



Integration of Arab Female Students at a Technological University—Narratives of Identity in Figured Worlds

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Abstract

This study deals with the academic identities of 13 female Arab students upon their entrance to STEM studies in a university in Israel. Female Arab students in a predominantly Jewish Israeli engineering institution face conflicting narratives regarding their ethnicity, gender, and its relation to possible success in university-level studies in general and mathematical studies in particular. To exemplify this, we focus on two students, Lena and Mira, who both encountered difficulties upon entering the institute, yet of different kinds. While Mira was mostly preoccupied with ethnic and religious conflictual narratives, Lena was occupied with gender-inferiority narratives. We use the concepts of current and designated identities and space of authorship within figured worlds to explain how different conflictual narratives permeated the identities of the two students. At the same time, we relate the findings from the two case studies to the more general findings from the 13 participants of the study.

Keywords Arab female students · Identity · Gender · Ethnicity · Figured worlds · Post-secondary STEM education

Introduction

Female Arab students in Israel face an intriguing situation, with relation to STEM subjects. On the one hand, Arab girls consistently outperform boys in school STEM subjects, leading to STEM subjects in the Israeli Arab society being relatively devoid of their common masculine-related narratives (such as “math is for boys”) (Ayalon, 2002; Nasser & Birenbaum, 2005). On the other hand, Arab women suffer from the constraints of a highly patriarchal society (Arar, 2014) and are still often treated as the

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property of men (Hadad Haj-Yahya, Schnell & Khattab, 2018). Once Arab women enter engineering studies in predominantly Jewish institutions, the multiple minority status (being an Arab and a woman) raises complex challenges to their acclimation and success. These challenges have so far rarely been studied. In this paper, we aim to shed light on the role of identity and cultural narratives as they play out in the acclimation process of Arab female students to challenging engineering tracks (computer sciences and electrical engineering). We focus particularly on the students' coping with mathematics as these have historically been considered as gatekeepers in the particular Institute under investigation. For this, we use the concept of identity and mathematical identity (Sfard & Prusak, 2005) as it relates to the various ethnic- and gender-related narratives around the students. We do so by relying on the conceptual frameworks of figured worlds (Holland, Lachicotte, Skinner, & Cane, 1998) and identity learning as a communicational activity (Sfard, 2008). Our aim is to better understand the challenges that female Arab students, in particular, experience upon entering university-level STEM studies.

Background—Challenges Facing the Arab Minority in the Israeli Academia

Arabs in Israel consist of 21% of the general population (Myers-JDC-Brookdale, 2018). Out of these, 83% are Muslims, 9% are Christians, and 8% are Druze. There are long standing tensions between the Jewish majority and the Arab minority in Israel; these tensions have encouraged geographical, political, and social separation (Flum & Kaplan, 2016; Kaplan, Abu-Sa'ad & Yonah, 2001; Schiff, 2002). The separation also exists in the educational system: K-12 education is completely separated between Arabs and Jews. The Arab minority has an independent educational system, where Arabic is the official language (Cinamon, Habayib & Ziv, 2015); however, this system suffers from decades of deprived resources leading to much lower achievements in the Arab sector, as compared with the Jewish sector (Al-haj, 2003; Mustafa & Arar, 2009).

Despite these problems, in the past few decades, the representation of the Arab sector in Israeli universities has been growing slowly yet consistently (Arar & Haj-Yahia, 2016). At the institute where this study took place, Arab students currently occupy around their share of the general population. Yet this increase in Arab students' participation does not come without its challenges. Since universities are often the first multicultural encounter between Arabs and Jews, Arab students may feel like strangers in the Israeli academy, which is considered by them as essentially a Jewish institution¹ (Arar & Abu Rabia-Queder, 2011). The challenges experienced by Arab male students are coupled by the difficulties female Arab students' experience, which relate to changing gender roles in this relatively traditional society (Abu-Rabia-Queder & Weiner-Levy, 2008; Arar & Masry-Herzalah, 2014). University studies are often the first occasion for these girls to leave their home village and to be

¹ We are aware that the division Arab vs. Jewish may seem strange to those unfamiliar with the Israeli context: Arab is an ethnic category while Jewish may be thought of as a religious category (although often treated also as an ethnic category (Altman, Inman, Fine, Ritter & Howard, 2010)). Indeed, there are multiple religions belonging to the Arab community in Israel, as explained above. However, the main division relevant for this study is "Arab" vs. "Jewish," as it is for many others studies dealing with ethnic divides in the Israeli society (see for example Pines & Zaidman (2003); Nasser & Birenbaum (2005); Kaplan et al. (2001)).

exposed to Western, secular culture, a transition that often causes a “culture shock” (Arar & Haj-Yahia, 2016).

The challenges Arab females face in the Israeli academia are complexified when it comes to entering technological studies. It is a well-known fact that women, overall in the Western world, have been underrepresented in engineering studies (Lubienski & Ganley, 2017; Perez-Felkner, McDonald & Schneider, 2014; Snyder & Dillow, 2011). Women often suffer from less social support in STEM disciplines from negative stereotypes and experience more mathematics anxiety (Eccles, 2009; Lindemann, Britton & Zundl, 2016; Lubienski & Ganley, 2017; Tanningo, Mathew & Pachon, 2008).

