



Pre-service mathematics teachers' narrated failure: Stories of resilience

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ABSTRACT

In educational research, failure has often been touched upon as a by-product, but rarely has failure been investigated without attempting to find ways around it instead of attempting to simply understand it better. This paper provides insight into a pilot study on understanding math failure through narrative. I analyse two pre-service mathematics teachers' narratives about failure and identity in order to illustrate their personal understandings of their own failures. The analysed stories provide insight into the subjects and their failure resilience, and initiate a discussion on subjective understanding of resilience. These stories also illustrate the need to further research regarding the subjective understandings of failure in general and in math specifically.

1. Introduction

The concept of math failure has been included in many important discussions in mathematics education research, for example, in studies of learning difficulties (Heyd-Metzuyanim, 2013, 2015), achievement, motivation and engagement with mathematics (Baker, Gersten, & Lee, 2002; Boaler, Wiliam, & Brown, 2000), mathematics-related affect (Frezel, Thrash, Pekrun, & Götz, 2007) and school experiences (Lutovac, 2014; Lutovac & Kaasila, 2014; Di Martino & Zan, 2010; Hodgen & Askew, 2007). Failure in mathematics is, therefore, a familiar topic, as the subject has been considered intellectually and emotionally difficult for many students. However, failure has rarely been placed at the forefront of published research. In addition, the majority of the existing research on failure is comprised of quantitative studies (see for review, Johnson, Panagioti, Bass, Ramsey, & Harrison, 2017), conducted mostly in a manner where individual's response to failure was measured after receiving negative feedback. Arguably, the research has failed to understand this common phenomenon thoroughly, especially from a subjective viewpoint, such as by asking how an individual defines his or her own success or failure (Middleton & Spanias, 1999). This is surprising considering that Johnson et al. (2017) reported in their review that 'experiencing failure has marked emotional and psychological consequences across a range of individuals and settings' (p. 20). As the authors acknowledge, many suffer emotional ramifications, even after a single experience of failure.

My previous work has been confined to understanding future elementary school teachers' identities as they were shaped by negative experiences with mathematics and math anxiety (Lutovac, 2014; Lutovac & Kaasila, 2014). Among these math non-specialist pre-service teachers, the rhetoric of failure and identification as outsiders and victims in relation to mathematics appears to be common (Black et al., 2009; Di Martino & Zan, 2010; Hodgen & Askew, 2007). While we know that pre-service mathematics teachers report having had experienced mathematics learning in school in a more positive light and have developed a deep bond with the subject (Black et al., 2009), little is known about how they experienced and interpreted their failures. The earlier research findings then lead to the assumption that these two cohorts of pre-service teachers may have differing understandings of what failure is. Such

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subjective interpretations of success and failure are particularly important (Olson & Dweck, 2008), as they seem to shape how future teachers view a particular subject, themselves as learners and the emotions they experience in relation to a subject. In the long run, individual pre-service teachers' understandings of success and failure in math may influence their future teaching practices. Moreover, arguably, subjective accounts of failure could be an important factor in addressing math failure in research and in practice.

This paper reports on a beginning exploration into narrated failure in the context of mathematics. In an attempt to broaden understanding of math failure from the perspective of individual's subjective experience, I pursued a narrative approach, asking participants for their recollections of failure experiences and current thoughts on what failure is. I present two pre-service mathematics teachers' short stories of failure. Provided that both teachers pursue mathematics as their career choice, their stories of failure and their identities will revolve less around anxiety and more around resilience. This study therefore not only provides insight into this cohort of narrated subjects and failures, it also uncovers some aspects of their resilience to failure. While discussion on math resilience among pre-service teachers is a novelty as far as one can tell from the research literature (e.g., Lee & Johnston-Wilder, 2013), I also provide a discussion on subjective approach to understanding resilience to math failure. Research question guiding this study is: What is failure from the perspective of pre-service mathematics teachers' narratives?

