This case is consistent with **Goulding's (2007) statement "a teacher with a negative identity is good at understanding the students' faced difficulties."** It is emphasized that this situation may lead to the emergence of teachers who may have protected their students against mathematics (Barton et al. 2005; Hagger & Malmberg, 2011). Needless to say, Sinan may have defended his students against mathematics. Such a defensive behavior may result in simplifying mathematics and making it appear easy to dismiss any mathematics difficulties.

Given his narratives concerning math teaching period, his past-periods positively and negatively influenced his mathematics identity of the teaching period. This finding supports the relevant literature (Leatham & Hill, 2010; Lutovac & Kaasila, 2011; Op't Eynde et al. 2006). **Although the teacher identity interacts with such various contexts such as the school and student's family (Bjuland et al. 2012; Hamman et al. 2010)**, none of earlier studies has investigated the relationship(s) between mathematics identity and these variables. Sinan's narratives showed that the factor "student family" had both positive and negative effects on his mathematics identity. Also, the factor "worked school" had a negative effect on his mathematics identity. Lasky (2005) and White (2009) depict that school's structure and school culture also play an important role in the development of teacher identity. Further, school interactions and environment guide people's actions and therefore affect the teacher identity (Beijaard et al. 2004; Lutovac & Kaasila, 2011; Op't Eynde et al. 2006).

Education policies and curriculum are effective in generating the teacher identity (Gellert, 2013; Langer-Osuna & Esmonde 2017; Samuel & Stephens, 2000; Woolhouse & Cochrane, 2015). As a matter of fact, Sinan had some difficulties at comprehending and implementing the related curriculum. He stated that the curriculum was replete with much more concepts/topics and intense knowledge. Likewise, the related literature depicts that **some teachers' math teaching difficulties come from some subjects in the mathematics curriculum (Jita & Vandeyar, 2006; Macnab & Payne, 2003; Neumayer-Depiper, 2013)**.

As a result, teachers with negative mathematics identity will have pitfalls at educating creative and innovative students. Especially, primary school teachers who act as a role-model for their students play a crucial role in shaping and developing their advanced learning process as compared with other factors (Yıldırım, 2013). Phrased differently, a teacher, who dislikes mathematics and does not have math skills, **gives a limited chance for his/her students to create a positive math identity. Considering that a teacher's math identity may pedagogically pass to his students, a positive mathematics identity is quite important for all teachers (Yıldırım & Gürbüz, 2017)**. With a few correct answers in math, a student can be accepted into a "Primary school teacher program", it is important that primary school teachers have healthy identities. Therefore, the qualifications of primary school teaching programs are of great importance. The fact that Turkey lacks research towards teachers in mathematics identity makes this work even more valuable.

## IMPLICATIONS

1. **Because teachers' past-negative** experiences engender their negative mathematics identities, pre-service and in-service educations should afford teachers to positively rebuild their mathematics identities.
2. Since the relevant literature has mostly focused on **prospective teachers' identities, future studies** should be conducted with in-service teachers to satisfactorily examine their identities.
3. Teacher education programs should be enriched with courses and practices that affect math identity.
4. Identity studies can be carried out with an integrated method instead of a single term.
5. Since the qualitative research method is used in the study, other studies can be done by using the mixed method (quantitative + qualitative).