Interestingly, the bias against STEM studies has not reached Arab females in Israeli K-12 settings. Similarly to other non-Western cultures where females participate equally or even better than males in STEM subjects (Forgasz & Mittelberg, 2012; Perez-Felkner et al., 2014), Arab girls in Israeli schools have consistently outperformed boys in mathematics and sciences (Alayan & Yair, 2010; Forgasz & Mittelberg, 2008). This is particularly interesting since the picture is opposite for Jewish girls, who, although in the last decade have been catching up with boys on measures of mathematics school achievements, are still underrepresented in the advanced-level physics and computer science courses at high school (Ayalon, 2002; Eidelman & Hazzan, 2005)). Arab girls do not only outperform boys in school STEM subjects, they also report more confidence and less anxiety (Nasser & Birenbaum, 2005), a situation that is quite the opposite in terms of affect related to math and sciences reported by girls in Western countries (Forgasz, Leder & Kloosterman, 2004).

Yet the female advantage in school ends abruptly as Arab youngsters turn to university-level STEM studies. Only about 7% of Muslims women and 13% of Druze and Christian choose to study mathematics-related subjects at the Academia, which is lower than the percentage among female Jewish students (16%) and much lower than the Arab men (26% of Muslims, 34% of Christians and 38% of Druze) (Fuchs & Wilson, 2018). This situation makes the entry of Arab female students into tertiary-level engineering studies particularly interesting to study with relation to narratives of culture on the one hand (being Arab and an ethnic minority) and gender (being a woman) on the other hand. In what follows, we turn to presenting the main theoretical framework that will aid us in examining these gender and culture-related tensions—figured worlds.

Theoretical Framework—Identity Within Figured Worlds

Our examination of students’ identity and its development in a new academic context is generally related to sociocultural conceptualizations of learning as becoming a participant in a certain community (Lave & Wenger, 1991; Sfard & Prusak, 2005). Holland et al. (1998) argued that people construct their identities in “figured worlds,” where a figured world is defined as “a socially and culturally constructed realm of interpretation in which particular characters and actors are recognized, significance is assigned to certain acts, and particular outcomes are valued by others.” (p. 52). In the case of Arab students, the home, family, and village figured world is extremely different from the Jewish, technological, and Western

figured world of the university. The figured worlds of most Arabs in Israel is dominated by values of solidarity, cooperation, support, and belonging, and the main important social groups are the nuclear and extended family, the neighborhood, and the community (Pines & Zaidman, 2003). In this collective, traditional figured world, women have little exposure to men (Abu-Rabia-Queder & Weiner-Levy, 2008). In contrast, the Israeli Jewish figured world is more aligned with Western individualistic values, including personal strength, confronting challenges, and relatively democratic family relations (Pines & Zaidman, 2003).

Figured worlds form the background or, more metaphorically, the soil for the construction of certain *identities*. The narratives populating them are those from which identities are authored (Holland et al., 1998). This conceptualization is in line with the definition of identity as a collection of reifying, endorsable, and significant narratives (Sfard & Prusak, 2005; Sfard, 2019). Stressing that identity is a *collection* of various narratives, Sfard and Prusak (2005) distinguished between two types of such narratives: current identity and designated identity. Current identity is made up of stories about the current situation, for example, “I am good in mathematics.” Designated identity is made up of stories about the expected situation—what the person hopes or expects to become in the future, for example, “I want to be a computer engineer in Google.” These designated identity narratives often carry with them the roles and positions valued in a certain culture, those conceptualized by Holland et al. (1998) as parts of a figured world.

More accurately, Holland and her colleagues (1998) link between identity and figured worlds through the concept of “space of authorship,” which they conceptualize as a contested space “where social languages meet, generically and accentually, semantically and indexically, freighted with the valences of power, position, and privilege.” (p. 191). Such a contested space of authorship, in the case of Arab female students, may be the result of narratives originating in the home figured world, which conflict with the new values of the university figured world. The idea of “space of authorship” accentuates the fact that a person is not a mere product of the figured world in which she participates. Rather, people enact agency in adopting certain values of a figured world, while resisting or ignoring others. Those values, roles, and storylines that do enter their consideration or awareness are considered by us as their space of authorship.

Identity stories told by a person about herself (1st Person stories) often echo or conflict with the 2nd and 3rd Person stories told to her or about her by others (Heyd-Metzuyanim, 2015). In addition, identity narratives, both current and designated, are adopted from narratives of what is valued or devalued in certain figured worlds (Shabtay and Heyd-Metzuyanim, 2018). For example, a figured world of a Muslim young woman living in a small village may include multiple prohibited actions such as partying, drinking alcohol, or walking outside late at night, while valued actions are studying, helping at home, and obeying paternal figures. This young woman’s identity as a “good girl” is constructed according to these valued and devalued actions. Once she moves to a new figured world, her identity stories necessarily undergo some realignment in accordance with those new values that enter her space of authorship.

In the present research, we seek to apply the theoretical lens of identity within figured world to the situation of Arab women entering university-level STEM studies. Our research question is: how do the female Arab students author their STEM identity in relation to conflicting narratives in their figured world?

Method

Research Participants and Procedure

We followed 13 Arab female undergraduate students during their first semester at a technological university (between October 2016 and March 2017). Nine of the students were Muslim, three Christians, and one Druze. Participants' ages ranged between 18 and 19.5 years old. All the participants were studying in either the Faculty of Computer Science or the Faculty of Electrical Engineering, both of which are among the most coveted faculties in the institute and have very high entrance qualifications. Our choice to focus on these faculties stemmed from informal knowledge about the higher-than-usual failure rates of Arab female students in these tracks. We thus hypothesized that the tensions and challenges encountered in the transition from the Arab home figured world to the engineering figured world could best be found in the stories of women studying in these tracks.