2. Theoretical framework

2.1. Math failure

Several theories have offered explanations for why individuals fail and when they persevere. Weiner's (1985) attribution theory of motivation and emotion is perhaps the most widely used resource with its three dimensions of causal attributions: (1) locus of control can be internal or external, which means that an individual attributes the cause of failure to him or herself, or alternatively, to others; (2) when speaking of stability, the causes of failure can be understood as stable or unstable, that is, whether they can change or not; and finally, (3) controllability refers to whether or not the causes of failure can be controlled. In the context of mathematics, Clarkson and Leder (1984) showed that the attributions for success and failure differ in different cultural contexts. Similarly, expectancy-value theory (Eccles & Wigfield, 2002) has been used to discuss how individuals' expectations for success and subjective task value predict one's motivation and achievement. For example, in the context of mathematics, individual beliefs, such as self-efficacy beliefs and its power to explain the likelihood of success and failure, have been much investigated.

Zeldin and Pajares (2000) noted that an individual's beliefs about their mathematics ability affects the choices they make, the amount of effort they put forth, their resilience in the face of failure, their persistence and ultimately, the level of their achieved success. Perceived success has been shown to strengthen efficacy, and repeated failure to lower it (Bandura, 1997; see also Zeldin & Pajares, 2000). As suggested by Bandura (1986), failure and success, are both a matter of personal definition and personal standards. Therefore, if a student has high personal standards and expectations, the student will more likely interpret undesirable experiences as failure. In addition, Bandura (1997) discusses about the significance of personal beliefs about one's own abilities as these are likely to shape how resilient one may be in the face of failure. The positive effect of such self-efficacy beliefs is seen when students in the face of failure focus more on the strategies to handle their failure rather than ruminating and worrying about failure. It is understood that students' disbelief in one's own abilities will likely lead to failure (Bandura, 1997). While these and other theories have been significant in providing explanations for the 'why' of one's success and failure, they often fail to account for 'what is' math failure for each individual (Middleton & Spanias, 1999). This is because often, in research and in practice as well, there is a predefined understanding of what failure is, for example, a student's inability 'to solve the problems and discover the canonical solutions by themselves' (Kapur, 2014, p. 652). On the other hand, students' interpretation of their performance as failure may also lead to undesirable consequences. And these are the ones that need further attention.

2.2. Failure and mathematics identity

Math failure has also been linked to the concept of identity (Forster, 2000; Heyd-Metzuyanim, 2013, 2015). For example, Sfard and Prusak (2005) maintain that 'it is our vision of our own or other people's experiences that constitutes identities' and argue that identities act as self-fulfilling prophecies in determining learning and its success or failure (p. 17). It has been generally observed that failure, whether actual or perceived, rapidly integrates itself into one's sense of self and defines one's entire identity (see, e.g., Dweck, 2006). Di Martino and Zan (2010) explained that 'attributions of success/failure often provide information about the writers' beliefs about him/herself, thus contributing to outline his/her mathematical self-concept' (p. 40). Similarly, Olson and Dweck (2008) pointed out that it is the interpretation of certain experiences as failure that is important. Thus, a failed attempt to solve a math problem or the failure of a math exam easily becomes associated with such thoughts as, 'I am a failure', or 'I am just not a math person' (Heyd-Metzuyanim, 2013; Palmer, 2009; see also Black et al., 2009). These identifications may ultimately lead some individuals to choose pursuing mathematics as their career choice and others not.

Similar and other identifications have been discussed at length in the context of mathematics teaching (Lutovac & Kaasila, 2014; Graven & Heyd-Metzuyanim, 2019, 2018b, 2019b). For example, Hodgen and Marks (2009) noted that teachers define themselves in terms of their abilities and performance, which leads them to reproduce 'the inequitable mathematics that they themselves experienced' (p. 40). Heyd-Metzuyanim (2013) study discussed the significance of teacher-student interactions in construction of the identity of math failure. Similarly, in other stories about school experiences with mathematics, including failure, these are often associated with mathematics teachers (Lutovac, 2014; Hodgen & Askew, 2007; Perry, 2004; in general context see, e.g., Uitto et al., 2018). Pre-service elementary school teachers tend to use highly emotional utterances in their narrations, and multiple references to

the lack of math ability, past performance and grades as relevant indicators of their failure (Lutovac, 2014). Such attributions are said to lead to negative emotions, avoidance, less persistence and consequently, lower performance (Bandura, 1997; Zeldin & Pajares, 2000). Overall, research has shown that generalist and math specialist pre-service and in-service teachers have different relationships with mathematics (Black et al., 2009; Hodgen & Askew, 2007), and arguably, we can assume that failure plays a role in these differences.

