

Analysis of STEM Study Program Selection in University Viewed from Family Support: A Study on Senior High School Students in West Sumatra

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Abstract

The Society 5.0 era demands experts in STEM fields, but interest in STEM study programs is declining. In West Sumatra, only 1.5% of new students choose STEM study programs. There is a gap between the vast opportunities available and the low interest of students in STEM. Based on literature analysis, it was found that family is an important factor in career choice. Therefore, it is considered necessary to review this based on family support. This study uses a quantitative approach with a descriptive comparative method on 331 high school students in West Sumatra, then measured using the chi-square test to examine the difference in the proportion of family support for STEM program choices. This study employs Lent's Social Cognitive Career Theory to illustrate the ideal state of alignment between students' talents and interests in their career choices. This study aims to prove the hypothesis that there are differences in program choices among high school students in West Sumatra when viewed from the perspective of father and mother support. From the hypothesis analysis, the following novelties were found: (1) parents do not agree on their children's program choices, (2) father support influences students to choose STEM programs, while mother support does not. This study has implications as a comparison with previous studies and has the potential to assist high school students in making appropriate program choices and enhancing fatherly support through the optimization of information, career, and family services.

Abstrak

Era Society 5.0 menuntut tenaga ahli di bidang STEM, namun minat terhadap program studi STEM justru menurun. Di Sumatera Barat, hanya 1,5% dari total mahasiswa baru yang memilih program studi STEM. Ada kesenjangan antara luasnya peluang dan rendahnya minat siswa pada STEM. Berdasarkan analisis literatur ditemukan keluarga adalah faktor penting dalam pemilihan karir. Sehingga dinilai perlu peninjauan berdasarkan dukungan keluarga. Penelitian ini menggunakan pendekatan kuantitatif dengan menggunakan deskriptif komparatif kepada 331 siswa SMA di Sumatera Barat, lalu diukur menggunakan uji chi-square dengan melihat perbedaan proporsi dukungan keluarga terhadap pilihan program studi STEM. Penelitian ini menggunakan teori Social Cognitive Career Theory oleh Lent untuk melihat gambaran keadaan ideal berupa keselarasan antara bakat & minat siswa terhadap pemilihan karirnya. Penelitian ini untuk membuktikan hipotesis berupa terdapat perbedaan pilihan program studi pada siswa SMA di Sumatera Barat ditinjau dari dukungan ayah dan dukungan ibu. Dari hasil analisis hipotesis ditemukan kebaharuan (1) dukungan orang tua tidak berada pada satu kesepakatan yang sama dalam pemilihan program studi anaknya, (2) dukungan ayah mampu mempengaruhi siswa memilih program studi STEM sedangkan dukungan ibu tidak. Penelitian ini memiliki implikasi sebagai bahan perbandingan dengan studi sebelumnya dan berpotensi membantu siswa SMA melakukan pemilihan program studi yang tepat dan meningkatkan dukungan ayah melalui pengoptimalan layanan informasi, karir dan keluarga.

Kata kunci:

Pemilihan Program Studi;
Dukungan Keluarga; Siswa SMA;
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INTRODUCTION

The Society 5.0 era demands a large number of experts in STEM fields, promising broad and promising job prospects. Unfortunately, interest in STEM study programs is declining. In West Sumatra, only 1.5% of new students choose STEM programs. Yet, the demand for STEM workers is extremely high. Data from the U.S. Bureau of Labor Statistics (2003) indicates that jobs in this sector are projected to grow by 10.4% between 2023 and 2033, far exceeding the average growth rate of all jobs, which is only 4.0%. In Indonesia, the Ministry of Communication and Information Technology (Kominfo) estimates that 9 million digital talents will be needed by 2030, most of whom will come from STEM fields (Kominfo, 2024). This need also aligns with the potential for increased income.