All students were recruited voluntarily, during the first week of the semester. The students were promised complete confidentiality and signed informed consent forms.

Around 30 hours of interview recordings were collected for the study. The interviews were conducted in Arabic and were fully transcribed in Hebrew. This, since the first author is fluent in both Arabic and Hebrew, while the second author is fluent in Hebrew and English. The transcriptions were thus made in Hebrew to allow mutual engagement with the data. Parts of these transcriptions were translated into English by the second author for presentation of the data in this paper. The double-translated excerpts were checked by a third auditor, who is fluent both in Arabic and in English. This, to make sure that none of the nuances of meaning were lost during the translation process.

Data Was Collected Via Three Main Methods

Semi-structured interviews The first author held two interviews with each of the participants during the semester. These interviews lasted between 30 and 90 min. The first interview was an introductory one, including questions that started with background information (e.g. the participants' track of studies at high school, previous experience with studying in Hebrew), continued to questions about the reasons for choosing this particular university and track, questions about the family and its influence on this choice, and finally questions regarding first impressions of the university and initial experiences of cultural conflict. Final interviews were conducted at the end of the semester. These interviews included, in addition to a cultural identity part, a mathematical part. Within this mathematical part, we asked students to relate to, reflect upon, and answer some of the questions in their final calculus exam. This part was intended to give access to the actual forms of the students' participation in learning. Participants varied to the extent that they cooperated with the request to mathematize together with the interviewer. These differences will be discussed in the findings section.

Reflective diaries During the semester, the participants were asked to respond to two written interviews. These written interviews were communicated via email. The first was carried out before midterm exams and the second after midterm exams, the

rationale for this being our acquaintance with the midterm exams as a point of time where students often receive their first indication of whether they are attaining the standards of knowledge expected in the course. The midterm diaries included questions sent to the students by email relating to their struggles, confusions, and successes in learning as well as to any cultural conflicts they may be experiencing.

Stimulated recall interviews To gain additional insights into the lived experiences of the participants, particularly in their mathematical studies, which often pose the toughest challenge during the first semester, the first author recorded three calculus tutorials in which some of the participants were studying. This recording was done so that the students can later be interviewed about the specificities of their mathematical understandings around calculus subjects, as well as their feelings and thoughts about actual lessons. The stimulated recall interviews were conducted up to 2 days after the lesson with students who were present in the lesson. Four interviews were conducted with students who participated in the lesson and who agreed to be interviewed at the time allocated for it. For these interviews, a method of video-simulated recall was adopted from Chidiac (2016). In it, the interviewee and interviewer sat facing a screen streaming the videotaped calculus lesson. The interviewee was asked to press the pause button whenever something of interest occurred or whenever she recollected a point of confusion. In addition, the interviewer paused the video at places where she felt she could assess the interviewee's understanding of the lecture and commenced conversation about that topic. This technique of "casual" talk around the lesson was used to avoid, as much as possible, the students feeling they are under examination or being assessed for their mathematical knowledge.

Data Analysis

For data analysis, all interviews were transcribed. Transcriptions were analyzed using a grounded theory approach (Corbin & Strauss, 1990), coupled by discourse analysis (Gee, 2014; Sfard, 2008). We used a combination of inductive and deductive coding (Saldana, 2016) to first identify general themes in the transcriptions of the interviews (for example, "cultural conflicts," "social expectations," "narratives about learning mathematics") and further divided each theme to several subcategories (e.g. "narratives about the family," "narratives about the Arab community," "narratives about learning habits"). Categories were reduced, revised, and refined using an iterative process (Corbin & Strauss, 1990).

Deductive codes were based on the theoretical orientation of identity authoring in figured worlds (Holland et al., 1998). In particular, we searched in the interviews' transcripts for valued actions and valued outcomes in the participants' figured worlds.

Selection of Cases for Closer Analysis

For examining the narratives of identity in figured worlds, a highly close-up analysis is needed. For this, we focus mainly on two out of the 13 students studied, pseudonymed Lena and Mira. We chose these two students since their interviews exemplified themes found in the interviews with the 13 students, albeit relatively more clearly and vividly.

Thus, we are not claiming they are representative of the other 11 students but rather that their cases afford the examination and illustration of conflicts between figured worlds. To enhance the trustworthiness of our findings, we report on how prevalent each of the themes found in Lena and Mira's case was in the larger dataset.

Researchers' Positionality

As in any cultural study, the identity and cultural affiliations of the researchers form a lens through which the data is analyzed (Berger, 2015). In our case, we bring to the study a dual look that comes from quite different cultural perspectives. The first author identifies as a Muslim conservative woman. She is a graduate student that has, as an undergraduate student, experienced many of the challenges facing the participants of this study. The second author is her advisor, self-identifying as a Jewish secular woman. Some of the challenges reported in this study have been experienced by her first hand as an undergraduate student of computer science, but most of the challenges, especially related to ethnicity, are foreign to her. The different cultural backgrounds of the authors have led to repeated conversations and alternative interpretations of the data. The findings are in a large part a result of these conversations. They have nevertheless been discussed with multiple peers, both Jewish and Arab, women and men, Israeli and non-Israeli, to enhance the trustworthiness of the analysis.