2.3. Resilience to failure and individual mindset

Provided that people seem to experience failure differently, failure resilience becomes especially important to address. Psychological resilience is understood as a dynamic process rather than a personal trait (Chmitorz et al., 2018), and it is defined as a 'behavioral, attributional, or emotional response to an academic or social challenge that is positive or beneficial for development' (Yeager & Dweck, 2012, p. 303). The research into psychological resilience in response to stressful circumstances in one's life is extensive, and teacher resilience has become an increasingly addressed topic in educational research (Clarà, 2017; Le Cornu, 2009). Research on failure resilience, however, has been identified as scarce (see for review, Johnson et al., 2017). A similar scarcity of research on resilience can be observed in the context of mathematics, where Lee and Johnston-Wilder (2013) defined resilience as 'a positive adaptive stance to mathematics such that it will allow them [pupils] to continue learning despite barriers and difficulties' (p. 104). Therefore, we can speak of resilience when both some kind of failure and a positive resolution or outcome that follows are present. Research has also suggested that resilience is essential due to the nature of mathematics, the ways the subject is taught and students' ability beliefs (Lee & Johnston-Wilder, 2013).

While constructs, such as self-efficacy and locus of control have been used much to explain why some persist and others give up in the face of struggle or failure, I found Dweck and colleagues' (Dweck, 2006; Yeager & Dweck, 2012) work on mindsets particularly suitable for exploring resilience in narratives. Arguably, this framework provides a more holistic lens on the issue that is much akin to what the narratives have to offer. Yeager and Dweck (2012) define mindsets as 'implicit theories about the malleability of human characteristics' (p. 302) (also see Dweck, 2006). The authors acknowledge that particularly relevant to educational context are mindsets about intelligence and personality, although there are many others as well. Students then can be labelled as holding the fixed mindset, where they believe both traits are fixed and unchangeable; others hold growth mindset, wherein they see that both traits can change and develop over time. Students may also hold both, fixed and growth mindsets simultaneously, depending on the context (see Yeager & Dweck, 2012). Research on mindsets, arguably, represents the link between failure (and success) and resilience; individual attribution depends on the mindset of the student (Hong, Chiu, Dweck, Lin, & Wan, 1999). For example, fixed attributions may compromise an individual's resilience. Yeager and Dweck (2012) explain that what makes students more or less resilient are the following mindset variables: (1) goals, (2) beliefs about effort, (3) attributions for failure, and (4) the learning strategies adopted while facing a setback or failure. While the aim of this paper is not to explain, but rather display, what failure is and, consequently, what resilience is via pre-service teachers' narratives, the above discussed research findings on resilience and mindsets have informed the sense making of the data and will provide the language for interpreting pre-service mathematics teachers' short stories of failure.

3. Method

3.1. Data collection

Elsewhere, I built on Ricoeur's (1991) notion of narrative identity and defined pre-service teachers' identity in the context of mathematics as a story (Lutovac, 2014; Lutovac & Kaasila, 2014). Pre-service teachers' mathematics-related identity is then a story a pre-service teacher tells about their self in relation to the subject (also see van Putten, Stols, & Howie, 2014). In methodological terms, this view assumes that all the elements of the story are constituents of pre-service teachers' identity. Moreover, Sfard (2019) noted:

Stories are also these special spaces within which thinking becomes irrevocably tinted with emotions and where feelings get the power to navigate the course of thinking. Thus, under narrative definition, the study of identity and its relation to our activities become the scrutiny of the way identity stories emerge, of how they feed into one another, how they impact our actions and how they are impacted by our actions in return. (p. 558)

I build on these views, stating that the stories of failure inherently constitute in part pre-service teachers' identities. I use the terms 'narrative' and 'story' interchangeably.