A phenomenon observed in the field is that many high school students with a science background actually switch to non-STEM programs when they enter college (Hutabarat, 2024), which results in low interest in STEM programs. However, students with a science background already have the basic skills and interest in STEM fields (Simon, 2016; Saidah, 2018; Van, 2016). To ensure optimal career development, program selection should align with interests and competencies developed during secondary education (Saehu, 2020; Savickas, 2001). This phenomenon leads to an imbalance in job availability, particularly in STEM fields, causing STEM sectors to operate suboptimally due to a shortage of professionals, which in turn prevents them from meeting the needs of society in the Society 5.0 era, which has a strong dependence on science and technology. The gap in interest toward STEM programs is a serious and complex issue that has not received adequate intervention from the government or in-depth scientific research (Wang, 2013; Kmec, 2013). The causes of this gap are what the researcher aims to investigate further by examining the factors influencing it, which will then be analyzed quantitatively.

The purpose of this study is to identify the factors influencing students' choice of STEM programs. More specifically, this study also aims to address the limitations of previous research, which primarily focused on holistic career selection factors, thereby failing to map the issues or factors related to STEM career selection through previous findings. This research will fill that gap by contributing concepts for mapping the factors influencing career choices in STEM fields. This can then be used as a data source for addressing the issue of inequality. Additionally, this research separates parental support from fathers and mothers as two distinct variables to address the limitation of previous studies that combined them. Combining parental support risks producing biased analysis, as differences in support from fathers or mothers may be obscured and fail to reflect the reality experienced by students. This separation is crucial for generating more accurate findings, as Lent (2013) notes that fathers and mothers have distinct characteristics and perspectives, leading to varied forms and impacts of their support on children's career decisions.

Guidance and counseling must integrate family support through various services provided to students (Harahap, 2024; Zadrian, 2016; Fandilla, 2023). Therefore, further analysis is needed regarding the most significant factors or issues faced by students that prevent them from choosing STEM. With this data, the government, guidance counselors, and other relevant parties can develop intervention strategies to create conditions, opportunities, and facilities to encourage the selection of STEM programs, ultimately contributing to efforts to enhance the regeneration of STEM workforce in Indonesia.

This research is important to support national research, particularly in the field of education, aimed at strengthening social capital to optimize the selection of STEM programs at universities. Through this research, the researcher aims to prove the hypothesis that there are differences in program choices among high school students in West Sumatra based on fatherly support and that there are differences in program choices among high school students in West Sumatra based on motherly support.

RESEARCH METHODS

This study uses a quantitative approach with descriptive comparative analysis and chi-square data analysis techniques. The population in this study was high school students in West Sumatra. The sample size was 307, selected using purposive sampling with the following criteria: high schools in West Sumatra, accredited with grade A, consisting of 12th grade students, both public and private schools, and students majoring in science. As shown in the following table;

Number	District	Name of School	Sample
1	Payakumbuh	SMA Negeri 1 Harau	48
2	Agam	SMAN 1 Lubuk Basung	39
3	Padang Panjang	SMAN 1 Padang Panjang	40
4	Pasaman Timur	SMAN 1 Bonjol	41
5	Solok	SMAN 1 Gunung Talang	49
6	Sawahlunto	SMAN 1 Sawaluhto	32
7	Pesisir Selatan	SMAN 2 Koto Tarusan	28
8	Padang	SMAS Adabiah 2	30
Total			307

This study used a Likert scale instrument. This scale was used to obtain an overview of the level of family support provided to 12th grade high school students majoring in science. The administered instrument contained questions or statements that revealed family support in terms of emotional support, sensory support, informational support, and facility and infrastructure support. Before the instrument was administered, a pilot test was conducted on 30 students outside the research population. In the validity test, three items were found to be invalid, and in the reliability test, the instrument was found to be reliable with a Cronbach's alpha value of 0.973. The data analysis technique used in this study was descriptive analysis, and the hypothesis testing used the chi-square test because it was appropriate for the form of the research data. The criteria for the chi-square test are that the data does not need to be normally distributed, the data scale is nominal and ordinal (in this study, data variable dependen is on a nominal scale and data variable independen is on an ordinal scale), it can be used on large data sets, and it aims to test the relationship between variables (Vikaliana, et al. 2022).

