Research Paper

# "Engineering or Computer Science Are Better for Males:"[1] Female Refugee and Migrant Students' Lived Experiences of Learning Digital Skills

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## 1 Introduction

> *Today, women and girls are 25 per cent less likely than men to know how to leverage digital technology for basic purposes, four times less likely to know how to programme computers and 13 times less likely to file for a technology patent. At a moment when every sector is becoming a technology sector, these gaps should make policymakers, educators and everyday citizens 'blush' in alarm.*
>
> (West et al., 2019, p. 4)

With the proliferation of Information and Communication Technology (ICT), societies worldwide experience the advancement of digital inequalities. This timely paper provides empirical evidence on the lived experiences of 28 female refugee and migrant students learning digital skills in Germany. In this multi-case feminist study, I examined two research questions through survey, interview, document, and direct observation data: (1) What motivated the students in the cases to acquire digital skills? (2) What opportunities and challenges did the students in the cases have when learning digital skills? The results indicate that the students possessed various motivations to learn digital skills related to past and present experiences and future goals. They were motivated to understand cybersecurity and keep safe online because of being

[1] Quotation from participant, Ingrid, in Case Two: [there is a] "misconception that positions like engineering or computer science, these are better for the males."

hacked in the past. The students wanted to advance their digital skills because of the proliferation of ICT in Germany. In the future, they intend to use digital skills to support employment. The students also experienced opportunities and challenges when learning digital skills. On the micro-level, they displayed reduced self-efficacy concerning their use of ICT. On the meso-level, they faced barriers in learning digital skills remotely during the COVID-19 pandemic. However, online learning also provided more students with access to digital skills lessons. On the macro-level, the students experienced gender stereotypes about women and technology, including the notion that females, especially mothers, cannot learn advanced digital skills. The findings suggest that educators and policymakers should pay close attention to the backgrounds and characteristics of students learning digital skills, the environment in which they are learning, and the consequences of gender stereotypes on female students' ICT programme participation and learning experience. In the following sections, I provide the background to the research, research design, results, research significance, and discussion, finishing with conclusions and recommendations.

## 2 Background to the Research

### *Digital Skills and Literacy*

Digital skills range from the "physical-operation" of ICT to computer programming and "computational thinking" (United Nations Educational, Scientific, and Cultural Organization [UNESCO] as cited in West et al., 2019, p. 14). Digital skills are ever-evolving because of "the constant development of new technologies" (UNESCO, 2018, p. 7). Digital literacy is "the capabilities that fit someone for living, learning, working, participating, and thriving in a digital society" (Health Education England, n.d., para. 3). Eshet-Alkalai (2004) suggested that digital literacy includes "a large variety of complex cognitive, motor, sociological, and emotional skills" required for functioning in a digital environment (p. 93). UNESCO consider digital skills and literacy indicators as

measures of development. I applied UNESCO's "Digital Literacy Global Framework" to support the study's research design (see West et al., 2019, p. 14). This framework offered an insight into the digital skills competencies encapsulating digital literacy. Existing scholarship agrees that digital literacy is essential in the modern world, enabling engagement with local and national communities and access to economic, social, and political benefits (West et al., 2019). A "failure to obtain" digital skills would, therefore, "limit" an individual's capability (Jung et al., 2001, p. 508).

*The Digital Divides*

The digital divide is the gap in access to ICT, use of ICT, and the impact of ICT use (Organisation for Economic Cooperation and Development [OECD], 2001; van Dijk, 2020). Van Dijk (2020) argued that the digital divide is not a "technical issue" but a "social" one (p. 4). Latimer (2001) explained that "social gaps in society cause the digital divide, but the digital divide, in turn, may intensify existing social gaps and create new ones" (as cited in Cooper and Weaver, 2003, p. 3). Davaki (2018) added that "disparities have pronounced gendered dimensions . . . generated by political, economic and sociocultural factors" (p. 6). The digital skills gender divide encapsulates that digital skills competency is unbalanced between females and males (OECD, 2018; West et al., 2019). West et al. (2019) identified that women are "25 per cent less likely than men" to use ICT for basic purposes, like "browsing, searching, and filtering data, information and digital content" (pp. 14-15). Still, the digital skills gender divide is prolific "in the more complex and less generalised tasks," such as computer programming (West et al., 2019, p. 19). I situated the study within the digital skills gender divide scholarship to engage with questions about ICT and gender inequality. After all, Kuroda et al. (2019) noted that "as societies become increasingly dependent on digital technology, women, their broader communities and national economies are at risk of losing out" (p. 2).