The data for this study were collected in a didactics course for pre-service teachers of various subject disciplines, such as math, history, language, etc. The course was organized as a series of lectures on different topics tightly bound to the research expertise of the lecturers. Some examples of the topics are the teacher's role in facilitating group work, different ways of assessing student work, caring in teachers' work, inclusion, gender issues in teachers' work, etc. The writings I used as data were obtained as a task following a lecture on teacher identity, where students were instructed to write about their experiences of success and failure, and the way those experiences shaped their teacher identity. During the lecture, students became familiar with research on teacher identity and some examples of research done by the lecturer. Together with the lecturer, we devised a reflective task to be assigned to students. The task included the following sub-questions: (1) How do I, as university student, understand my failure in my own subject? (2) How do I, as a future teacher, understand my students' (pupils') failure in my subject, and what kind of impact does this have on my teacher identity? (3) How do I, as a future teacher, understand my own failure as a teacher, and what kind of impact does this have to

my teacher identity?

In total 80 writings/narratives of failure and identity were obtained. As the aim of the study was to look at failure in the context of mathematics, I focused on analysing only the data obtained from mathematics and science teachers, which rendered 16 writings. These stories were extracted to create a data set. After the initial analysis of this data set, I chose two pre-service teachers' writings in their raw, unedited form to present in this paper. I refer to these writings as short stories, and also analyse them as such. These writings were translated from Finnish language to English, the parts that do not link to the focus of this paper were omitted, but for the most part, they maintained their original form.

Teacher education studies that these students are undergoing are conducted in a research-based manner, which also means that the importance of research for designing their courses and studies is highlighted and students of various courses get familiarized with this principle. Students are also informed in detail whenever the work produced within any given course may be used as research material and are asked for a written consent. All students are usually required to complete such tasks as the one assigned here, however, they do not have to consent to their data being used for research purposes. Whether students give or do not give a consent, does not affect their completion of the individual course nor the studies. Likewise, the participants in question were aware their data may be used for research purposes and their consent have been obtained.

3.2. Narrative analysis and listening guide approach

The first step in analysis involved a holistic reading of 16 writings (Lieblich, Tuval-Mashiach, & Zilber, 1998), which demonstrated some common themes. All pre-service mathematics and science teachers reported successful experiences with math from their years at school where they received much positive appraisal from their teachers. They reported solving specific tasks and achieving high grades. For these individuals, the university level was often the first time they encountered failure, and they often reported it as a 'shock'. Their writings reveal a black-and-white understanding of failure akin to the way they see the nature of the subject, that is, either you do it right or you do it wrong. As I was interested not only in what was told about the failure, but also its link to narrator's identity, I noticed that in two stories, the authors almost rejected failure, not allowing it to enter their identity. I wanted to look into these two stories more closely, and have therefore chosen them—one male and one female—for closer examination; the results section presents Mikko's and Tiina's (both names are pseudonyms) short stories. I follow Yeager and Dweck (2012) recommendation that in addressing pre-service teachers' failure and resilience, it is their subjective understanding of failure that is crucial. For this reason, I present their raw, unedited stories, and analyse them holistically without pre-determined categories. This manner will highlight pre-service teachers' authentic voices and provide a better understanding of the meanings that these pre-service teachers assign to their experiences (Lieblich & Josselson, 1994).

In analysing the selected stories, I applied some of the suggestions made in the 'Listening Guide' approach (Doucet & Mauthner, 2008; Gilligan, Spencer, Weinberg, & Bertsch, 2006; Mauthner & Doucet, 2003), which allowed for an interpretative and multi-layered examination of the data via multiple readings. As suggested by Doucet and Mauthner (2008), I was flexible in how many times each story was read and in what way. The first reading of both stories was holistic (Lieblich et al., 1998). I was trying to get the 'feel' of the entire story, asking myself, 'What is happening in this story?' I wrote down my first impressions about each story, such as the development of the plot, and therefore character (also see Mishler, 1986). The second reading was more specific; I was looking for and underlined all the interesting and repeated words or utterances, which allowed for the emergence of specific themes. While this reading was done without any pre-determined categories, it came to my attention that what sparked my interest the most were those bits of text where the narratives of these two students were at odds with my previous research on pre-service elementary school teachers. In the third reading, I focused on the narrated subjects. This means that I paid special attention to how both Mikko and Tiina spoke about themselves in relation to failure. The 'I' sentences were of key importance here, as well as other personal pronouns such as 'you' or 'we'. While 'I' sentences highlight the main character at the centre of the story, other pronouns may reveal how the character relates the topic discussed and self to others and the world around them (Doucet & Mauthner, 2008). The fourth reading allowed for interpretations to be formed. I related what was known to me about narrated subjects and their experiences of failure with knowledge on narrated subjects obtained from my previous research. At this phase, the findings were linked to other relevant research on failure and failure resilience.