## REFERENCES

- Adams, G. (2013). Women teachers' experiences of learning mathematics. *Research in Mathematics Education, 15*(1), 87-88.
- Akkoç, H., Yeşildere-İmre, S., & Balkanlıoğlu, M. A. (2014). Examining professional identity through story telling. *Research in Mathematics Education, 16*(2), 204-205.
- Andersson, A. (2011). A "curling teacher" in mathematics education: Teacher identities and pedagogy development. *Mathematics Education Research Journal, 23*(4), 437-454.
- Aşkın, M. (2007). Identity and dressed identity. *The journal of Social Sciences Institute of Ataturk University, 10*(2), 213-220.
- Barton, B., Paterson, J., Kensington-Miller, B., & Bartholomew, H. (2005). Dodging the dragon: Strategies for mathematics professional development in low socio-economic areas. *Mathematics Education and Society Proceedings of the 4th International Mathematics Education and Society Conference*, (pp. 161-170).
- Beijaard, D., Meijer, P. C., & Verloop, N. (2004). Reconsidering research on teachers' professional identity. *Teaching and Teacher Education, 20*(2), 107-128.
- Bibby, T. (2010). *An 'Impossible Profession?': Psychoanalytic Explorations of Learning and Classrooms*. Routledge.
- Bjuland, R., Cestari, M. L., & Borgersen, H. E. (2012). Professional mathematics teacher identity: Analysis of reflective narratives from discourses and activities. *Journal of Mathematics Teacher Education, 15*(5), 405-424.
- Black, L., Mendick, H., & Solomon, Y. (Eds.). (2011). *Mathematical relationships in education: Identities and participation*. Routledge.
- Boaler, J. (2015). *Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages and innovative teaching*. John Wiley & Sons.
- Boaler, J., & Staples, M. (2008). Creating mathematical futures through an equitable teaching approach: The case of railside school. *Teachers College Record, 110*(3), 608-645.
- Brodie, K. (2011). Book review: Mathematical relationships in education: identities and participation, edited by Laura Black, Heather Mendick, & Yvette Solomon (2009). *Educational Studies in Mathematics, 76*(2), 237-241.
- Chronaki, A., & Matos, A. (2014). Technology use and mathematics teaching: Teacher change as discursive identity work. *Learning, Media and Technology, 39*(1), 107-125.
- Clandinin, D. J., & Connelly, F. M. (2000). *Narrative inquiry: Experience and story in qualitative research*. San Francisco, CA: Jossey-Bass Publishers.
- Clark, L. M., DePiper, J. N., Frank, T. J., Nishio, M., Campbell, P. F., Smith, T. M., ... & Choi, Y. (2014). Teacher characteristics associated with mathematics teachers' beliefs and awareness of their students' mathematical dispositions. *Journal for Research in Mathematics Education, 45*(2), 246-284.
- Cortazzi, M. (2014). *Narrative analysis*. Routledge.
- Creswell John, W. (2007). *Qualitative inquiry and research design: Choosing among five approaches*. Sage Publications.

- Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.)*. Thousand Oaks, CA: Sage.
- Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice, 39*(3), 124-130.
- Czarniawska, B. (2004). *Narratives in social science research*. Sage.
- D. J. Clandinin & F. M. Connelly, *Narrative inquiry: Experience and story in qualitative research*, San Francisco, CA: Jossey-Bass Publishers, 2000.
- Darragh, L. (2016). Identity research in mathematics education. *Educational Studies in Mathematics, 93*(1), 19-33.
- DeBellis, V. A., & Goldin, G. A. (2006). Affect and meta-affect in mathematical problem solving: A representational perspective. *Educational Studies in mathematics, 63*(2), 131-147.
- Dede, H. G., & Akkoç, H. (2016). A comparison of professional identity of pre-service mathematics teachers in pedagogical formation program and undergraduate teacher education program. *Turkish Journal of Computer and Mathematics Education, 7*(1), 188-206.
- Di Martino, P., & Sabena, C. (2011). Elementary pre-service teachers' emotions: shadows from the past to the future. *Current state of research on mathematical beliefs XVI, proceedings of the MAVI-16 conference*, (pp. 89-105).
- Drake, C., Spillane, J. P., & Hufferd-Ackles, K. (2001). Storied identities: Teacher learning and subject-matter context. *Journal of Curriculum Studies, 33*(1), 1-23.
- Elliot, J., (2005). *Using narrative in social research: Qualitative and quantitative approaches*. CA: Sage Publications.
- Engle, R. A., Langer-Osuna, J. M., & McKinney de Royston, M. (2014). Toward a model of influence in persuasive discussions: Negotiating quality, authority, privilege, and access within a student-led argument. *Journal of the Learning Sciences, 23*(2), 245-268.
- Esmonde, I. (2009). Mathematics learning in groups: Analyzing equity in two cooperative activity structures. *The Journal of the Learning Sciences, 18*(2), 247-284.
- Essien, A. A. (2014). Examining opportunities for the development of interacting identities within pre-service teacher education mathematics classrooms. *Perspectives in Education, 32*(3), 62-77.
- Foucault, M. (1982). The subject and power. *Critical Inquiry, 8*(4), 777-795.
- Franzak, J. K. (2002). Developing a teacher identity: The impact of critical friends practice on the student teacher. *English Education, 34*(4), 258-280.
- Gellert, U., Espinoza, L., & Barbé, J. (2013). Being a mathematics teacher in times of reform. *ZDM, 45*(4), 535-545.
- Goulding, M. (2007, January). Mathematical subject knowledge in primary teacher training- A view from England and Wales. In *Nuffield Mathematical Knowledge for Teaching Seminar Series. Retrieved* (Vol. 19, p. 2013).
- Graven, M. (2011, July). Creating new mathematical stories: Exploring potential opportunities within maths clubs. In *Proceedings of the Seventeenth National Congress of the Association for Mathematics Education of South Africa* (pp. 161-170).
- Grootenboer, P. (2013). The praxis of mathematics teaching: developing mathematical identities. *Pedagogy, Culture & Society, 21*(2), 321-342.
- Grootenboer, P., & Zevenbergen, R. (2008). Identity as a lens to understand learning mathematics: Developing a model. *Navigating Currents and Charting Directions, 1*, 243-250.
- Gujarati, J. (2013). An "inverse" relationship between mathematics identities and classroom practices among early career elementary teachers: The impact of accountability. *The Journal of Mathematical Behavior, 32*(3), 633-648.**
- Gürbüz, R., & Yildirim, K. (2016). An investigation of mathematics anxiety of primary school teachers. *Turkish Journal of Computer and Mathematics Education, 7*(3), 536.
- Hagger, H., & Malmberg, L. E. (2011). Pre-service teachers' goals and future-time extension, concerns, and well-being. *Teaching and Teacher Education, 27*(3), 598-608.
- Hamman, D., Gosselin, K., Romano, J., & Bunuan, R. (2010). Using possible-selves theory to understand the identity development of new teachers. *Teaching and Teacher Education, 26*(7), 1349-1361.
- Hobbs, L. (2012). Examining the aesthetic dimensions of teaching: Relationships between teacher knowledge, identity and passion. *Teaching and Teacher Education, 28*(5), 718-727.