*The Digital Skills Gender Divide in Germany*

With the launch of the 2020 "Internet Für Alle" (Internet for All) initiative, the German Federal Government planned to ensure that high-speed Internet became a legal right (Delhaes, 2020). Yet, Germany "still has some way to go on the journey towards digitalisation" (The Local Creative Studio, 2019, para. 1). Digital divide research in Germany by Lutz (2016) identified the segregation of citizens "into distinct Internet milieus that differ in their intensity, variety, understanding, and attitudes toward online participation" (p. 1). However, a limitation to the Lutz study was its failure to account for gender as a variable in the data. Ullrich (2019) argued that the digital skills gender divide is exacerbated in Germany because women lack confidence in their digital skills. Hence, the German ICT sector has little belief in females' capabilities, causing a pay gap of 24% between women and men working in ICT (Ullrich, 2019). Heltsche (2019), the founder of Germany's Digital Media Women, explained that "women don't want to fight their way through an [ICT] degree" to graduate into an industry dominated by men (as cited in Ullrich, 2019, p. 29). In Germany, the "stereotype of technology as a male domain" continues to exacerbate the digital skills gender divide (West et al., 2019, p. 20).

## 3 Theoretical Foundation

Overall, this study is viewed through the lens of feminist theory, with computer anxiety (Cooper, 2006), the Social Cognitive Theory (SCT), and the Social Shaping of Technology Theory (SSTT) informing the research design and data analysis.

*Feminist Theory*

Feminist theory is interdisciplinary and supports the exploration of the digital divide from a gender perspective. Wajcman (2010) explained that in many Western cultures, technology is "cast in terms of male activities" (p. 144). Consequently, ICT and careers in ICT are rejected by women asked to

"exchange major aspects of their gender identity for a masculine version" (Wajcman, 2010, p. 146). Additionally, the intersecting social characteristics of the students in the study, including being refugee and migrant women, were reflected on during data analysis. As Crenshaw (1991) described, "identity politics" and discussions about groups of women "frequently conflates or ignores intragroup differences" (p. 1242).

*Computer Anxiety*

Cooper (2006) argued that computer anxiety is central to the digital skills gender divide. Computer anxiety reflects the "feelings of discomfort, stress, or anxiety that people experience when responding to computers" (Cooper, 2006, p. 13). Cooper (2006) said, "girls begin their socialisation into computers in a world in which gender stereotypes for computers already exist" (p. 331). Cooper and Weaver (2003) explained, "the stereotype is clear: women are not as competent as men at technology, science, or math" (p. 96). Computer anxiety leads to girls' unwillingness to use ICT, affecting their performance with ICT (Cooper, 2006). Consequently, there are fewer women engaged in tertiary ICT education and careers (Cooper, 2006). Computer anxiety identifies that there "are several psychological factors that are at work behind the scenes," dissuading females from developing their full potential using ICT (Cooper & Weaver, 2003, p. 7).

*The Social Cognitive Theory*

Other theories emphasize micro-, meso-, and macro-level factors when exploring the digital skills gender divide. The SCT suggests that individuals are influenced by what their peers achieve. This influence causes them to form perceptions about their capabilities, or self-efficacy, to do the same activity. Bandura (2002) identified that self-efficacy affects "whether individuals think in self-enhancing or self-debilitating ways" (p. 271). Jung (2014) highlighted that "a future-orientated belief about what one can accomplish appears to be

more important for the adoption of technology than the actual capability to use that technology" (p. 28). If a woman experiences other women working in ICT, this will impact her self-efficacy, showing her that she could work in ICT, too. However, suppose she lacks digitally literate and technologically competent role models with a similar background. In that case, she will learn that computing is "not intended for" her, diminishing her self-efficacy and ICT adoption (Cooper & Weaver, 2003, p. 27; see also Bandura, 2002; Jung, 2014).