4. Results

In this section, I first present Mikko's short story followed by my interpretative summary and then Tiina's story, also followed by a summary.

4.1. Mikko's short story

Throughout primary school, schooling was never a challenge to me. I didn't have to do school stuff outside the classroom besides homework (sometimes not even that). I didn't have to study for the exams at all since I managed to get good grades without [studying]. So during primary school, I didn't experience any failures. Maybe because of that, it is now difficult for me to accept my failures, and I am my worst critic and enemy.

As I started upper-secondary school, I realized that I wasn't able to achieve the same results with the same amount of work I did in secondary school. Still, I was too lazy to invest in school more, so I ended up lowering my standards. That's how I didn't get any disappointments in high school either. In the university, I should have worked even more, but I kept lowering the standards and

avoiding the failures once again. If you count as a failure, for example, failing an exam, I have failed dozens of times in the university, but I'm still not disappointed in myself. You can always redo an exam and try again, start again, so failing is just a learning possibility. As it is, I don't take my failures very (if at all) seriously. I just move on.

My jovial attitude on the matter differs significantly from other people's attitudes. As for me, passing the course is enough, but for some, it is a catastrophe if they only get a four [the highest score at university studies is 5] from the course. Anyhow, I try to understand these people instead of only seeing it from my own perspective. As a teacher, it is important to understand students' different views on failing. Even though, as a teacher, you might feel that a student has succeeded nicely with 8 [the highest score in upper-secondary school is 10] on the exam, he/she can be very disappointed about his/her performance and feel like a failure. It is difficult to know beforehand how each student defines failure. When you have seen enough times how different students relate to their performances, you can try to create for yourself some sort of a pattern on the matter (and also strengthen your own identity).

Failures help you grow, and I feel that the failures related to school situations, I can handle without taking them too heavily. In other aspects of life, I cannot always react to my mistakes as rationally, but that is not the topic of this reflection diary.

Mikko's story begins with what is likely a typical story of a student who does well in school, succeeds in learning without much invested effort. As he states, he barely had to study and was able to achieve high grades. A turning point occurred in upper-secondary school, where the difficulty level rose, and Mikko was no longer able to keep his high grades with the same approach to learning. In order to resolve this situation, Mikko lowered his self-expectations. It appears that he was not particularly driven for academic success and did not feel the need or desire to invest the effort needed to attain the high grades that came about so easily earlier. Mikko maintained the same mindset all the way until university studies. His story reveals an easy-going, light feel when he speaks of lowering his expectations and avoiding the unease, disappointment and other unpleasant emotions associated with failure. An interesting aspect of Mikko's utterance 'if you count as failure failing an exam' points to the fact that Mikko does not necessarily experience a failed exam as failure. It appears that, specifically due to the possibility of retaking exams, trying again and again, he does not define failure as failed exams. Mikko also compares himself with others and recognizes he might have a different understanding of and ways of dealing with failure, and projects this knowledge to his future teaching profession where he might need to understand better those students whose threshold to label their performance as failure is much lower/higher. The end of Mikko's story reveals that he, indeed, seems not to be particularly affected by academic failure; in other settings, however, failures might come with greater emotional tolls.

