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A Phenomenological Study of Irish and Portuguese Women's Experiences of Receiving Family Support When Studying STEM Subjects at Technical Institutes

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A phenomenological study of Irish and Portuguese women's experiences of receiving family support when studying STEM subjects at technical institutes

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ABSTRACT

This paper reports a research study of women's experiences of receiving family support when studying science, technology, engineering, and mathematics (STEM) subjects at technical institutes in Ireland and Portugal. Specifically, it reports phenomenological analysis of 19 interviews conducted during the 2014-2015 academic years with female students studying engineering subjects at technical institutes in Ireland and Portugal. It identifies forms of positive support received from family as well as problematic family dynamics and concerns. Parents, uncles, and aunts provide many positive forces, as do surrogates (i.e., adopted family and close mentors). Cousins and brothers also provide role models and information. For our participants, meeting family obligations and being first-generation college students presents some challenges and stress.

1 CONTEXT

In Ireland, our research team interviewed 10 Irish women majoring in first-year engineering and physics at Dublin Institute of Technology. In Portugal, we interviewed 9 Portuguese women enrolled in engineering-related subjects such as bio-technology at Escola Superior de Tecnologia do Barreiro, a branch of Instituto Politécnico de Setúbal. One theme running throughout these interviews involved the role of family in providing support for these women, and because prior research

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suggests that parental support is important to student success, we elected to study this issue using our extensive pool of qualitative data.

2 LITERATURE REVIEW

The overall study both draws from and contributes to four main bodies of literature, dealing with: (1) theories on how students develop cognitively and epistemologically, (2) studies of women in engineering and engineering education, (3) research about both collaborative and Problem-Based Learning, and (4) the use of phenomenology as a methodology for conducting research on engineering and STEM education.

Based on the identification of the central role of familial support in our participants' descriptions of their experience in engineering education, we also reviewed of literature on this topic. Family support has been recognized in prior research as a significant in helping women choose careers in STEM. For example, quantitative analyses by Bieri Buschor *et al* [1] identified parental support, as well as learning experiences and role models, as crucial in the decision-making process for women who ultimately pursued STEM at ETH in Zurich. Parents appeared to be completely supportive during the time they were choosing the location and major, these same authors found using qualitative methods. The parents were "deeply concerned with their daughters' needs and the high requirements of the rigorous ETH" [1, p. 174]. Bieri Buschor *et al* inferred "that parents' (particularly fathers') worries concerning study and job-related requirements can be a barrier for students considering a STEM career" [1, p. 174]. They supported this idea with prior research that identified fathers as role models of particular importance to individuals choosing to pursue engineering [2, 3]. Bieri Buschor *et al* found that women who, in high school, intended to study STEM did in fact later enroll in such courses. The loss of women from the "pipeline" was not occurring at the point of transition from second to third level, but rather, earlier.

Parents' level of education influences persistence toward earning STEM degrees, according to Gayles and Ampaw [4]. Highly educated parents typically provide high levels of academic encouragement which raises the likelihood of women entering STEM majors. Financial support provided by parents has been found to predict completion of STEM degrees by women [5]. The quality of students' experiences at the third level also helps predict their persistence toward earning STEM degrees [6]. Gayles and Ampaw [4] found that although living on campus supported higher rates of graduation, this effect was much more evident for men than for women in STEM in four-year institutions in the USA.

3 PHENOMENOLOGY

Given that our aim was to study the experience of women on STEM courses, we decided to adopt an exploratory qualitative methodological approach guided by phenomenology as this provides an appropriate method for exploring how women experience engineering education and what sources they draw upon for support. Prior phenomenological studies in engineering have assessed students' learning strategies [7] and gender roles [8], how first-generation college students discovered engineering [9], how doctoral students experienced collaborative learning [10], how students learn to discuss engineering [11], students' use of textbooks in problem-solving [12] and their experiences entering the engineering profession [13] and working as designers [14].

4 RESEARCH DESIGN

4.1 Sample Group

From an overall pool of transcripts from 47 interviews conducted with women studying STEM subjects in three countries, we focused in on 19 interviews for the study reported here. This sub-set was conducted with students native to country of their post-secondary study. This included interviews with 10 Irish and 9 Portuguese women.

4.2 Interview Protocol

Interviews conducted in Ireland were highly open-ended and occurred in English. They began with the interviewer stating that she wanted to learn what it is like to be a woman studying engineering and posing a very general question. Most topics were raised by the interviewees themselves, with little prompting by the researcher. The interviewer/ primary author personally transcribed these interviews. She is currently analyzing them as part of a large-scale grant-funded study. During the period the interviews were collected, she also served as a participant-observer in the design project labs many of the Irish students were taking. She attended lab sessions to (1) learn about engineering education and (2) build trust and rapport with the students she wanted to interview, but she was not involved in evaluating the students' work for grades.