Findings

Lena and Mira are both Muslim, exemplifying conservative behavior (for example, they refrained from drinking alcohol, wore modest clothes, and did not participate in parties). Despite this similarity, cultural differences were apparent in the two women's conduct as well as in their stories about themselves. Mira wore a Hijab, while Lena did not. Mira was first generation to academic studies, while Lena's parents had bachelor degrees from Israeli universities. In what follows, we present similarities and differences between the two cases, while also referring to corroborating evidence that similar narratives existed in the space of authorship of other participants in the study.

The report of the findings is structured around the main themes found in all the 13 interviews. We start by examining the academic identity with which the students' entered their studies and continue to tensions found between current and designated identity stories. We then examine the conflicts reported on by the girls between their home and the Institute's figured worlds. This is followed by a more specific look at the students' narratives about learning and, finally, report on their actual engagement in mathematical discourse.

Academic Identity

Lena and Mira both entered the university with a current identity of a very high achieving student. These identity narratives were strongly supported by identity narratives as authored by family and friends. Lena, for example, said in her first interview:

My sisters think that I have super powers (like) “Rambo.” That I can manage doing anything. Most people expect me to do so.

Lena and Mira, however, varied with relation to how much they attributed their success in high school studies to effort vs. talent. In Lena’s case, her stories reflected a strong assumption of academic success being an inherent talent of hers. She said:

(In high school), lots (of people) were envying me for not studying long hours, like they did, and still succeeding. For example, in mathematics, I got one of the highest grades in the classroom. It wasn’t a result of effort but... I do not know why exactly. (Lena, 1st interview)

In contrast, Mira talked about academic studies as something that necessitated work. Talking about her experience with mathematics in high school, she said:

I was good (at it), I got a high grade in 5 units.² But I did not feel like I’m studying as I should, even though I got good grades. (Inter: why?) Because I would procrastinate a lot on homework. Mathematics needs a lot of practice. I’d postpone the work or not solve (exercises). But the [name of university] demands lots of practice. (Mira, 1st interview).

Despite these differences, it was clear that both girls saw STEM studies as something that they had some natural ease with. Such identity narratives were very common, almost unanimous, in most of the participants’ stories about high school mathematics. This is not surprising since the entrance qualifications of this particular institute are such that only students with very high achievements in high school can enter it.

Tensions Between Designated and Current Identities

Both Lena and Mira’s designated identities included very high aspirations upon entering the university. Again, these aspirations often resonated voices of their family and close relations. Lena said:

They (parents) always remind you that you have potential. So I somehow try to turn this potential (to reality).

Mira also told stories of high expectations from her family:

I’m the first one (from my family) that pursues her academic studies. Everyone at home has expectations (from me) and that’s a bit stressful (Mira, 1st interview).

The stories about high expectations of the family and social milieu at home were common in the narratives of participants of the study. Eight out of the 13 mentioned such expectations in at least one of the interviews during the semester. As the semester

² 5 Units mathematics is the highest track in Israeli high school mathematics, equivalent, more or less, to AP calculus in the US.

progressed, however, both girls expressed growing tensions between their designated identities, including expectations to excel and their current identities, which started including stories about difficulties.

Lena wrote in her 1st diary, in response to the question “have you encountered any difficulties so far? If so, what are they and how are you trying to cope?”:

Yes, I encountered and still encounter difficulties. Difficulties with time, as I’ve mentioned above. I’m trying to manage my study time more effectively by writing down everything on a calendar. Sometimes I need to sleep less, but I’m not always able to stay awake. I’m also having difficulties with the pace that courses are advancing in. Even if I review the lectures before (the next lesson), I do not memorize (meaning I do not remember it) so that sometimes when a theorem is mentioned I do not remember it 100% and that stresses me out a bit.
[Lena, 1st Diary]

Mira, although expressing less discontent with her learning habits, also talked about disappointments that indicated a growing disparity between her current and designated identity. When asked at the end of the semester “What did you expect that did not materialize and what did you expect and did materialize?” She answered:

My grades. You will not understand me if I talk about my expectations or what I want or what I aspire to. I want at least an average above 80. But that will not happen and will be difficult to get. Next semester ... Everyone tells me “either you get honors (excellency) in the first semester or you do not get it at all. But I do want the honors, whether it comes at the first semester or the 10th.

Growing disparities between designated and current identities were, again, common within the participants. Nine out of the 13 girls expressed such disparities during the semester, especially around their grades and achievements.

Conflicts Between Figured Worlds

Unlike the common themes shown so far in Lena and Mira’ identity stories and echoed in other participants’ stories, the students differed with relation to the conflicts experienced within their figured worlds of the home and Institute, and Lena and Mira differed most pronouncedly.

Mira—Ethnic-Related Conflict

For Mira, the most pronounced conflicts were related to her Arab ethnicity. Mira identified herself repeatedly as an “Arab Muslim girl,” coming from a “traditional family” and a “traditional village,” and these self-identifications were almost always mentioned in relation to the different values and expectations she was experiencing in the university. In her first diary entry, in response to the question: “have you experienced any cultural differences between the [Institute’s] environment and your home environment? If so, how do they manifest? Please be as specific as possible. “ she wrote:

Yes of course! I face difficulties every day and all the time. First, the atmosphere at the [Institute name] is not like the atmosphere at home at all. Here, everyone is independent and each person is responsible for himself and his own decisions. There are people from different places, different religion[s], different thoughts and different values and cultures. For example, I came from a village where everyone is Arab and we all belong to the same religion, whereas at the institute I meet people from all over the world and from different religions. (Mira, 1st diary)

It is clear from this entry that Mira made a clear distinction between her “home” world and the Institute’s world. She was locating the difference in the different “atmospheres” as well as the different beliefs, “values,” and backgrounds of the students around her. Notably, in her description of encountering “people from difference places,” Mira rarely mentioned Jewish students or staff (which are the great majority in this Institute) but rather referred to “different religions” or to Christians:

I live with a Christian student in the dorms; she is from a different religion. At first, I was worried about the idea of living with her, because I am a Muslim and she is Christian. I was worried I would feel restricted and not able to behave freely (Mira, 1st interview).