### *The Social Shaping of Technology Theory*

Looking at the study through a feminist lens avoided the technological determinist perspective that ICT causes gender inequality. Instead, the SSTT, a macro-level sociological theory, emphasizes social processes that shape the form and features of ICT and the patterns, characteristics, and direction of the development and application of ICT in a society (Russell & Williams, 2002). Wessels (2013) identified that "technology is shaped by social factors such as economic concerns and gender relations" (p. 19). The SSTT explains why smartphones are often too large for women's hands. Due to "male-biased design," "smartphones are designed without women in mind" by male technologists (Criado-Perez, 2019, p. 160). According to the SSTT, when examining ICT development and use, societal contexts and biases are more relevant than the existing ICT.

## 4 Research Design

This paper shares students' lived experiences of learning digital skills at a school in Germany. I employed a multi-case study design in the research, including Case One and Case Two from this school.

### *Research Questions*

To add the lived experiences of female students at the forefront of the digital skills gender divide to the discourse, I developed two research

questions: (1) to understand why the students in the cases wanted to acquire digital literacy; and (2) to explore the inequalities and opportunities that the students in the cases experienced in accessing, using, and benefitting from ICT:

(1) What motivated the students in the cases to acquire digital skills?

(2) What opportunities and challenges did the students in the cases have when learning digital skills?

*Methods for Data Collection*

I collected data remotely at a school in Germany teaching digital skills to refugee and migrant women between June and December 2020. I surveyed 28 students, interviewed five, two from Case One and three from Case Two, observed eight online digital skills lessons, four from each case, and examined the content of two school documents. In this paper, I share quotations primarily from the five interviews conducted, although the analysis accounts for all student data. I selected the survey to provide continuity in the data across the two cases, support the development of the interview questions, and give the students a gradual introduction to the research. I distributed the survey in English via a Google Form for Case Two students and by paper for Case One students, facilitated by the staff at the school in Germany. The survey for Case One was offered in English and German, with the school's staff translating verbally into other languages when required. Interviews conducted in English enabled me to gain a greater insight into the student's viewpoints (Flick, 2014). Direct lesson observations helped with immersive data collection (Allen, 2017). I observed predefined entities in the lessons (Smit & Onwuegbuzie, 2018); these included the lesson content, the student's digital skills levels, and indications about the student's motivation and confidence. In line with data protection in Europe, all data collected and presented in this paper are anonymous.

*Case Contexts and Research Participants*

Case One included 22 students in a programme teaching basic digital

skills, like using a keyboard and mouse. Case Two included six students in a programme teaching computer programming skills. The programmes were created for women by women, including a female-only student cohort. In 2020, the programmes occurred remotely because of the pandemic. Lessons were held once a week for ten weeks. Neither programme charged tuition fees. The programmes supported refugee and migrant women, helping them acquire digital skills for daily life, employment, and integration in German society. I selected Case One and Case Two to include women in the study ordinarily overlooked in digital skills gender divide research; female refugee and migrant students learning digital skills. The 28 women from 17 nationalities participating in the study possessed various intersecting social characteristics, making the data distinctive.

*Data Analysis*

Phase one of data analysis included transcribing the recorded interviews and exporting the raw survey data from the paper forms and Google Form. In phase two, I imported the interview, lesson observation, documents, and qualitative survey data into Quirkos. In phase three, I adopted a hybrid approach to data coding. I first coded the data deductively using codes developed from computer anxiety (Cooper, 2006), the SCT and the SSTT. Secondly, as I wanted to share women's lived experiences, I inductively coded, identifying patterns and themes within the data. In phase four, I triangulated the study, sharing the findings with the Programme Manager at the school to obtain feedback and enhance the validity of the results.

## 5 Research Significance

The women significantly affected by the digital skills gender divide, including minority groups like refugees and migrants, are rarely central in the scholarship (see West et al., 2019). This paper analyzes female refugee and migrant students' lived experiences of learning digital skills in Germany,

drawing attention to the perspectives of women at the forefront of the digital skills gender divide. Existing scholarship exploring the digital skills gender divide lacking women's perspectives is not grounded in the lived experiences of those facing it. Research should aim to understand women's motivations to study digital skills in different contexts. After all, incentivizing women to engage in education and employment in the ICT sector is vital to overcome the digital skills gender divide (West et al., 2019). Also, van Dijk (2018) highlighted that after over twenty years of the digital divide examination, theorizing lacks empirical evidence, requiring more interdisciplinary research. This paper offers a multidisciplinary exploration of the digital skills gender divide. It includes feminist, ICT, and sociological theories and a thematic analysis of the data to provide thoroughly researched empirical evidence.