RESEARCH RESULTS AND DISCUSSION

Result

Descriptive Analysis

Based on the results of the study, descriptive data on the choice of study programs among high school students in West Sumatra tended to show that more students chose STEM study programs. Of the 331 respondents, 134 chose STEM and 197 chose non-STEM, so it can be concluded that high school students in West Sumatra predominantly chose non-STEM study programs. Furthermore, to see the descriptive data on family support (father and mother) for high school students in West Sumatra, see the following table;

Table 1. Frequency Distribution and Percentage of Family Support (Father & Mother), High School Students in West Sumatra (n= 331)

FATHER	Categorization			
	Category	Interval	f	%
	Very High	≥114	33	10
	High	92 - 113	52	16
	Moderate	70 - 91	12	4
	Low	48 - 69	230	69
	Very Low	≤47	4	1
	Total		331	100

MOTHER	Categorization			
	Category	Interval	f	%
	Very High	≥114	49	15
	High	92 - 113	120	36
	Moderate	70 - 91	9	23
	Low	48 - 69	149	45
	Very Low	≤47	4	1
	Total		331	100

Based on Table 1, it can be explained that overall father support is in the low category with a percentage of 69% (230 respondents). Then, overall mother support is in the low category with a percentage of 45% (149 respondents). This shows that the majority of high school students in West Sumatra have low family support (father & mother). This finding suggests the potential for issues related to family support involvement in the academic life and program selection process of high school students in this region. Low family support can be a risk factor for students' career planning and academic development, including their academic performance, motivation, and psychological well-being.

Furthermore, to examine the descriptive data on family support (father and mother) in more detail based on the results of data processing using the family support instrument from the entire sample (respondents) of 331 high school students in West Sumatra, please refer to the following table;

Table 2. Subvariables of Frequency Distribution and Percentage of Family Support (Father & Mother), High School Students in West Sumatra (n= 331)

FATHER	Aspects	Score						Description
		Ideal	Max	Min	Sum	Mean	%	
	Emotional Support (12)	60	60	12	11543	34,88	58	S
	Appreciation Support (5)	25	25	5	4277	12,92	52	S
	Informative Support (4)	20	20	4	3492	10,55	53	S
	Instrumental Support (6)	30	30	6	5370	16,22	54	S
	Overall (27)	135	135	27	24684	74,57	55,24	S

	Aspects	Score						
		Ideal	Max	Min	Sum	Mean	%	Description
MOTHER	Emotional Support (12)	60	60	12	13008	39,3	65	T
	Appreciation Support (5)	25	25	5	5024	15,18	61	T
	Informative Support (4)	20	20	4	4096	12,37	62	T
	Instrumental Support (6)	30	30	6	6157	18,6	62	T
	Overall (27)	135	135	27	28285	85,45	63,3	T

Based on the data in Table 2, it can be seen that the overall average of the sub-variable of family support from fathers is in the moderate category, at 55.24%, and the lowest support is in terms of appreciation (52%). This means that fathers are lacking in providing support to students, especially in terms of appreciation, where fathers may rarely give positive encouragement, motivation, or rewards for students' achievements. However, recognition support is crucial in the process of a child's career development, as this support helps children build confidence in their skills or abilities, enabling them to progress to the next level effectively if their performance is good.

Meanwhile, support from mothers is in the high category at 63.3%, with the highest support being emotional support (65%). These results indicate that mothers provide significant emotional support, which plays a crucial role in helping students feel valued and confident in their abilities. This support also helps students optimize their academic abilities by providing a sense of trust and affection that makes them feel safe and comfortable during their education.

Based on these results, it can be concluded that, on average, for both father and mother support sub-variables, most students feel that emotional support is more dominant from mothers than from fathers. The same applies to other types of support, where mothers' support is always superior or greater than that of fathers.