4.2. Tiina's short story

I am an achiever. I have always done well in school and in life, with the minimum amount of effort. My family has been warm and safe. As I look at my life in the past, I have to admit that I have gotten and achieved everything I have ever wanted. Not until university did I begin to appreciate my success. Before university, I hadn't experienced a lot of 'great successes' because I had always known I was able to perform everything demanded of me. During university, succeeding in the studies on the level I had hoped for was no longer obvious, and has required a lot of real work. It has been repulsive to see how some of my fellow students are doing great without putting any effort into it. That has always been my part. Failing depends on the aims you set for yourself. The same result can feel like a great success for some, and a bitter failure for the other.

During my university studies, I have, on the moment of the failure, comforted myself with sentences like: 'I don't need this information as a teacher', 'Good thing I'm not gonna be a researcher' and 'This wasn't even that important for me'. I have beforehand lulled myself into thinking that it is not relevant for the sake of my profession that I'm barely passing the advanced math courses. The contents of the courses would not even be close to what I would actually be teaching. This is how I sort of reject the whole failure and feel that it never happened, and I can still hold on to the identity of an achiever. I know it's not very constructive, but it is the easiest way to go, considering my psyche. Even though the mathematical subjects have always been easiest for me, I know that's not the deal with everybody. However, this is difficult for me to understand. Throughout my whole life, I have surrounded myself with achievers like myself, especially now in the university; my whole circle of friends consists of mathematically and logically talented people. At this moment, the above-mentioned is my biggest flaw as I'm thinking my future career as a teacher. I know that the subjects I will teach, math, physics and chemistry, are very challenging for some of the students, but I cannot understand why. I have also performed well in traditional exam situations, and even though I know that for some people it causes a huge amount of stress, 'freezing' and underachieving, I simply just don't understand where it comes from. I don't feel I'm a cold person, but I might unintentionally demand too much from the people surrounding me. This is the side of myself I would like to develop, and I am constantly working on it.

However, it may be that after years of teaching experience, I will really be there. I feel like I'm failing as a teacher if no one learns anything or if everyone hates my lessons. I know already that I will take these things way too personally. Still, I trust what comes to my future. At the moment, I don't see why I should become a bad or failing teacher. I said before that I don't deal well with failures. It is true, but I also strongly trust that I will succeed, and I have this experience that I will manage in life. I'm not afraid of being a bad teacher because I know I am not. I acknowledge my weaknesses, and I strive to improve them. In the lecture, we talked about how a strong professional identity protects you from the bumps in your work life. Even though I haven't worked a single day as a teacher, still the identity of a teacher and pedagogue is strong in me, although perhaps a bit idealistic. I take failures in work personally, but I am not sensitive or fragile. I will manage.

Tiina's story begins in a very similar manner as Mikko's. She identifies as an 'achiever', which meant achieving high grades

without having to invest much effort into studying or anything else. As Tiina recounted, she always succeeded and achieved what she wanted. Tiina's first experiences of failure came at the university, which is also a period where she learned what success really means. For the first time, Tiina had to work hard to reach the success that came so easily earlier, and for the first time, she was seeing others succeed in the same fashion she was succeeding earlier. Tiina reflects upon failure and links it to one's own goal setting. She elaborated on an experience during her university studies when she consciously decided that a certain degree of failure is fine, as her goal for the future is not to be in academia, but to work as a teacher in school where the level of knowledge and skills she would need to teach math is not as high as it is demanded during the studies. She feels she has enough knowledge and skills to teach in a school. This kind of thinking, as Tiina states, helps her cope, and distance herself from failure. Like Mikko, Tiina pointed out that she can not easily relate to those who experience difficulties in mathematics, and labels this as her biggest weakness with respect to her future profession. Tiina struggles to understand why students see math and science challenging, why the assessment circumstances are frightening to some and lead them to underperform. That said, Tiina displays awareness of her own weaknesses, and, as she states, is currently working on them. Even though Tiina talks about failure from the perspective of being a teacher, she also distances herself from it. Her talk appears optimistic; she believes she can succeed in being a teacher as she succeeded in all other aspects of her life. Tiina believes in her own abilities as a teacher, and she projects her own future success.