## 6 Thematic Results

### 6-1 Research Question One

Firstly, I address (1) What motivated the students in the cases to acquire digital skills? The analysis revealed themes relating to the student's past experiences, present experiences, and future intentions for digital skills use. There was no significant difference in refugee or migrant students' urgency to acquire digital literacy. Although, refugee students predominantly started the programmes with fewer digital skills than migrant students, possibly owing to their disrupted prior education. All names in the following sections are pseudonyms that I assigned to the students at random.

#### *Past Experiences*

The students were motivated to understand cybersecurity and keep safe online because of being hacked in the past. Gawa, in Case One, explained that she had her social media accounts hacked in Myanmar. She said, "I changed my Facebook account password but . . . I [was] hacked again . . . I [was] really afraid . . . what's wrong?" When explaining this hack, Gawa became agitated,

revealing it was an upsetting experience to recall. This experience caused her to lose confidence in her digital skills. However, it also motivated her to study at the school in Germany as she wanted to know "more about security issues." Hla, in Case Two, was also from Myanmar and shared that her Facebook account was hacked, too. As a result of this experience, she said, "I want to know about social media security" and how to use two-factor authentication. These data imply that students' past experiences of being hacked played a role in motivating them to learn cybersecurity skills to be safer online.

The students were motivated to prove their worth by learning new digital skills because of past exposure to unsupportive family members. Honor, in Case One, explained: "The man I was married to always underestimated me and say I'm good at nothing." This experience motivated her to learn new skills and "look the man in the eyes and say, I did it!" Honor wanted to use her digital skills to prove her value and capability. Teresa, in Case Two, also wanted to prove herself. She stated that in Mexico, "I was always encumbered . . . with [people saying] it's very hard for you" to study digital skills, and "I had a very bad experience in my school education . . . boys were treated differently." Teresa explained that negative attitudes about her capabilities made her "strong" and determined to acquire computer programming competency and pursue an ICT career. These data illustrate that some students used their past experiences of being underestimated to fuel their enthusiasm to learn new digital skills.

*Present Experiences*

The students wanted to advance their ICT skills because of the proliferation of ICT in Germany. Teresa said, "computers are ubiquitous" and "it's important to understand what happens in the logic of the interfaces." Her experiences and perceptions were consistent with her having prior digital literacy competency. Ingrid, in Case Two, identified, "I honestly really enjoy programming. It's like solving a puzzle, and it's so much fun." She explained

that she attended the programme to upskill, network, and enjoy herself. In contrast, Case One students were motivated by initially furthering their basic ICT knowledge for menial daily tasks. After learning about it during lessons, Honor described that she used Google Sheets to make shopping management and budgeting easier. Whereas the students in Case Two recognized that computers are abundant. Advancing their digital skills would be beneficial, allowing them to indulge their curiosity about computer programming.

The students who were mothers were motivated by helping their children complete school homework. They wanted to support their children using ICT because the homework often required computer use, like word-processing. Honor exclaimed that the programme "is like a little drop of water making an ocean in my life" because it taught her new skills that she, in turn, taught her children. She said: "It would be a joy as a mother to say, oh, I can teach you, and I can tell you how [ICT] works." In 2020, 67% of students at the school in Germany were mothers. The digital literacy school provided mothers with childcare when in-person lessons occurred and offered flexibility for mothers learning remotely during the pandemic, like permitting their children to be present during lessons. These data imply that the student's motivations were connected to their circumstances, such as being single mothers. They also suggest that Honor intended to be a role model in using ICT for her children.

*Future Goals*

Despite the various motivations of the students in the cases, the findings suggest that obtaining digital skills for future employment was the primary reason for participation in the programmes. The students in both cases recognized that they needed digital literacy to support employment in Germany. Teresa said that learning digital skills "will open the path for different things . . . it will open the path for data science." Ingrid explained that "[Germany] is really good to find a tech job." Ingrid uniquely graduated from the programme into a paid internship with an ICT company, demonstrating

that the programme aided her digital skills and social capital acquisition. In Case One, 18 of the 22 students in the survey said they were learning digital skills to support a future job. Gawa said that she was learning digital skills because she was "interested about the Photoshop and also interested about the digital marketing." Honor explained that "in ten years' time, I will be a professional photographer." She understood that she needed digital skills to achieve that goal, including skills like digital photo editing.

