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Identifying the Parenting Approaches of Parents of Women in Engineering

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Abstract

The purpose of this exploratory study was to identify key aspects of parenting approaches and practices used by influential parents of female undergraduate engineering students and map them to existing parenting styles. Through inductive analysis of in-depth, semi-structured interviews with six (6) female engineering majors, we investigated the parenting approaches employed by their parents and key factors that may have influenced their daughters' decisions to pursue engineering. The parenting practices used by parents of female engineering students revealed a balance of *support, responsiveness,* and *high academic expectations.* The findings of this research- open communication, encouraging independent decision making while providing support, holding high academic expectations while being responsive- align closely with the authoritative parenting style characteristics described by pioneering researcher Baumrind (1996). Since the data analysis revealed strong similarities between parents of female engineering students and the characteristics of authoritative parenting, future studies should further investigate the link between engineering majors and parenting styles using a broader sample. This could provide more conclusive evidence about which styles are most common among parents of female engineering students.

Keywords: female in engineering, parents & engineering, parenting styles, parenting and engineering

Introduction & Background

Parenting styles play a significant role in shaping children's development, including their career choices. When examining factors that influence student career choices, i.e. peer group influence, role model influence, family influence, parental influence is the most common factor in determining a students' career choice (Kumar, 2016). This helps emphasize the importance of parenting styles' influence on their children's choice of a career path. Baumrind (1996) defines and categorizes four parenting styles: authoritative, authoritarian, permissive, and uninvolved. Among these four parenting styles, the authoritative parenting style which is characteristic of high expectations held by the parents facilitated through open discourse while being both responsive and supportive has been associated with positive outcomes in various domains, including academic achievement and psychosocial development (Baumrind, 2013). While previous research has examined the relationship between parenting styles and career decision-making (Sovet & Metz, 2014), there are limited studies that have specifically investigated the parenting approaches used by parents of female engineering students. Given the underrepresentation of women in engineering and the importance of parental influence on career choices, this study aims to explore the parenting practices employed by parents of female engineering majors who intend to enter the STEM workforce.

In an attempt to respond to this persistent issue, various intervention programs have emerged, including afterschool STEM activities, academic mentoring initiatives, and e-mentoring platforms, with aims to increase participation of historically underrepresented groups such as women, minorities, and those from disadvantaged backgrounds in STEM fields (Denson & Bayati, 2023; Denson et al., 2022; Tyler-Wood et al., 2012). Even though parents can play an important role in these areas by providing support and opportunities, their indispensable role as

parents has not been emphasized or activated enough in these efforts. Several studies demonstrate that gender-biased parenting practices, including parental behaviors, values, and attitudes significantly influence female students' attitude and career trajectories (Chown, 1958; Eccles et al., 1993; Jacobs et al., 2005; Jacobs et al., 2006).

Parenting styles are one of the most significant contributors to the development of gendered limitations or opportunities for girls. Baumrind (1996) defines and categorizes four parenting styles—authoritative, authoritarian, permissive, and uninvolved parents. She delineates nuanced characteristics of each family dynamic, mentioning that authoritative parents, for example, aim to balance warmth and discipline, being equally responsive and demanding, while explaining reasons behind disciplinary measures. Authoritarian parents prioritize adherence to "rigid rules" and high expectations over open dialog. Permissive parents indulge child autonomy over behavioral regulation, while uninvolved parents provide general neglect and disengagement. Several research studies have examined the relationship between parenting styles and career-decision making and career self-efficacy (Guay et al., 2003; Sovet & Metz, 2014).

In another line of research, Kincaid et al. (2012) mentioned that “Bronfenbrenner (1961, 1979) was among the first to suggest that parenting behaviors, including parental affection and tenable authority, may have differential effects on boys and girls" (p. 5). Given the importance of parents’ role and parenting styles on career decision making and child development with respect to gender differences, this research seeks to identify the parenting practices used by parents of women in engineering majors who intend to enter the STEM workforce. The guiding questions for this study will be —what is(are) the parenting approaches used by parents of females who are enrolled in engineering programs and have intentions to enter the STEM workforce? What

specific styles of parent-child dynamics, communication channels exist between parents and their daughters?

Method

This study analyzed interview data originally collected by Bayati (2023) examining the experiences of female engineering students in relation to their parents. Participants were recruited from a university in the southeastern United States. This study takes an asset-based approach by examining the key factors of parenting style used by influential parents of women with engineering identities.

Out of the seven students who completed the questionnaire, six female undergraduate students acknowledged that their parents had an impact on their career decision-making process. Given the phenomenological nature of this study and the aim of this study; exploring the parenting factors that influenced students' engineering career choices and mapping them to existing parenting styles, only the six students who recognized parental influence were invited to participate in the interviews. This purposeful selection aligns with the study's objectives, as it allows for an in-depth exploration of the parenting approaches and practices that played a role in these students' decision to pursue engineering.