5. Discussion

In this paper, I examined two pre-service mathematics teachers' stories about their math failures. These stories entwine many otherwise separately discussed theoretical constructs, which I bring together here in order to illuminate the findings. I purposively entwine my readings of the two stories with the knowledge provided by earlier research (including my own) on pre-service elementary teachers. In so doing, I hope first, to provide more versatile interpretations of the subjects, their math failures and their resilience, and second, to respond, at least theoretically, to the call for attending to less fragmented knowledge of/about various cohorts of teachers who are or will be teaching mathematics (Lutovac and Kaasila, 2018a, 2019a).

The protagonists of the two stories define failure in a very similar manner. For Mikko and Tiina, failure is a highly personal phenomenon related to their own goals and expectations as well as those that they may take upon themselves. While a failed exam may relate to failure for some, Mikko and Tiina do not necessarily define it as failure. This is interesting as research on pre-service elementary school teachers shows us that for many, a failed exam is failure (Lutovac, 2014). Instead, in Mikko's and Tiina's cases, failure is understood as a situation or a circumstance in which what was earlier experienced as success is no longer attainable without more effort. Because both pre-service teachers defined success as achieving high grades with little work or invested effort, failure was then understood as the unattainability of that state. The aspect of having to invest little effort is a central piece to their understanding of the puzzle of failure as they seem to measure how well they have succeeded or whether they have failed based on the effort they needed to invest. Despite experiencing some failures, Mikko and Tiina continue identifying themselves as achievers and as successful in mathematics by rethinking and redefining their self-expectations and their goals. By expecting little, Mikko faces little disappointment. Failure, in his view is not the end of the road; it can always be rectified. Similarly, Tiina evaluates her failures and comes to the realization that, in order to be a good school teacher, she does not need to succeed on the level that is expected from her in mathematics studies at university. Because for both, failure is defined in terms of goals and self-expectations, lowering their expectations and/or redefining their goals appears to be their strategy in the face of failure (Yeager & Dweck, 2012).

The stories examined could in part be read as echoing a 'fixed mindset' (Yeager & Dweck, 2012); however, arguably, rather than avoidance, they portray a certain dynamic in Mikko's and Tiina's mindsets. These individuals are acceptant of the changes they may undergo in their performance; their goals, efforts and strategies to handle failure are subject to change. I am of the opinion that Mikko's and Tiina's stories reflect the 'growth mindset' (Yeager & Dweck, 2012) as they believe they have the math ability needed, but their stories of failure and resilience significantly highlight individual goals and effort, the centrality of attributing failure to lack of effort rather than ability, and importantly, that the strategy for facing failure should involve self-examination of goals and managing of expectations—knowing when to persist and when to recruit more support or give up (see Janoff-Bulman & Brickman, 1982). In the midst of these, however, Mikko's and Tiina's identifications, that is, who they are mathematically, remain stable. Tiina's story is a very explicit example in this regard. It seems as though nothing could undermine their beliefs in their abilities to succeed in mathematics and their identities as achievers. This may be because, contrary to some pre-service elementary school teachers, they did not experience many failures or repeated failures and because eventually, they did succeed (see, e.g., Zeldin & Pajares, 2000). Also, lack of failures in their early school experiences helped them develop strong beliefs in their own abilities, which appears to help them recover from setbacks and persevere (Bandura, 1997). Di Martino and Zan (2010) similarly noted that one's 'idea of success and of the possibility of keeping under control associated factors thus appears as one of the most crucial for one's perceived competence and in particular for the interpretation of a possible failure' (p. 44).

These stories teach us that being good at school math and deciding to pursue it as a career does not equal an absence of failure. It is, however, the understanding of failure and the way of approaching it that differs greatly from what we are used to hearing in narrative accounts of the mathematically vulnerable cohort of pre-service teachers. Mathematics and science teachers seem to internalize failure differently; failure enters and shapes their identities in a different manner. Therefore, I am claiming that Mikko's and Tiina's failure resilience is visible in a variety of adaptive strategies they utilize that do not allow the failure they experience to affect their identities, to define who they are mathematically or who they are in a more general sense. Contrary to the stories of anxiety and giving up, I see the two stories in question to be about resilience. One could challenge, however, whether Mikko's and Tiina's stories of failure presented here measure up to the stories produced by those pre-service teachers who failed exams repeatedly and had their goals put in question due to these failures. Mikko's and Tiina's resilience could then be questioned, and we may ask whether they are

resilient or whether they have only experienced such challenges that their current level of resilience was sufficient to meet. These questions, arguably, would imply that we know exactly what failure is and how it looks for all students and that we know how much is enough to trigger a threat to one's identity. This also assumes that we know exactly what resilience is and how much of it is needed for someone to be considered resilient.