### 6-2 Research Question Two

Secondly, I address (2) What opportunities and challenges did the students in the cases have when learning digital skills? The analysis revealed challenges the students encountered on the personal, community, and societal levels. Nevertheless, I uncovered some noteworthy opportunities, including that online learning provided more students with access to digital skills lessons.

#### *Opportunities*

One opportunity revealed in the data was how the female-only student cohorts demonstrated an investment in women. Female teachers also led the digital skills lessons I observed. Gawa explained that in lessons, "the teachers are really great. They have always positive thinking . . . I get the energy from them." Moi exclaimed during a Case One lesson observation: "You said I did a good job, and I feel butterflies in my belly! You really know how to motivate me!" Hla ventured an opinion on the impact of the female-only student cohorts: "When it's only women, I . . . feel like there is more support . . . I feel people want to help each other more." Ingrid said, "it's definitely more nurturing" when a lesson was female-only. These data imply that the all-female student cohort in the cases showed investment in women, offering a supportive learning environment that prioritized access to women using ICT.

During the pandemic, the programmes in the study rapidly transitioned from in-person lessons to online learning. Online learning changed how the

students and teachers used ICT. However, it provided more students with access to digital skills lessons. Honor explained that online learning enabled her to study digital skills while being at home with her four children because "I don't have to arrange a babysitter." She stated: "I can do home-schooling" and look after the children while attending lessons. Without online learning, it would have been difficult for her to attend the programme because she needed childcare support. The school initially rejected Honor's student application because they could only offer her childcare for two of her four children. Gawa lived in a refugee camp and, in November 2020, was forced to move to a new camp far from the previous one. Although she experienced poor Wi-Fi and a lack of privacy when studying, because her digital skills lessons occurred online, Gawa continued attending them remotely. These data show that online learning for at least two students enabled them to obtain digital skills that in-person lessons could not because of lesson access issues.

*Challenges*

The students also experienced challenges when learning digital skills, which affected their participation in the programmes. Gawa demonstrated reduced self-efficacy when she said, "I think oh I cannot do that . . . I [am] really afraid that in my class I'm the only one who cannot use the computer." However, Gawa was still willing to demonstrate digital skills when asked by the teachers. I observed her confidently showing classmates how to add images in Google Slides. Additionally, during a lesson observation of Case Two, Sara said: "Every time I do my homework, I feel like I interpreted the questions wrong, and my answers are not what you are looking for." It appeared that Sara felt challenged by reduced self-efficacy and lacked confidence when asked to demonstrate digital skills in front of her classmates. The students in Case Two possessed digital skills from the offset, theoretically enhancing their self-efficacy and confidence (see van Dijk, 2020). Nevertheless, there is a distinction between *using* digital skills and *creating* computer code. Thus, it is less

surprising that Sara lost her confidence when computer programming, despite possessing advanced digital skills.

The students in Case One experienced language barriers when learning digital skills, struggling to understand what teachers meant during lesson activities. I observed that the students had to use Google to "find out the life span of your favourite animal." To this instruction, Moi responded, "life span, what is life span?" Also, the teacher instructed the students to "enter your name on the Google Sheet. It looks like this" [she displayed a screenshot of a Google Sheet]. I watched Cecil from Case One trying to input her name on the screenshot rather than the Google Sheet. I observed Cecil's frustration dominating the lesson for more than ten minutes. These data imply that the multicultural and multilingual environment of the school in Germany caused challenges for the students when learning digital skills. This finding especially applied during online learning, as teachers could not offer one-to-one support for struggling students.

A further challenge that affected the women when learning digital skills was that some students did not have enough time to study outside the lessons. Two of the three students interviewed in Case Two suggested they did not study computer programming skills in their own time, with Hla eventually dropping out of the programme. Hla mentioned that she was stressed and chose the course "by accident." While she elaborated that she enjoyed the lessons, Hla faced many demands as a refugee, including learning German, which led to her withdrawal from the programme. Teresa explained that she was motivated and knew "you get as much as you put in," but she did not always have the time to complete additional study. Some students did not practice digital skills outside the classroom, likely limiting their development.