- Hodgen, J. (2011). Knowing and identity: A situated theory of mathematics knowledge in teaching. In *Mathematical Knowledge in Teaching* (pp. 27-42). Springer, Dordrecht.
- Hodgen, J., & Askew, M. (2007). Emotion, identity and teacher learning: Becoming a primary mathematics teacher. *Oxford Review of Education*, 33(4), 469-487.
- Holland, D. C., Lachicotte Jr, W., Skinner, D., & Cain, C. (2001). *Identity and agency in cultural worlds*. Harvard University Press.
- Hossain, S., Mendick, H., & Adler, J. (2013). Troubling "understanding mathematics in-depth": Its role in the identity work of student-teachers in England. *Educational Studies in Mathematics*, 84(1), 35-48.
- Izadinia, M. (2013). A review of research on student teachers' professional identity. *British Educational Research Journal*, 39(4), 694-713.
- Jita, L., & Vandeyar, S. (2006). The relationship between the mathematics identities of primary school teachers and new curriculum reforms in South Africa. *Perspectives in Education*, 24(1), 39-52.
- Kaasila, R. (2007). Using narrative inquiry for investigating the becoming of a mathematics teacher. *ZDM*, 39(3), 205-213.
- Kaasila, R., Hannula, M. S., & Laine, A. (2012). "My personal relationship towards mathematics has necessarily not changed but..." analyzing pre-service teachers' mathematical identity talk. *International Journal of Science and Mathematics Education*, 10(4), 975-995.**
- Kaasila, R., Hannula, M. S., Laine, A., & Pehkonen, E. (2008). Socio-emotional orientations and teacher change. *Educational Studies in Mathematics*, 67(2), 111-123.
- Lamote, C., & Engels, N. (2010). The development of student teachers' professional identity. *European Journal of Teacher Education*, 33(1), 3-18.**
- Langer-Osuna, J. M., & Esmonde, I. (2017). Identity in research on mathematics education. *Compendium for Research in Mathematics Education*, 637-648.
- Lasky, S. (2005). A sociocultural approach to understanding teacher identity, agency and professional vulnerability in a context of secondary school reform. *Teaching and teacher education*, 21(8), 899-916.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge university press.
- Leatham, K. R., & Hill, D. S. (2010). Exploring our complex math identities. *Mathematics Teaching in the Middle School*, 16(4), 224-231.
- Lutovac, S., & Kaasila, R. (2011). Beginning a pre-service teacher's mathematical identity work through narrative rehabilitation and bibliotherapy. *Teaching in Higher Education*, 16(2), 225-236.
- Lutovac, S., & Kaasila, R. (2012). Dialogue between past and future mathematical identities. *Nordic Studies in Mathematics Education*, 17(3-4), 125-139.
- Lutovac, S., & Kaasila, R. (2014). Pre-service teachers' future-oriented mathematical identity work. *Educational Studies in Mathematics*, 85(1), 129-142.
- Lutovac, S., & Kaasila, R. (2018). Future directions in research on mathematics-related teacher identity. *International Journal of Science and Mathematics Education*, 16(4), 759-776.
- Ma, J. Y., & Singer-Gabella, M. (2011). Learning to teach in the figured world of reform mathematics: Negotiating new models of identity. *Journal of Teacher Education*, 62(1), 8-22.
- Macnab, D. S., & Payne, F. (2003). Beliefs, attitudes and practices in mathematics teaching: Perceptions of Scottish primary school student teachers. *Journal of Education for Teaching*, 29(1), 55-68.
- McCulloch, A. W., Marshall, P. L., DeCuir-Gunby, J. T., & Caldwell, T. S. (2013). Math autobiographies: A window into teachers' identities as mathematics learners. *School Science and Mathematics*, 113(8), 380-389.**
- Neumayer-Depiper, J. (2013). Teacher identity work in mathematics teacher education. *For the Learning of Mathematics*, 33(1), 9-15.
- Op't Eynde, P., De Corte, E., & Verschaffel, L. (2006). "Accepting emotional complexity": A socio-constructivist perspective on the role of emotions in the mathematics classroom. *Educational Studies in Mathematics*, 63(2), 193-207.**
- Owens, K. (2008). Identity as a mathematical thinker. *Mathematics Teacher Education and Development*, 9, 36-50.
- Potter, J. (1996). *Representing reality: Discourse, rhetoric and social construction*. Sage.
- Ricoeur, P. (1992). *Oneself as another*. University of Chicago Press.