We interpret this avoidance of talking about Jews or referring to other students as Jewish as an indication of Mira’s difficulties to settle to herself the conflicts between her Arab Muslim identity and the majority with which she experienced political as well as religious conflicts. These political conflicts were expressed most clearly in the following story, told by Mira in her 1st interview, about dealing with the logo of an Israeli military-related company:

Mira: When I saw the word “[name of company]” (on the backpack) I felt that I’m going against values that I believe in... I do not know... we as Arabs are against things like this. Then comes the [university name] under this company and gives us (such a bag), it’s like forcing us, and all that.... A few days ago, a Jewish student sitting next to me at one of the lectures looked at the bag and started laughing and asked me, ‘who gave you this bag?’ I felt bad, he hurt my feelings and I’ve been thinking how to delete it (the name of the company).

Interviewer: Why did you feel that way?

Mira: He was looking at me as an Arab and Arabs are Palestinian, now we are starting to talk politics... (laughs), I do not wanna talk about it.

This excerpt was unique within the whole dataset of interviews collected in this study. It was the only place where one of the participants directly talked about the Israeli-Palestinian conflict. Yet even here, we see Mira attempting to avoid the subject (“I don’t want to talk about it”). In the very few other places that Mira mentioned “Jews” or “Jewish” in her talk, these related to feelings of alienation. For example, when asked if her being “A woman from the Arab sector” would influence her studies she said:

Mira: I do not know. I have not yet felt anything different. Like when I ask a lecturer or TA a question... fearing how he would look at me, I have not experienced such a thing yet. But I expect it in the future. It's everywhere.

Int: how?

Mira: We, Arab and Jews, uhh.. I do not know if you can say this word.

Int: Talk freely, no one will...

Mira: Discrimination is everywhere. Surely there are lecturers that look (at you that way). But personally... on this Arab and Jewish (matter), I have heard (about it) but have not experienced it.

This rather harsh and gloomy expectation, regarding "discrimination being everywhere" does not necessarily relate to Mira's actual experiences at the university's figured world since it talked about her expectations (mentioning she did not actually experience such discrimination personally). In fact, it was not mentioned any more in later diary entries or in her final interview. However, we do not know if this was a result of Mira, eventually, not being exposed to narratives or actions of discrimination in the Institute's figured world or whether the topic was too sensitive for her to be talked or written about.

Although, as mentioned above, mentioning of the Israeli-Arab political conflict was very rare in the dataset, some mentions of ethnic-related conflicts were more common. Eight out of the 13 girls mentioned some tension between the conservative values of the home figured world and valued actions or narratives of the Institute.

Lena—Gender-Related Conflicts

In contrast to Mira, Lena made every attempt to minimize ethnic or religious conflicts. In her opening interview, she stated she did not expect problems with Hebrew and supported this claim by telling of her experiences during 9th grade at a youth program for young scientists in which she participated in the same Institute and which was held all in Hebrew. When asked what she expected of encountering men and women from different cultures, she answered she did not expect to have close friends from other cultures, yet did not expect any tensions either.

Instead of the ethnic (Arab-Jewish) divide, Lena's narratives of conflict were mostly themed around the gender (female, male) divide. Interestingly, in answering an almost identical question to which Mira had answered above, referring to her Arab Muslim identity, Lena talked mainly about her gender:

Interviewer: Do you think your experience (at the Institute) will be different from the experience of a Jewish girl?

Lena: Not really. I think that the difference between a male and a female can be that a Jewish girl will be able to integrate in the social life here better and that will make (her life) easier than mine. Not more than that.

Interviewer: What is the difference between a male and a female?

Lena: I will not start now by saying that (people) say that the men are smarter than women, I do not believe it, but I believe that a man has more self-confidence

than a woman in mathematics and in the realistic³ (mathematical/scientific) domain. He thinks that the realistic domain is for him and the woman thinks she is less. It's not always (so), it's about what I see and experience around me ... But it does not mean anything about the final results because sometimes the ways by which the woman thinks helps her win all her competitors, whether male or female, through the way by which she studies and thinks.

Here we saw the first occasions of narratives that Lena authored relating to conflicts between men and women in STEM studies and the ways she negotiated them. On the one hand, it was clear that the narrative *men have stronger self-confidence in STEM domains* had unfavorable consequences for her as a woman (especially since she did not exclude herself from this assertion). On the other hand, the narrative about how a woman can “win over” her male peer by her unique “ways of thinking and learning” indicated that Lena was authoring the Institute’s figured world as a space of struggle for her as a woman and that she was designating women to have at least some chance in winning this struggle.