Hypothesis Testing

H₁ : There are differences in the choice of study programs among high school students in West Sumatra in terms of father's support

The following are the results of the chi-square test analysis related to the choice of study programs among high school students in West Sumatra in terms of father's support;

Tabel 3 *Chi-Square Test Results for Study Program Choices Among High School Students in West Sumatra as Viewed from Father's Support*

Chi-Square Tests			
	Value	df	Asymptotic Sig. (2-sided)
Pearson Chi-Square	64.841 ^a	1	.000

Based on Table 3 with a sig value of $0.000 \leq 0.05$, it can be concluded that H₀ is rejected and H₁ is accepted. Thus, it can be concluded that there is a difference in the

choice of study programs among high school students in West Sumatra in terms of father's support. Furthermore, to see the differences, refer to the follow-up test table that uses the Z test for paired proportion comparison with Bonferroni as follows.

Tabel 4. *Advanced Test Table*

Crosstabulation					
Father's Support * Choice_of_Study_Program					
			Choice of Study Program		Total
			STEM	NON STEM	
Father's Support	HIGH	Count	72 _a	25 _b	97
		% within Father's Support	74%	26%	100%
	LOW	Count	62 _a	172 _b	234
		% within Father's Support	27%	73%	100%
Total		Count	134	197	331
		% within Father's Support	40.5%	59.5%	100%

The subscript in each Count shows the result of the paired proportions Z test. If two values in the program study selection column have different subscripts (e.g., a vs. b), then the difference is statistically significant at $\alpha = 0.05$ (after Bonferroni correction). Then, if the subscripts are the same (e.g., both a or b), there is no significant difference between the categories in the same column.

Based on the explanation above, Table 10 shows that the values in the program study column have different subscripts (a,b and a,b), so that high and low father support have significant differences, and the one that has the greatest influence is low father support. From the table above, it can be concluded that the level of fatherly support for high school students in West Sumatra is predominantly low, with 234 students receiving low fatherly support and only 97 students receiving high fatherly support. The results of this test also indicate that there is a difference between fatherly support and program selection, where students with low fatherly support tend to choose Non-STEM with a percentage of 73% and only 27% choose STEM. Meanwhile, students with high fatherly support tend to choose STEM with a percentage of 74% and only 26% choose Non-STEM. H_2 : There are differences in the choice of study programs among high school students in West Sumatra in terms of mother support

The following are the results of the chi-square test analysis related to the choice of study programs among high school students in West Sumatra in terms of maternal support:

Tabel 5. *Results of the Chi-Square Test of Study Program Choices Among High School Students in West Sumatra in Terms of Mother Support*

Chi-Square Tests			
	Value	df	Asymptotic Sig. (2-sided)

Pearson Chi-Square	.472 ^a	1	.492
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Based on Table 5 with a sig value of $0.492 \geq 0.05$, it can be concluded that H_0 is accepted and H_1 is rejected. Thus, it can be concluded that there is no difference in the choice of study programs among high school students in West Sumatra in terms of maternal support. Furthermore, to see the differences, refer to the follow-up test table that uses the Z test for paired proportion comparison with Bonferroni as follows:

Tabel 6. *Advanced Test Table*

Crosstabulation					
Mother's Support * Choice_of_Study_Program					
			Choice of Study Program		Total
			STEM	NON STEM	
Mother's Support	HIGH	Count	69 _a	109 _a	178
		% within Mother's Support	39%	61%	100%
	LOW	Count	65 _b	88 _b	153
		% within Mother's Support	43%	57%	100%
Total	Count	134	197	331	
	% within Mother's Support	41%	59%	100%	

Based on Table 6 above, it can be seen that the values in the program choice column have the same subscripts (a,a and b,b), so there is no significant difference between students who choose STEM or non-STEM majors in terms of maternal support. Furthermore, the table above can be concluded that maternal support for high school students in West Sumatra is mostly at a high level, with a slight difference in low maternal support. A total of 178 students had high maternal support, and 153 students had low maternal support. The results of this test also indicate that there is no difference between maternal support and program selection. The percentages are as follows: if maternal support is high, 39% choose STEM and 61% choose NON-STEM; if maternal support is low, 43% choose STEM and 67% choose NON-STEM. The difference between those choosing STEM and NON STEM is not significantly different between high and low maternal support, indicating that students do not have a tendency to choose a program of study based on maternal support. It can be concluded that students choose STEM or NON STEM not based on the level of maternal support.