The students in Case One with fewer digital skills faced additional barriers in online learning, such as technical issues accessing the lessons. I observed problems during online lessons, like students disconnecting or not understanding how to access the lesson materials. Students also lost the in-

person social interaction in online lessons they had when lessons occurred face-to-face. Teresa reported: "The human element was missing . . . I prefer sometimes to go to the school and talk with the teachers . . . [the] more personal touch is missing." She also said that the technical challenges made her feel "demotivated." Gawa explained that "it's nice to [be] social [in-person] as well" and not only "focus about the learning." If the programmes in Germany had occurred in-person, teachers would have better-supported students who experienced technical barriers. Nevertheless, social and in-person interaction was not always possible during the pandemic, affecting the students' lived experiences of learning digital skills.

Finally, the students faced stereotypes and gender norms about women and ICT. As a single mother, Honor reported that she experienced gender norms affecting people's perceptions of what she could achieve. She said that people think: "[She has] four children, how is she going to make it?" Teresa also experienced people saying to her, "but you have a daughter . . . maybe you can't do it," when she told them she wanted to learn computer programming skills. Ingrid said there is a "misconception that positions like engineering or computer science, these are better for males." Ingrid's perception aligns with computer anxiety and the SSTT. Gender stereotypes affect women's engagement with ICT by predefining their societal roles, ICT adoption and usage, and career options.

## 7 Discussion

I discuss the results in the following sections, relating the findings to previous studies and exploring the implications for digital literacy educators and policymakers.

### 7-1 Micro-Level Personal Factors

*Student's Motivation*

Motivation is "an individual's desire to act in particular ways" (Walter &

Hart, 2009, p. 163). The students had differing motivations that drove them to participate in the digital skills programmes, such as gaining new skills for employment or helping their children with ICT. All students interviewed identified at least one goal for learning digital skills, from becoming professional photographers to understanding Google Suite. Motivated students setting goals aligns with van Dijk's (2020) statement that motivations "are conscious intentions," without which "individuals will not develop digital skills or competencies" (pp. 34-36). However, according to van Dijk (2020), people are not motivated to acquire and use ICT when "they have no time/are too busy" (p. 34). Van Dijk (2020) considered that before the motivation to learn digital skills comes the time to study. While having children to care for was an additional time commitment for the mothers in the study, I disagree with van Dijk's (2020) assertion that people lacking time to acquire digital skills lack the motivation. The results show that the prospect of helping their children use ICT motivated busy mothers to learn digital skills. As the school in Germany attracted so many mothers to the programmes, 67% in 2020, they established childcare provision and flexibility in online lessons. First came the student's motivation to learn digital skills, followed by the time assisted by the school. This finding concurs with the suggestion from Aydin et al. (2019) that "bringing flexibility in the system in line with learners' needs and providing support for learners regarding efficient time management may contribute to decreasing their rates of drop-out" (p. 54).

### 7-2 Meso-Level Community Factors

*Female Teachers*

There is a lack of relatable female role models within the ICT sector. The OECD (2018) stated that a cause of the digital skills gender divide is the "paucity of female role models in technology-based endeavours" (p. 26). The school in the study offered a primarily female-led learning environment, potentially providing the students with role models in their female teachers

and peers. Concerção (2018) argued that "female teachers provide an important solution to ensuring equal access to learning opportunities for both girls and boys. They can disseminate a culture of gender balance through education—not just in the classrooms but in local communities" (para. 2). Although there is no guarantee that a female ICT teacher will become a female role model, arguably, women often teach in gender-appropriate ways (see Mitra, 2016; The University of California, Los Angeles [UCLA], n.d.). The Wehrwein et al. (2007) study about students' learning preferences revealed that "54.2 [%] of females and only 12.5 [%] of males preferred a single mode of information presentation . . . male and female students have significantly different learning styles" (p. 153). Gender-appropriate digital skills education could capitalize on female students' preferred learning preferences, enhance their ICT education experience, and "disseminate a culture of gender balance" in the ICT sector (see Rusk et al., 2007).

*Sex-Segregated Education*

Mitra (2016) argued that male students could support female students in learning digital skills: "I asked the boys to explain the 'why' of things to the girls. The boys soon learned they did not know it all, so attempted a deeper understanding . . . in the process, the girls got their answers" (p. 42). Mitra's findings suggest that the student's digital skills education in the female-only cohorts in the study would have been enhanced by desegregation and enrolling male students. In sex-segregated education, "males or females attend school exclusively with members of their own sex" (The United States Department of Education, 2005, p. ix). Sex-segregated education attempts to account for "male-female differences in development and performance and . . . the achievement gap favouring boys" (UCLA, n.d., p. 2). Yet, the benefits of sex-segregated education lack empirical evidence. Still, advocates argued that for females, "single-sex education . . . [enables] them to do better in math and science, opening up careers where females are underrepresented" (UCLA, n.d., p. 2).