Semi-structured interviews were conducted to capture females in engineering majors' lived experiences regarding their parents and the role they played in their STEM pathways. Semi-structured interviews are an appropriate method of data collection when researchers are seeking to glean the unique perspectives of participants in lieu of a generalizable understanding of a phenomena (Adeoye-Olatude & Olenik, 2021). Furthermore, this method allows for further exploration of participant answers through the use of probing questions.

We used an inductive approach to analyze the data and look for patterns in transcripts of participants' interviews. Indicative analysis is more useful when the research is new and seeking for new conclusions and theory (Tracy, 2013). Employing an inductive qualitative approach to data analysis, the researchers read the transcripts and immersed themselves in the transcripted interviews with the aim of making sense of the data and defining and developing categories and themes. Tracy (2013) mentioned inductive reasoning as " a 'bottom-up' type of reasoning that begins with specific observations and particular circumstances and then moves on to broader generalizations and theories" (p. 36).

Based on the exploratory and new nature of this study we used open coding techniques to identify and label concepts and categories that emerge from the data (Strauss & Corbin, 1998). Strauss and Corbin (1998) describe three main types of coding process in this approach: open coding, axial coding, and selective coding. Open coding involves breaking down, examining, comparing, and reading the data through a line-by-line analysis to identify initial concepts and categories. Axial coding focuses on relating the categories identified during open coding to their subcategories/themes, specifying the properties and dimensions of each category, and making connections between them to develop a more comprehensive understanding of the phenomenon. Selective coding is the final phase, where the researcher selects a core category that represents the central phenomenon and systematically relates it to other categories, validating those relationships and refining the categories as needed. Using this definition, the researchers read and coded the transcripts line by line and then categorized them to find the emerging themes. This iterative coding process enabled the researchers to reveal and understand the key parenting approaches for the parents of females in engineering described by the participants of this study.

To enhance the trustworthiness and credibility of the findings, the researchers employed investigator triangulation (Merriam & Tisdell, 2015). This involved having a second researcher independently code a portion of the data using the same open coding approach. The two researchers then compared their initial codes, discussing similarities, differences, and interpretations until they reached a consensus. By employing investigator triangulation, the researchers enhanced the rigor and trustworthiness of the qualitative analysis of this study.

Findings

Open Communication

The inductive thematic analysis of interviews with female engineering students sharing their lived experiences from their childhood and impact of their parents in STEM trajectory revealed several prevalent themes that align with key dimensions of an authoritative parenting style (Baumrind, 1996). A common theme across participants was their parents having *open communication* with their daughters. This manifested through reciprocal discussion and conversation between parents and children. Specifically, there was collaborative problem solving around career decisions and education, with parents engaging in job discussions, giving career advice, making job suggestions, and having open dialogues about future career directions and school challenges. For instance, one participant shared that

> Well, we had a very open channel of communication, both my parents and I, about finances and kind of their return rate I think for when you're working." Another

participant also shared that “if someone's struggling we sit down and we talk about why we're struggling.

Independent Decision-making

Moreover, encouraging *independent decision-making while providing support* was prevalent among participants. Several participants shared how their parents provide them with advice, provide them with resources, guiding them toward the college majors but at the same time providing autonomy for them to make their own decision. As one of the participants mentioned that “So I do feel like from a young age it was just kind of like suggested to me.” Another participant also shared that “they've been supportive throughout the whole thing. It wasn't just about STEM, they would give me all the options and be like, there's so many things you can do.” This maps onto the authoritative approach of validating children's interests while also explaining and recommending perspectives and guiding them towards making informed decisions. Participants mentioned their parents being highly supportive and responsive through behaviors like providing resources, offering career advice, offering support and help when needed, and being involved in their education and suggesting what can be best for them.

High Academic Expectations

Additionally, almost all the participants described their parents *having high academic expectations*. Participants mentioned how their parents hold high academic expectations by wanting straight A's, pushing them to have extracurricular activities, and prioritizing their education. As an example, one participant mentioned, “They definitely set a standard when I was in high school and of course when I got to college." This reflects the authoritative tendency to

establish high standards while being responsive. It was also common for parents to be highly supportive by assisting with homework, involving themselves in school selection, and supporting educational goals. This pattern of high expectations paired with high responsiveness aligns with defining features of authoritative style, which balances demands and support (Baumrind, 1996).

Gender Neutral Environment

Most of the participants of this study also shared how their parents provide a *gender neutral environmen*t for them. Parents rejecting gender stereotypes and giving daughters equal treatment also reflects authoritative parenting ideals. Authoritative style emphasizes clear communication without psychological manipulation (Baumrind, 2013). Parents encouraged daughters' STEM capabilities over traditional expectations, devoid of shaming or limiting messages based on the gender norm. This gender-equal treatment facilitates the positive outcomes associated with authoritative approach (Baumrind et al., 2010). For instance, one participant state that " Like it was never like a stereotype and I would almost say that I was never like said, you're a female"

While four participants shared that they did not experience any stereotypes while growing up in their household, it is worth mentioning that one of the participants experienced stereotypical behavior from her parents while another participant experienced some level of historical gender role expectation such as cooking from her mother.