Lena’s narratives that started out at the beginning of the semester as relatively “objective” statements about the world turned to be more strongly associated with her own 1st person current identity as the semester progressed. After around a month of studies, she wrote in her diary entry:

Over the last weeks, I’ve noticed that, despite all the self-confidence I have, I’m not sufficiently self-confident, as compared with boys, or to [this] boy that I sometimes study with. I think it comes from all the stereotypes about the brains of females vs. the brains of males (although I have a tendency towards a male’s brain. I’m bad at multitasking, I lose my concentration. I read once about this matter, not sure how true the facts there were). And sometimes I’m scared, I’m scared that it’s true. That my mental abilities are not enough. [Lena, 1st Diary]

Several points are worth noting regarding this diary entry. First, it is remarkable how salient the social sources for the narrative “boys are better than girls in mental abilities related to engineering” are for Lena. She openly critiques the facts written in the source she read, saying “she’s not sure how accurate the facts were,” yet she reports having great difficulties to counter these narratives. One way she attempts to contend with these threatening narratives is by authoring her own identity as partially masculine (“having a masculine brain”) and attaching to herself “masculine” properties (“bad at multitasking,” “loss of concentration”). Another is by distancing herself from these narratives. She adds in the next words of her diary that “It’s just a matter of perspective ... If I say that girls are less smart, that’s just a screwed excuse that doesn’t help anyone, and is of course not true.” It is thus clear that narratives about boys being better than girls in mathematics or STEM related subjects because of their sheer biology are very dominant in Lena’s space of authorship. She is authoring her identity with relation to them, trying on the one hand to contest them, but on the other hand adopting them and admitting that they cause her to doubt her chances of success. In that way, the

³ Here Lena used the Hebrew word “ri-aly,” which comes from “realistic” and denotes mathematics and scientific subjects in school.

narratives of male superiority existing in the Institute's figured world start shaping Lena's designated identity as the semester progresses.

The gender-related conflict was strongly connected in Lena's identity narratives to what we term *colloquial psychological discourse* about the importance of self-confidence for one's achievements. Towards the end of the semester, these psychological narratives were also directly connected by Lena to her current identity narrative as failing (or not sufficiently achieving) in her studies:

When a person is less confident, I do not know how (to explain this) ... But sometimes you do not believe in yourself, sometimes you do not want to meet anyone. That (decision), not wanting to meet anyone, is not the best decision in the world. You have to be with people who you see every day and share with them the things you studied and the things you did not yet (accomplish). So that it helps you keep going. Sometimes it made me stop or slow down (Lena, 2nd diary).

The self-diagnostic statements in this quote are authored as pre-given and beyond Lena's control. Further, these psychological states (lack of self-confidence) led Lena, according to her narrative, to certain decisions that she regrets ("you have to be with people"), yet there is no indication in Lena's words that she had a choice regarding these decisions. In this way, narratives about "low self-confidence," being a particular characteristic of girls, are related by Lena to her current identity as underachieving.

The pronouncement of the gender-related conflicts in Lena's identity narratives was quite unique. Only 2 out of 13 girls in the study explicitly talked about such narratives about boys being better than girls. However, the colloquial psychological discourse was more common in participants' narratives. Six out of 13 girls talked about themselves in terms of "having" or "not having" self-confidence or attributed their failures (and less often, their successes) to their psychological states.

Narratives About Learning

We now turn to participants' narratives about mathematics as shifting between the home and university figured worlds. A common narrative about mathematical learning at the university level, both in Lena and in Mira's talk, was that the mathematics they were studying necessitated very hard work. Such levels of hard work were described by them as different from those that were needed in school. Lena said:

In high school, there were also such situations, where I was "stuck in the corner" (meaning: with my back against the wall). I wasn't a person that studies hard (in Arabic: plows the ground) but I also did not encounter something that got me in trouble. My grades were overall good ... but here, to be on track, you need to start absolutely from the beginning. So that you know where you stand and what you do and that you follow (the material).

Mira echoed these narratives of difference between high school and the Institute:

At school I felt that I study and get results. Here I study and understand but I do not get the result I want [Mira, final interview].

These narratives, describing frustration or discontent with the gap between their efforts and the results obtained in grades, were indeed common in the other participants' talk and mentioned in interviews of 8 out of 13 of the participants.

With relation to the valued actions around mathematical learning in the Institute's figured world, both Lena and Mira made distinctions between "deep understanding" and just "solving exercises." For Lena, these were particularly important as she theorized that girls tend to study harder, and aim at deeper understanding:

We girls like to study harder, surely you noticed that. We study seriously and I feel that gives us a certain privilege. (But) it turns to be an obstacle when we focus on quality without taking quantity into account. Like what happened to me, that I did not achieve the right balance. [Lena, final interview].

Notably, Lena put all the focus on femininity or gender when talking about the challenges of mathematical learning at the university level. She never related to her ethnic minority, including Hebrew being a second language for her as a potential challenge. This was, however, quite unique. Most participants of the study did not relate challenges in mathematical learning to femininity. However, they also did not blame their failures on ethnicity. Rather, almost all girls, when talking about challenges, talked about their own psychology that needed amendment. These needed psychological changes included developing self-discipline, "growing up," and the ability to work harder. However, since much of Lena's narratives about gender were directly related to issues of such psychological nature, it may be that there was such a link (between gender and psychological factors, especially self-confidence) for other girls as well, only it was not declared explicitly in the interviews.