West et al. (2019) stated that sex-segregated education "may be helpful in some scenarios when teaching digital skills, as a way to boost girls' engagement and self-confidence" (p. 48). The students in the study concurred. Ingrid considered that the school's female-led learning environment felt "nurturing." While I recommend further research, these findings imply that the students in the study benefited from the sex-segregated digital skills programmes.

*Storytelling Network Access*

The school in the study is an important member of their community. However, moving their programmes online in 2020 in response to the pandemic affected this membership. Literat and Chen (2014) stated that according to the Community Infrastructure Theory (CIT), "individuals living in a geographical community are part of a neighbourhood storytelling network (STN) comprising of the residents themselves, geo-ethnic media and community organisations" (p. 89). Pre-pandemic, the school acted as a meso-level STN actor. They provided "communication hot spots" and "comfort zones" whereby community members gathered in-person to converse (Wilkin et al., 2011, p. 201). However, when the school moved programmes online, their role in the STN was affected as these interactions were no longer possible. Nevertheless, community organizations should ensure that they provide community members with access to "communication hot spots" and "comfort zones," even in an online environment. After all, the pandemic is a period of upheaval and uncertainty. Spaces in which to network with community members and learn about local pandemic measures are essential. For the school, their role in the STN is even more notable. They support refugee and migrant women, some of whom do not speak German, navigate their integration into German society. Thus, it is vital that they continue to act as an STN actor, even when only operating online.

*Access to Social Capital*

Networking opportunities were reduced when the programmes in the study moved online. The school struggled to support all students in building social capital remotely. Students with more advanced digital skills could attend online networking opportunities hosted by external organizations. However, those with lower digital skills could not. For Ingrid, who possessed advanced digital skills, this networking resulted in a paid internship. Madda (2021) explained that with social capital, "we are talking about networks" and "if you do not have social capital, it is harder to get jobs throughout your life" (as cited in Global Campus of Human Rights, 2021). Pearce and Rice (2017) observed that individuals engaging in "capital enhancing" activities with ICT are likely to experience "upward mobility" (p. 2). UNESCO's 'Digital Literacy Global Framework' includes "collaborating through digital technologies" as a digital literacy indicator (as cited in West et al., 2019, p. 14). Learning digital skills alone are insufficient to support social and economic advancement; social capital is also required.

As an STN member, the school ordinarily served as a space where students, teachers, and other community members could network and build social capital (Wilkin et al., 2011). However, the move to online learning during the pandemic affected access to these networks. Educational organizations delivering online education should be deliberate in helping participants of all digital skills levels engage in "capital enhancing" activities with ICT. Failure to do so could exacerbate the digital divide. Those who are unable to participate in social capital building online during the pandemic may find themselves experiencing downward "mobility" post-pandemic. Education and community organizations should take note of their important role in STNs and commit to supporting community members to network and build social capital, online and offline.

### 7-3 Macro-Level Societal Factors

*Structural Location*

The student's structural location within German society impacted their experience of using ICT and acquiring digital skills. Individuals' structural location reflects "[their] social class, social status, the roles [they] play, and the culture, groups, and social institutions to which [they] belong" (College of Social and Behavioural Sciences, n.d., p. 1). The College of Social and Behavioural Sciences (n.d.) noted, "people develop these perceptions, attitudes, and behaviours from their place in the social structure, and they act accordingly" (p. 1). Females' social characteristics, such as being refugees, migrants, and mothers, augment their structural location. In the study, Teresa, a mother from Mexico and a migrant in Germany, faced additional barriers in acquiring advanced digital skills because of her social characteristics. People made assumptions about her structural location and her ability to alter it by pursuing an ICT career. Nonetheless, it is noteworthy that Teresa did not subscribe to the same understanding of her structural location in Germany as those who questioned her ability. Hence, her participation in the Case Two programme.