Interviews in Portugal were conducted in the Portuguese language and were more structured as a result. It was necessary to use a pre-determined list of questions since the interviews were conducted by two different people (sometimes with the primary author present, but usually not). In contrast to Ireland, these interviews were conducted by the students' own teachers. Overall, the responses were briefer, less detailed, and generally less fluid and a bit more guarded than those conducted in Ireland. Although the resulting data are a bit less phenomenological, they still provide rich content and valuable insight regarding the student experience. The interviews conducted in Portugal have been translated into English by a team of Portuguese speakers.

4.3 Data Analysis

The two lead authors of this paper conducted interviews and met in person throughout the process to: discuss the design of the study, identify the research method and framework, conduct several interviews together, discuss procedures for analysis, identify emerging themes. We wrote and edited this paper in tandem. We used the iterative, interpretive, and hermeneutic approach to analysis, as described in van Manen's book *Researching Lived Experience: Human Science for an Action Sensitive Pedagogy* [15].

The authors used NVivo to identify all mentions of words related to family, including: parents, family, mother, mum, father, dad, pop, grandfather, grandmother, aunt, uncle, cousin, sister, brother, son, daughter, grandparent. In this search we did not include the word "home" so it was only considered if associate with other words on the list.

We conducted thematic analysis (manually, after entering extended passages into a word document chart). Then we highlighted all ideas related to family, and placed each distinct idea into its own row for thematic analysis. After reviewing the entire set of passages, we identified themes. We then tagged each row according to the theme(s) is best represented. During this process, we adjusted the themes to fit the

overall set of interviews and tallied results in order to understand the overall effect of each theme.

5 RESULTS

Table 1 lists all family-related themes that emerged in these interviews. The column to the left shows the relative importance of each theme by indicating the number of times the specific topic was mentioned by interviewees. The middle column indicates the number of individuals who reflected the theme; this middle column also notes the number of Portuguese (P) and Irish (I) students affected, in parentheses. The themes are listed in order of relevance, based first upon the number of women affected by the theme, and secondly by the number of mentions that arose. These tallies do not reflect word frequency, but rather the number of *passages* where a distinct idea was expressed around the topic. Thus, a paragraph about the role of a cousin, for instance, would count as one mention, even if the word "cousin" appeared multiple times.

Table 1. Helpful support

# Mentions	# Individuals	Theme
11	9 (2P/7I)	Parents – discussing academic events
11	8 (7P/1I)	Parents – indirect/distant exposure to engineering
9	8 (5P/3I)	Parents – general emotional support and unconditional encouragement
10	8 (2P/6I)	Uncles/Aunts – providing examples and advice to her or her parents, providing access to internships, or providing place to live
9	7 (1P/6I)	Parents – home life and care (i.e., providing shelter, meals, laundry, etc.)
11	6 (2P/4I)	Parents – direct/close exposure to engineering or access to internships
10	6 (2P/4I)	Surrogate – non-relatives described as family
10	6 (2P/4I)	Parents – providing advice for life and identification of daughter's characteristics
7	5 (2P/3I)	Mentoring – being an example for friends and family with regard to STEM
13	4 (2P/4I)	Cousins – providing examples or information on school and careers, playing together or providing access to toys (i.e., Legos), acclimating her to working with boys
8	4 (0P/4I)	Family – learning from their behavior
6	4 (0P/4I)	Parents – place to make stuff
9	3 (1P/2I)	Brothers – acclimating her to working with boys; providing examples of engineering-related ideas and activities, or assist with child care
3	3 (2P/1I)	Grandparents – examples and surrogate parents
13	2 (0P/2I)	Surrogate – mentor providing crucial advice leading to choice of STEM
6	2 (0P/2I)	Parents of older students – providing space for independence and autonomy, direct academic support, or financial support
5	2 (0P/2I)	Mentoring – mothering others (academically and non-academically)

Because the interviews and overall analysis are grounded in a phenomenological approach, we have included themes that arose in even just one or two interviews. These help capture the diversity of experience faced by our sample group. These numbers should not be interpreted as absolutes. Moreover, few direct comparisons can be drawn between the two cultural groups because the interview protocols and level of translation differed between the two groups. Problems and stressors noted by various women are listed in Table 2.