Engagement in Mathematical Discourse

As explained earlier, we attempted to engage the participants of the study in actual mathematical discourse, to try and get a sense not just of their narratives *about* mathematical learning but also of their forms of participation in the mathematical discourse. Here, participants greatly differed. Part of them (7 out of 13), like Mira, agreed to engage in mathematical talk, either through stimulated recall interviews around videotaped tutorials in which they participated or through talking about a question they had not been able to solve in the final calculus exam. Around half of the girls, however, avoided such conversations, with clear indications that such engagement with mathematics (especially exam questions) in front of the interviewer was uncomfortable for them. Due to ethical considerations, we were always careful not to push participants into conversations in which they would not feel comfortable. Therefore, we got very different access to participants' mathematical discourse, depending on how much they would engage in these parts of the interviews. Lena and Mira formed two extremes in this respect. While Mira was relatively at ease when talking about particular theorems, procedures, and other specific mathematical content, Lena made every effort to avoid talking about mathematical specificities.

Following is an excerpt from Mira's explanation about how she attempted to solve a calculus problem in the final exam (see problem in Fig. 1). Note that it is not our intention to get into the mathematical content of this excerpt, just to show it as an example of Mira's relative ease in participating in the discourse of calculus:

Mira and the Interviewer discuss the Calculus exam. Mira talks about questions that went for her better or worse. Then, the interviewer asks:

Inter: Would you like to solve the third question?

Mira: Now? (a bit surprised, laughs).

Inter: Yeah.

Mira: (Starts writing) I know that if there is a continuous derivative, then there's the maximum and the minimum and we need to relate to the maximum.

Inter: Would you like to solve (it)?

Mira: Let me look at it I did not solve it all the way through I know, when you know that (a function) has a continuous derivative, it means there is a maximum and a minimum. (So) we need to relate to the maximum. I derived $g(x)$ because f is a differentiable (function) and e^x is differentiable, that is a given ... In the beginning we need to show that it (g) is a monotonically decreasing function, that is to say $g'(x)$ is smaller than or equal to zero. That is to say $f(x)$ is smaller than or equal e^x .

We see here that Mira not only engages easily in the mathematical discourse, she does so albeit having confessed to not having succeeded in its solution previously. Thus, she is aware that she may not be able to produce acceptable solutions, yet she is ready to try.

In contrast to Mira, a considerable part of the participants (6 out of 13) showed at least some expression of anxiety or avoidance of engaging with such mathematical problem-solving, particularly around the questions of the exam. This was most pronounced in the case of Lena, whose avoidance strategies were quite sophisticated. Following is how she reacted to the Interviewer attempting to engage her in the final exam:

Inter: Which question was the most difficult for you in the exam?

Lena: Remind me of the exam (looks at the exam she wrote). The last question. I did not know where to start! In the quiz I knew to do something with them (the statements written in the question) but in the exam, first, it was hard. Second, for solving it, I had to draw the things (probably meaning the graphs of the functions) but I could not understand how they wrote the claim. ... In the last question, I

1. Let $f(x)$ be a function with a continuous derivative in $[0,1]$. Prove that there exists a constant c such that the function $g(x) = f(x) - c \cdot e^x$ monotonically decreases in the interval $[0,1]$.
2. Give an example of a function f with a continuous derivative in $(0,1)$, such that for every $c \in \mathbb{R}$, the function $g(x) = f(x) - c \cdot e^x$ is not monotonically decreasing in the interval $(0,1)$.

Fig. 1 The calculus problem discussed with Mira

totally did not get anything from it. Second question, I did not succeed in an orderly manner. The first question—I knew how to solve but the wording (exact articulation) wasn’t right. I knew their trick but I had a calculational error. In the third question I had difficulties solving the question. I got the (main) idea but I did not know how to implement (the solution). The fourth question I also knew but I wasn’t able to write properly.

....

Inter: would you like to solve one of the questions again?

Lena: Solve now? No, I do not feel like getting into this (reminiscing on it).

Really, I do not feel like getting into it.

The above excerpt is quite representative of all the instances where the interviewer tried to engage Lena with mathematical talk throughout the study. Although she readily talked about the exam, studying for it, and also agreed to be interviewed on a tutorial session, her talk was always very general and never got into the mathematical content. This could be seen, for example, in her talking about the problems in the exam in terms of “the first,” “second,” or “third question” (not referring to the actual content of the question); in talking about “knowing how to do the question” and “knowing the trick” behind it (without saying what that trick was); and in claiming “she knew the answer but was not able to write it appropriately,” yet never saying what this answer was.

Given that Lena reported having “low self-confidence” and being also silent in class (never asking questions, for example), we hypothesize this avoidance was not just indicative of a certain anxiety from engaging in mathematical discourse with the interviewer (who had no actual power to influence her grades or to influence her achievements) but as an indication of a general avoidance of engaging in mathematical discourse with people who may judge her negatively. Since Lena reported that she avoided studying with others in general (because they stressed her out), it may have been that Lena had very restrictive opportunities to engage in mathematical discourse with anyone besides herself during the semester.

We saw similar avoidance of engaging in mathematical discourse with the Interviewer, albeit to different degrees, in 6 out of 13 of the participants. The 7 participants that did attempt to solve a problem from the exam mostly repeated the solution that they saw in the official solution advertised by the course lecturers. Only a few (like Mira) attempted to construct a solution of their own to problems that they had not been able to solve in the exam and none of them succeeded in doing so.