While the study revealed that most participants experienced a gender-neutral environment from their parents, it is crucial to acknowledge the role of family background/culture and values in shaping gender role expectations. For instance, one participant's experience with gender stereotyping from her parents could be influenced by their cultural or ethnic backgrounds since her family had a different background from other participants in the study. Similarly, another

participant's mother, who came from a Christian background with traditional values, may have held certain historical gender role expectations, such as cooking, despite being a woman in STEM herself. The participant shared that:

> So my mother is a very Christian woman, so she does kind of have and she's from the South. So she does kind of have a bit of a warped view at times. I think of how much a woman should provide for a relationship.

However, the participant mentioned that " But she did always remind me that like you do need to be self-sufficient, you know?" and she believed seeing her mother in STEM helped her to find her way faster. Therefore, while she has experienced some level of traditional gender role expectations in the past, she maintained that her mother played a significant role in shaping her decision regarding her career path.

Discussion

Parents and parenting practices play a significant role in child-development and career development. By utilizing an asset-based approach, this study took a different approach to explore parenting practices for the parents of females in engineering majors who intend to enter the STEM workforce. An analysis of the lived experiences of participants revealed strong alignment between their described parents' behaviors and the defining dimensions of an authoritative style. Participants experienced open communication, autonomy in decision making while parents hold high expectations paired with abundant support and resources, and equal treatment regardless of gender norms with their parents while growing up. However, two participants shared about experiencing some stereotyping behavior from their parents or just their mother highlighting a potential contradiction between the messages participants received from their parents.

In other words, these two participants received mixed messages - they were empowered to pursue their aspirations and received this message from their parents, while they faced constraints stemming from traditional gender role expectations from their mothers or parents. To further understand these nuances and contradictions, future research should examine the family context, family cultural background and the values they share, as well as the messages they send to their daughters. It would be valuable to explore how much influence these traditional gender role expectations hold and how daughters navigate accepting or rejecting these values and expectations.

In sum, by exhibiting responsiveness, support, and reasonable demands, parents can be a valuable agency to support academic thriving of their children, particularly sparking STEM interest in their daughters. The findings of this study endorse authoritative parenting as an optimal approach for facilitating positive youth trajectories, with respect to gender. Different genders may develop different attitudes and careers or respond differently to the same parenting practices /parenting style. Therefore, this study focuses on parenting practices used by parents of females in engineering majors. However, further research is needed with larger, more diverse samples to determine the prevalence of these patterns in parents of STEM college students.

Future research may look at parenting styles of women in STEM or students in engineering directly by using parenting styles questionnaires. This study provides initial qualitative evidence revealing strong overlap between authoritative parenting style and female with engineering identity. Additional investigation can enrich these conclusions and evaluate their generalizability.

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Appendix

Table 1

Code Book

Themes	Codes	Definition of Codes	Data
Open Communication	Reciprocal discussion and exchange, collaborative problem solving, job discussion, giving career advice, job suggestion, future career discussion, educational support	Having an open and reciprocal dialogue and allowing for free exchange of thoughts and ideas, working together to solve problems, particularly around career decisions and education.	e.g: "Whenever I was trying to decide what major they would sit down with me and talk through all the different disciplines that I can be involved with." e.g: "I think there was a lot more, at least as a kid, it was explained to me that there's a lot more job security in STEM field than there was for like."
Independent Decision-making	Giving freedom while guiding, freedom to decide independently while providing support, support throughout life	Encouraging and supporting independent decision-making while providing support and resources, allowing children to make their own decisions while offering advice, resources, and guidance and avoiding micromanaging	e.g: "It was nice to know that they supported me no matter what and did think that I would succeed in engineering." e.g: "They encouraged me to go on and do that if I wanted to do it like they knew I could do it."

High Academic Expectation	Straight As, high achievement, focusing on learning	Expecting excellent grades/straight A's and encouraging/providing extracurricular activities such as STEM camp. Prioritizing education and academic pursuits in all years while providing tremendous support.	e.g: "I guess the more indirect source of encouragement was that they always had really high expectations from me and my brothers academically." e.g: “Well, they always, I would say that they always definitely set a standard. I, I graduated high school with honors.
Gender Neutral Environment	No stereotypical behavior, no expectation to cook or clean choice in pursuits based on interests and strengths, no gender activity limitation	Creating an environment free from gender stereotypes, biases, and discriminatory treatment, where children are viewed and treated as individuals regardless of their gender.	e.g: "Don't ever let being a woman or a girl make you think that you can't pursue this or that because, and I was very fortunate that they had that outlook and, because I don't think that I would." e.g: "There was never like you have to cook and clean and you have to like do this."