Table 2. Problems mentioned

# Mentions	# Individuals	Theme
9	5 (2P/3I)	Family – meeting family obligations such as caring for younger siblings
7	5 (2P/3I)	Parents – poor or no 3rd level experience, or lack of understanding of the topic or what she's going through
6	5 (2P/3I)	Parents – living very far away (long commute)
6	4 (3P/1I)	Parents – going against their advice, arguing with or hurting them
5	4 (3P/1I)	Family – limiting her options or pushing in a direction the daughter didn't want (includes trying to appease parents, live up to their expectations, or compensate them for their support)
3	3 (2P/1I)	Parents – doubting or nagging their daughter
3	2 (1P/1I)	Family – guilt
2	1 (0P/1I)	Family – money concerns
1	1 (0P/1I)	Younger family members – household noise
1	1 (1P/0I)	Parents – only child having to leave parent' home to study

6 DISCUSSION

6.1 Helpful Support

Participants discussed their families frequently during interviews, often in association with positive and helpful support (see Table 1). Many women described discussions with their parents about academic events or topics. Secondary or distant exposure to engineering that came by way of their parents featured heavily in the narratives, particularly among female students at IPS in Portugal, as illustrated in this quote from a Portuguese student[2]:

P06: I love the cosmetic area because my mother is a hairdresser, so since I was young I've always liked that area. And Biotechnology has investigation of cosmetic products.

Q: Natural products?

P06: Exactly, manipulation of any gene in a cream. I've always loved this area. Also always liked the medical area, the part of medical tests. The part of Forensic Science I also really like.

Consistent with prior literature, students enrolled in STEM majors at third level described a high level of general emotional support from parents and the type of encouragement associated with unconditional love. Uncles and aunts featured highly in the narratives of women at DIT in Ireland, who described their parents' siblings as providing role models, direct advice, and delivering insights and advice to her parents. Aunts and uncles also helped by providing access to internships and—for at least two participants—by providing place to live. Seven participants discussed the convenience of being able to live in their parents' home. A majority of participants in this sample do live at home, although not all described specific benefits. The longer interview period in Ireland paired with the fact that interviews were conducted by someone who was not the students' teacher may have affected the level of conversation on this topic.

Women at DIT were more likely than those at IPS to identify close, direct exposure to engineering provided by their own parents (e.g., a parent in STEM or a parent's

[2] Portuguese interviewees are identified by a number preceded by the letter P and the Irish by the letter I. The interviewer's questions are indicated by the letter Q.

ability to connect her with a seminal internship). This is likely due to socio-economic factors; comments related to indirect exposure often mentioned parent's manual labor or service jobs. Direct exposure was typically provided by parents with higher education:

Q: And, when you're stuck in physics, when you're working at home?

I02: I'd ask one of my friends or my dad, or anyone that could help me. Friends outside of college, as well.

Q: You have a whole bunch of people you can ask?

I02: Yeah.

One-third of participants discussed people in the larger community feeling like "family" and providing essential social support. We've called these people surrogate family.

I03: *we're having a course night out in two weeks. … I don't know, we're all kind of like a little family. It's lovely.*

And

I07: *because Pat, my kind of tutor fellow [and a frequent client in the place she works]—he's always telling me to stop. Stop worrying about stuff that's happening. Because when I first started, I'm like, "What am I going to do my Masters in?" [laughing] He's like, "You have to get through the first semester! Never mind the f-ing degree."*

Parents are also important sources of advice, often mentioned for identifying their daughter's characteristics.

P04: *My mother always encouraged me, because she knew that I liked this area. And, I always talked of these courses.*

These women also help others in their families, providing STEM-related information, ideas, and role models for friends and family.

P03: *I have said to my (female) cousin who is 14 and is finishing year 9, I would advise her to go for a professional course. If she had a clear idea of what she wants to do, I think a professional course gives more of a base, for example there in Setubal they have an excellent study plan and you have the chance to do various work placements, learn other languages, improve our English. When you are out in the field you learn more. This is what I say to my cousin.*

And

I03: *Last week, when I came home, when my foot was in the Mechanical box, [I was] showing mom and dad. And my brother was like, "You didn't build that!" I was like, "I did! I did and I designed it." And I showed him the pictures of me gluing it and everything and I was just so confident. I was just delighted with myself. I was like, "I did. I built that!" I was showing everyone. I sent it to a WhatsApp group for girls—a bunch of girls I went to school with—and I haven't talked to them in about 6 months—and I was like, "Look what I built!"*

Women described learning from the behavior of family members, and benefiting from having a place, provided by parents, to make stuff. Four women described cousins as being particularly important. Cousins provide them important role models as well as information on school and careers. They also were important sources of tinkering

playing together, and people who provided some women access to toys (i.e., Lego). Male cousins helped acclimate participants to working with boys.

Similar to cousins, brothers—particularly older ones—had helped acclimate our participants to working with boys, provided examples of engineering-related ideas and activities, or (in one case) assisted with child care. Within this sample, sisters were not described in the same way as brothers. Only younger sisters were mentioned, either as needing care or providing an interesting/active family environment. Grandparents stood in as surrogate parents for some participants—raising one, helping select STEM courses, and modelling engineering behaviors for another. Two non-traditional students (who were a bit older than the others) described some types of parental support not mentioned by the younger participants, such as providing them: space for independence and autonomy, direct academic support, or financial support. Moreover, two women described being a “mother hen” or “mothering” others with regard to academics and life. Guardians (parents or grandparents) were mentioned by two participants as having helped select her institution and course, but friends also influenced these decisions.