*Hegemonic Gender Stereotypes*

The students experienced hegemonic gender stereotypes about women and ICT. Hofstede (n.d.) defined national culture as "the collective programming of the mind that distinguishes the members of one group or category of people from others" (as cited in Hofstede Insights). Such categorization of society members results in stereotypes. Kabeer (2020) identified that hegemonic gender stereotypes and ideologies "construct women as inferior to men, undermining their sense of self and social worth" (p. 1). The findings included that Gawa and Sara displayed reduced self-efficacy during lessons. Women with low "self and social worth" will likely lack confidence in stepping outside their comfort zone with ICT, impacting their "future-

orientated belief about what one can accomplish" (Jung, 2014, p. 28) with it. Gender stereotypes about women and ICT can affect females' attitudes and behaviours towards ICT. Educators and policymakers should pay careful attention to female students' structural location and experience of gender stereotypes on their participation and experience in digital skills programmes.

## 8 Research Limitations

I interviewed the women in the study once, providing a snapshot of their lived experiences. I recommend that future studies include a series of interviews. Secondly, non-English speakers were excluded from providing further data by participating in the interviews. Future research with participants from various linguistic backgrounds should enlist a professional translator's support to ensure greater data representation. Finally, based on the findings in the study, further research is needed to understand the intrinsic and extrinsic motivations of students learning digital skills and the impact of sex-segregated learning environments in digital skills education.

## 9 Concluding Remarks

Listening to the women at the forefront of the digital skills gender divide will support scholars, policymakers, and educators to understand it better. This paper provides empirical evidence on the lived experiences of female refugee and migrant students learning digital skills in Germany. Adopting a multi-case study allowed me to capture this evidence from students with low digital literacy competency and those seeking to advance their digital skills in computer programming. I drew on the lived experiences of women learning digital skills from various backgrounds, including being refugees, migrants, and mothers. Of note in the findings are the student's motivations and that lacking the time to use ICT does not necessarily equate to a lack of motivation to acquire digital skills. The results also highlight that moving lessons online during the pandemic disrupted the school's important role in their community's

storytelling network. Online learning presented students with low digital skills an additional barrier in accessing remote lessons and building social capital. Educators developing online programmes should be mindful of offering spaces for communication and networking that individuals with differing digital skills can access. Overall, digital skills educators and policymakers should pay close attention to the backgrounds and characteristics of students, the environment in which they are learning, and the consequence of structural location and gender stereotypes on female students' ICT programme participation and learning experience. Like other examples of inequality, the digital skills gender divide cannot be left unchecked. Initiatives to combat digital disadvantages are necessary worldwide to help women advance their digital skills competency and take their place at the frontiers of technological innovation (West et al., 2019).

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Abstract

## 「エンジニアリングまたはコンピュータサイエンスは男性に有利である」――デジタル技術を学ぶ女子難民と移住学生の生活経験

ロレイン・ヘイマン

本論文はドイツでデジタルリテラシーを学習している28人の女性難民と移民女性学生の経験を経験的定性データとして分析した。今回のマルチケースの女性研究ではアンケート、インタビュー、直接観察データを通して二つの研究問題を吟味した。第一に、対象の学生たちがデジタルリテラシーを身につけようとする動機は何か。第二に、デジタルリテラシーを学ぶ際の学生たちが経験したことと挑戦は何か。

結果として、学生たちの動機は多様であり、過去や現在の経験と未来の目標に関連することが判明した。例えば、彼女たちは過去にハッキングされた経験があるため、サイバーセキュリティを理解しオンライン上で安全を確保しようとする動機があった。ドイツでの技術の進歩を目の当たりにしたことにより、学生たちはICTに関わる技術の向上を望むようになった。今後、学生たちはICT技術を活用して就職を支援したいと考えている。

また、学生たちは、新しいICTに関わる技術を学ぶ上でいくつかの挑戦を経験する。マイクロレベルでは、学生のICTを利用する際の自己効力感が低下する。メゾレベルでは新型コロナウイルス流行時、学生たちは遠隔でICTに関わる技術を学習することに障壁を感じた。マクロレベルでは、彼女らは女性が高度なICTに関わる技術を身につけることができないという考えなどの性別固定観念を挙げた。

本論文の結果は、デジタルリテラシー教育者と政策立案者がICTに関わる技術を学ぶ学生の背景と特性、環境、女子学生の性規範と構造的地位に注目しなければならないことを示している。

**キーワード：**フェミニスト研究、女子学生の経験、デジタルスキル、デジタルリテラシー、デジタルディバイド