Discussion

In this section, the researcher will describe the results of the research that has been conducted. Data analysis shows several findings, which will be discussed one by one with detailed explanations.

Choice of Study Program

Based on data analysis, out of 331 high school students in West Sumatra who participated in the survey, 194 chose non-STEM programs, while only 134 chose STEM

programs. This indicates that many high school students are switching majors by choosing programs that do not align with their talents and interests. STEM programs are part of the fields of science, technology, engineering, and mathematics (Caprile, 2015). STEM programs are among those with promising career prospects, yet unfortunately, students are not fully capitalizing on these opportunities. The high number of students switching majors when choosing programs has led to a decline in interest in STEM programs and a shortage of skilled professionals in STEM-related sectors.

Super states that teenagers in high school are in the crystallization stage, a phase where individuals begin to form career preferences based on interests, values, and talents. However, in practice, there is a mismatch between academic interests in school (science/social studies) and program choices in higher education. This can be interpreted as a failure in the process of internalizing interests and values, which should form the foundation for career decision-making. This condition may also indicate that even though students are “mapped” into science classes, they may not have undergone adequate exploration and clarification of their interests. As a result, their choice of major in college is not based on a mature understanding of their talents and long-term career preferences.

The low selection of STEM majors may reflect that students do not get enough exposure to the STEM environment, and there are negative perceptions of STEM majors. In this context, it is important for guidance counselors to not only provide information services but also conduct in-depth interest and personality assessments and exploratory guidance to help students find a match between themselves and their career choices.

Additionally, the decline in interest in STEM among high school students is also a strategic national issue. The government and industry are strongly encouraging the improvement of human resource quality in STEM fields to address the challenges of the 5.0 industrial revolution and the transition to a digital economy. The low interest in STEM among high school students in West Sumatra may indicate weak integration between educational policies and future labor market needs. In this context, the role of counselors is not only to provide career information but also to act as agents of change capable of promoting strategic fields and communicating the long-term impact of subject selection on students' economic and professional lives.

To increase the number of students choosing STEM, an innovative and interactive approach to career guidance counseling services is needed, such as career days with speakers from the STEM field, industry visits, and information services providing up-to-date information on STEM study programs or other career-related materials like career planning (Afdal, 2018), program alignment with interests (Zadrian, 2016), or education about various STEM programs (Honey, 2020), and so on.

Family Support

Based on data analysis, it was found that mothers tended to provide high levels of support, while fathers tended to provide moderate levels of support. Based on hypothesis testing, it was found that fathers' support had a significant effect on the choice of STEM study programs, but mothers' support did not have a significant effect on the choice of STEM study programs. This aligns with Lent's social cognitive career theory, which states that the social roles of family members can influence an individual's choice of academic program, with these differences viewed through a gender lens. This suggests that women (mothers) tend to fulfill affective functions such as emotional attachment, while men (fathers) are more associated with instrumental functions such as developing technical and analytical skills, which align with the characteristics of

STEM fields. Interestingly, emotional support from fathers, who are stereotypically known as providers of rational and financial support, turns out to be a determining factor in choosing STEM programs. This indicates a shift in traditional masculine roles, where emotional support from male authority figures (fathers) holds high psychological and symbolic value for children. In patriarchal societies, validation from fathers is often more authoritative in shaping children's self-confidence to choose fields considered "highly prestigious" such as STEM.

The ineffectiveness of high maternal support in guiding program selection choices highlights a support paradox. That is, despite mothers being highly emotionally involved, their form of support does not necessarily align with their children's career paths. This could be due to two factors: first, mothers lack career information, so their support tends to be passive or follows the child's wishes without providing strategic encouragement. Second, mothers' parenting style is more relational, prioritizing the child's emotional comfort and well-being over emphasizing career achievement based on logic and future work potential. In other words, the mother's support is generally facilitative but not strategic enough to guide rational or prospective choices such as STEM.