Discussion

In this study, we followed 13 Arab female students in their first semester of a demanding STEM program. Our goal was to examine how the students author their academic and STEM identity in relation to conflicting narratives in their figured world. We found that almost all of the students interviewed entered their studies with strong mathematical identities and expectations for excelling in their studies, yet as the semester progressed, many of them experienced varying levels of growing discrepancy between their current and designated identity.

To compare between various conflicting narratives and the ways they shaped students' identities, we focused on two case studies, Lena and Mira. Both students described strong conflicts in their space of authorship, yet these conflicts were of different types. While the conflicts in Mira's narratives were mainly related to her ethnicity, the conflicts described by Lena were mostly related to her gender and were not related by her in any way to her ethnicity. In counter to the naïve expectation that harmony between the values of the home and university figured worlds would lead to better acclimation, it was Mira who ended the semester relatively successfully (with an average of almost 80), while Lena failed in at least 2 out of the 4 courses she took.⁴

It is important to mention that we are not putting much emphasis on these differences in achievements. It is very common for students (of various identities) at this Institute to experience an "entrance shock," receive low grades in the first semester and thereafter to acclimate better to the academic demands. Rather, we believe these differences hint at the complex ways in which identity, cultural, and gender narratives interrelate with relation to academic success.

In contrast to Mira's space of authorship, which was populated by narratives about ethnic conflict, Lena's space of authorship was populated by narratives about her inferiority as a woman, especially in relation to psychological traits such as "self-confidence." We hypothesize that since Arab/Jewish political and ethnic conflicts did not have much to do with STEM related abilities, it may have been that, despite these conflicts potentially being very salient in Mira's figured world, they were mostly backgrounded whenever she engaged with mathematics and thus did not enter the space of authorship. This left her STEM identity narratives relatively conflict-free. This conclusion is strengthened by the fact that Mira started the semester claiming she did not particularly like mathematics, while expressing enthusiasm about some mathematical subjects (particularly the calculus lectures) as the semester progressed.

In contrast, the gender-conflictual narratives that were predominant in Lena's space of authorship were highly related to participation in STEM disciplinary discourses (e.g. mathematics and physics) since through the connection to "self-confidence" and other 1st Person identity narratives about learning ("being thorough") and narratives of competitive goals ("winning the boys"), they were tightly related to almost any of Lena's actions around learning. Thus, these conflicts may have been more harmful to Lena's academic success than the narratives about ethnic and cultural conflict dominant in Mira's space of authorship.

Upon entering a predominantly Jewish engineering university, Arab female students encounter two main sets of identity narratives that may be in conflict with the figured world of the university: narratives relating to their "Arabness" (or "Muslimness" in cases where their religious identity is more salient) and narratives about their femininity. Both these are identity categories that are defined in contrast to a certain majority: Arabness is defined (in this particular context) in relation to the predominantly Jewish population, while femininity is defined against the majority of male students in engineering studies (both at this Institute and worldwide, (Schnell & Amara, 2004)). In the context of STEM studies in Israeli universities, narratives that raise conflict around these identity categories are abundant. Engineering and mathematics are still considered masculine subjects in this society (Forgasz & Mittelberg, 2008; Fuchs &

⁴ At the time of interviewing, one course's grades had not been published yet. However, Lena reported the exam did not go well, thus it may have been that she eventually failed 3 out of the 4 courses.

Wilson, 2018), while being an Arab in Israel carries with it a full set of conflictual, discriminatory narratives (Arar & Masry-Herzalah, 2014). Yet what was clear in this study is that which particular narratives enter individual students' space of authorship is highly idiosyncratic. There are girls such as Mira who background the narratives existing in their figured worlds about feminine inferiority, while there are students like Lena who background narratives about ethnic inferiority. Still, it is reasonable to hypothesize that the intersectional minority identity (Avraamidou, 2020) poses greater challenges than belonging to only one minority.

With relation to mathematical learning, the case of two potential threats to identity that result from minority status (Arab and female) is particularly interesting as it may further shed light on how the processes of identity and mathematical learning are related. Thus, the cases of Lena and Mira hint that it is not so important to which intersectional minority status one belongs, it is more important which narratives enter the space of authorship of the individual. This conclusion can be strengthened by studies of Asian female students in the USA, who performed better when reminded of their Asian identity than when reminded of their feminine identity (Phinney, Dennis & Osorio, 2006).

The current study has several limitations, mainly the small number of participants and the sole reliance on the participants' stories stemming from the limited access we had to other sources of data about these girls (such as formal grades, observations of their learning activities, and others' identifications of them). Despite these limitations, we believe this study provides a step forward in exploring a domain that has hardly been explored until now, namely the academic identities of Arab female students in STEM studies. In particular, it offers some practical implications.

One implication of this study is that a minority identity, and particularly a minority identity that involves a major shift in figured worlds, is not a deterministic cause of certain acclimation processes. The ways by which identities interact with the figured world around them is much too complex for predicting an acclimation trajectory based only on certain identity categories. Institutes wishing to accommodate minority students are thus encouraged to keep in mind that there are multiple models of acclimation and that students coming from similar backgrounds can experience the shift in figured worlds differently. That said, the overall challenges of shifts in figured worlds seem to be high and demanding. In particular, they may be invisible to the student herself, thus institutions cannot count on the multiple-minority students to self-advocate. Rather, it is important that academic institutions wishing to enhance diversity and equity anticipate the challenges that may come across students whose figured worlds have considerably shifted and attempt to provide accommodations and assistance.

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