However, the premise here was to show the subjectivity of the concept of failure. These theoretical and methodological decisions invited a more subjective approach towards resilience (e.g., Jones, 2019). I suggest that in order to consider a student resilient, he or she does not have to display failure in terms of its external definition and neither should such understanding of failure be the only measure of how we understand resilience. Simply put, hitting a rock bottom, perhaps even repeatedly, cannot be the only definition by which we judge whether a student has failed enough and how resilient that student is. I especially warn against such an extreme take on resilience. Arguably, akin to failure, there is no single meaning of resilience; rather, it can have a variety of meanings depending on the subjects, contexts and experiences (Walsh-Dilley & Wolford, 2015). A single definition, as Walsh-Dilley and Wolford (2015) suggest, would lead to privileging certain voices over others. Moreover, Jones (2019) noted that it is important to 'challenge the notion that experts are best placed to evaluate other people's lives and have a better understanding of the factors that contribute to a person's own resilience' (p. 4). In evaluating Mikko's and Tiina's resilience, I have, therefore, relied on what they said about their own adaptive strategies in the face of what they labelled as failure. While the participants were not explicitly invited to write about their resilience, I used the utterances that were descriptive of how they dealt with failure to interpret their failure resilience.

Arguably, resilience to math failure (in the educational context in general) needs redefinition, from being looked at as normative to a concept that is highly personal and socially constructed (e.g., Walsh-Dilley & Wolford, 2015). If failure is a matter of pre-service teachers' own interpretations, then resilience is also a subjective construct—pre-service teachers' own adaptive stance regarding their interpretations of failure. Ultimately, what matters is how resilient an individual pre-service teacher feels he or she is. I would, therefore, suggest understanding failure resilience as an adaptive process, including the variety of strategies that allow students to not only cope with failure, but also adapt and respond to it in ways that allow them to maintain their identities and continue learning, developing and changing.

In terms of practices, the findings here point to the need to pay attention to students' goals and expectations, rather than our own, and explicitly address them, be it in the school settings or in teacher training. Moreover, as teachers or teacher educators, we may be too quick with labelling students. Mikko's story in particular, sheds some light on this matter and raises the question: Is the student lazy, lacking effort or does that student actually know what he/she wants? In addition, these cases show not only that individuals have differing and dynamic understandings of failure, but also that resilience to failure is not a static trait (e.g., Chmitorz et al., 2018; Walsh-Dilley & Wolford, 2015). Along this line, their stories further highlight the need to more carefully examine the subtle processes of how students understand and deal with their failures in different contexts. Resilience-building interventions (e.g., Yeager & Dweck, 2012) could also be helpful if we are to encourage all students to engage with mathematics. This can be done with the focus on personal goals and expectations and early emphasis on the possibility of change, which will enable all students to develop more resilient interpretations of failure and how to respond to it. It is also crucial to consider shared teacher education courses for both pre-service mathematics and pre-service elementary school teachers. Both cohorts of future teachers will teach a great variety of students with varying understandings of failure and resilience. Provided that learning via personal experiences or via hearing the stories of others' experiences may be the most powerful kind of learning (Lutovac and Kaasila, 2019b), the need for at least partial joint education of these two cohorts of future teachers of mathematics could better prepare them for the diversity they will encounter in their classrooms.

Finally, this paper hopes to initiate an awareness of different modalities of failure and discussion about this topic that require a more subjective approach. As failure is a cognitive and emotive construct that easily slips into one's identification process, it takes a wide range of research traditions, including those of cognition, affect and identity, to understand this phenomenon the way individuals who experience it do. Hopefully, this study serves as a stepping stone in widening the scope of identity studies.

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