- Samuel, M., & Stephens, D. (2000). Critical dialogues with self: Developing teacher identities and roles—a case study of South African student teachers. *International Journal of Educational Research, 33*(5), 475-491.
- Schifter, D. (1996). *What's happening in math class?* New York: Teachers College Press.
- Sfard, A., & Prusak, A. (2005). Telling identities: In search of an analytic tool for investigating learning as a culturally shaped activity. *Educational Researcher, 34*(4), 14-22.
- Singer, J. A. (2004). Narrative identity and meaning making across the adult lifespan: An introduction. *Journal of Personality, 72*(3), 437-460.
- Solomon, Y. (2007). Not belonging? What makes a functional learner identity in undergraduate mathematics? *Studies in Higher Education, 32*(1), 79–96.
- Stinson, D. W. (2013). Negotiating the "White male math myth": African American male students and success in school mathematics. *Journal for Research in Mathematics Education, 44*(1), 69-99.**
- Trujillo, K. M., & Hadfield, O. D. (1999). Tracing the roots of mathematics anxiety through in-depth interviews with preservice elementary teachers. *College Student Journal, 33*(2), 219-219.
- Uusimäki, L., & Nason, R. (2004). Causes Underlying Pre-Service Teachers' Negative Beliefs and Anxieties about Mathematics. *International Group for the Psychology of Mathematics Education.*
- van Putten, S., Stols, G., & Howie, S. (2014). Do prospective mathematics teachers teach who they say they are? *Journal of Mathematics Teacher Education, 17*(4), 369-392.
- Van Zoest, L. R., & Bohl, J. V. (2005). Mathematics teacher identity: A framework for understanding **secondary school mathematics teachers' learning through practice.** *Teacher Development, 9*(3), 315-345.
- Vignoles, V. L., Schwartz, S. J., & Luyckx, K. (2011). Introduction: Toward an integrative view of identity. In *Handbook of identity theory and research* (pp. 1-27). Springer, New York, NY.
- Wetherell, M., & Potter, J. (1988). *Discourse analysis and the identification of interpretative repertoires.* In C. Antaki (Ed.), *Analysing everyday explanation: A casebook of methods* (pp. 168–183). Sage Publications, Inc.
- White, K. R. (2009). Connecting religion and teacher identity: The unexplored relationship between teachers and religion in public schools. *Teaching and Teacher Education, 25*(6), 857-866.
- Williams, J. (2011). Teachers telling tales: The narrative mediation of professional identity. *Research in Mathematics Education, 13*(2), 131-142.
- Wood, M. B. (2013). Mathematical micro-identities: Moment-to-moment positioning and learning in a fourth-grade classroom. *Journal for Research in Mathematics Education, 44*(5), 775-808.
- Woolhouse, C., & Cochrane, M. (2015). Educational policy or practice? Traversing the conceptual divide between subject knowledge, pedagogy and teacher identity in England. *European Journal of Teacher Education, 38*(1), 87-101.
- Yıldırım, K. (2013). *An investigation of primary school teachers level of mathematics anxiety.* Master thesis. Adiyaman University, Adiyaman.**
- Yıldırım, K. (2019). *Investigation of mathematics identity of primary school teachers.* Doctoral Thesis. Adiyaman University, Adiyaman.**
- Yıldırım, K., & Gürbüz, R. (2017). A study of developing a mathematics anxiety scale for teachers. *Journal of Theory and Practice in Education, 13*(3), 392-410.