6.2 Problems Mentioned

Participants mentioned family stress much less frequently than family benefits. Stresses imposed by family are listed in Table 2. Notably, five participants discussed family obligations, such as caring for younger siblings or her own child. Not every instance of meeting a family obligation was described as problematic, but we categorized all comments related to family obligations together since prior research has shown that this type of activity can have adverse effects on persistence [4]. Individual stress-inducing items (related to these obligations) appear at the bottom of the list. They help us understand the various types of stress associated with childcare and providing assistance to family. These were discussed by three participants, and they represent stressors that many engineering students world-wide are likely to experience: family-related guilt, money concerns, household noise associate with younger siblings, and being an only child who must leave home to study. More widespread among our participants were problems identified by having parents who had not studied at 3rd level, or had poor experiences, and therefore didn’t understand what the student was encountering and couldn’t offer advice or empathy:

Q: But did your parents encourage you to choose a more technological course?

P07: At first they wanted me to be whatever I wanted. But I hadn't the results to get in what he wanted, so I said I would do the preliminary CET course and then convince them that I was going to do chemical engineering. They thought it would be very difficult, because my stepfather took five years to complete a course of only three years. My mother thought I would not be able to finish it. And I said I would try.

An Irish student explained:

I04: Like my Ma and Dad, no one's gone [to college]. So it is the first, so it's—it's weird now because none of them know what to do about it.

Another said:

I03: I'd show them photos and videos and stuff, and they're kind of like "Oh that's nice," because they don't get it. Because dad sells agri-feed and mom's a Montessori

teacher. And I'm the first out of the family to go to college in Ireland. My older brother went to college in England, and he was just away the whole time.

For a number of students who still live with parents, their home is very far from campus. A handful of women in the study must commute three or more hours per day. At least one participant with such a commute had to repeat first year following her interview, and another interviewee in such a situation was repeating first year at the time of the interview. Four women described conflict, such as going against a parent's advice, arguing with parents, or hurting them as described below:

I06: It happens a lot with my parents, with the stress, sometimes I answer them in a way that hurts them, and that was not my goal. But studying in college is a lot of pressure. But I'll get it.

This type of stress was associated with limiting their daughter's options or pushing her in a direction she didn't want. This had to do with trying to appease parents, live up to their expectations, or compensate them for their support.

P07: I joined Chemical Engineering thinking, "If it doesn't go well, I change the course, I can ask for transfer." That was my thinking. But I've finished the first year, I've done the subjects. I didn't get such good grades, but I thought, "My mother struggled to pay for me to be here and now I will give up? No. I will do the second year, if it goes wrong, I give up." I started the second year, I did Programming, did all the subjects. And they told me, "You're already in the middle of the course." And then I thought, "Will I give up? No, I won't." I tried, it was really not what I wanted, but I read, I asked, I did the subjects. But now I won't give up anymore.

Here, the sense of obligation has the student going down a path that doesn't hold much appeal to her. Somewhat similarly, three students who had struggled with their courses faced what they considered undue and unhelpful nagging from their parents.

7 CONCLUSIONS

Results suggest that social interaction as well as emotional and physical forms of support are very important to the women in our sample. Examples of positive family support identified by interviewees included the provision of: housing and domestic support (cooking, cleaning, housekeeping); physical and financial resources; fun and interesting social environments; ideas about what engineers do; images of success; opportunity to build and tinker; discussion, interest, and some assistance with homework; identification of what the interviewees enjoy and excel at; conceptualizations of careers and possibilities for the future; advice and guidance on life and assignments; and professional connections including access to internships.

Not all family interactions that were described actually provided helpful support, however. Some challenged the participants' goals or visions for themselves. Very subtle yet powerful barriers emerged in some of the stories. Most were isolated occurrences, described by just one or two interviewees (e.g., failing to provide diverse toys, provide a quiet enough home environment for study, suggest engineering, note that family members were involved in engineering, or support the notion of engineering as an appropriate career choice for a female). Others of these barriers were more widespread, such as providing housing at a very far distance from the girls' place of study or relying on the student for care of siblings.

These data confirm previous international studies which indicate that family interactions play an important part in influencing young women's decisions to choose STEM courses and in their subsequent retention. In combination with other data that

the authors are analyzing with regard to course selection, learning challenges and strategies of women on such courses in Ireland, Portugal, and Poland they are expected to provide a multidimensional portrait of the experience of these students which will be valuable to engineering educators and higher education policy makers who are concerned with the attraction of female students to STEM courses.

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