The fact that parental support is not always aligned opens the door to analyzing parental role fragmentation or differences in parental support. This can be viewed from two perspectives: on the negative side, this fragmentation can create ambiguity and confusion for children, as there is no consistent voice guiding their future direction. On the positive side, these differences in support can enrich the child's perspective if both are managed through healthy communication, where the child can see two sides of career considerations: emotional (from the mother) and rational (from the father). However, when there is no integration, the child risks making inappropriate decisions or decisions based on the perception of support from the most dominant party, rather than on an analysis of talents and interests.

The finding that fathers' emotional support is a strong predictor of STEM choices opens up opportunities for education and counseling policies that focus on fathers. This could include programs to get dads involved in their kids' education, like career workshops for dads that emphasize the importance of emotional support, changing how dads act and think in the family, from just being breadwinners to emotional mentors, especially when it comes to their kids' career development. Additionally, fathers can be involved in career counseling services, which have traditionally been more focused on mothers and children. In this way, family support is no longer viewed solely as a collective function but as a differential role that must be consciously synergized by both fathers and mothers.

Reviewing the Social Cognitive Career Theory (SCCT), these findings reinforce the basic assumption that social support plays a role in shaping children's self-efficacy and outcome expectations. Additionally, this study found that emotional support from fathers has a significant impact, indicating that the emotional value of support needs to be taken more seriously in the design of career guidance programs.

The implication of this research is that information and counseling services can be provided, but this is insufficient if it only focuses on knowledge content. Instead, it must be able to build emotional and relational involvement from parents, especially fathers, in their children's academic decisions. Thus, fathers and mothers can align in providing support to their children, serving as a catalyst for children to make optimal career choices aligned with their talents and interests.

High school students with high family support are more likely to make appropriate program choices aligned with their talents, interests, and career prospects. This finding is supported by research by Hariko (2016); Nurfahanah (2024) and Betz & Hackett (2006), which states that this support can help students build self-confidence, provide information, facilitate educational needs, and offer motivation and moral support.

CONCLUSION

Many high school students in West Sumatra choose non-STEM study programs over STEM study programs, meaning that many high school students cross disciplines by choosing study programs that do not match their talents and interests. This condition indicates that even though students are “mapped” into science classes, they have not necessarily gone through an adequate process of exploring and clarifying their interests. Therefore, the choice of major in college is not based on a mature understanding of talents and long-term career preferences.

A new finding in this research is that parental support differs between mothers and fathers; maternal and paternal support do not necessarily lead to the same conclusion regarding support. This is because parents are not a unified entity in providing support but differ according to their respective social roles. This finding has a greater impact than anticipated, as the initial aim of this research was merely to challenge the long-held assumption that parental support is not aligned in the selection of their children's academic programs. However, more than that, this finding opens up new discussions where parental differences in conclusions actually guide students toward specific academic program choices. Furthermore, this study found that fatherly support directs students toward choosing STEM academic programs. This is because fathers, as males, possess technical, analytical, and logical characteristics, so they also guide their children toward developing these skills, which are highly aligned with the STEM field.

The findings of this study contribute new concepts and perspectives regarding family support for individual careers, while also opening new discussions on how to maximize the role of fathers in the process of selecting academic programs for students. The research findings can be applied in the form of emphasizing the importance of increasing fathers' support in the educational process of students, particularly in encouraging them to choose STEM academic programs.

Guidance counselors can maximize the role of fathers through meetings, short seminars, discussions, or parent forums. Additionally, career parenting training should be conducted for parents so they know how to support their children without imposing their own preferences. The Education Department can facilitate school-based family counseling services by providing training for counselors and encouraging family counseling sessions that require the involvement of both fathers and mothers. The Education Department also needs to monitor parental involvement and its impact on study choices as a basis for policy-making. With this, guidance counselors, schools, and the Education Department can create an environment that supports students in choosing majors aligned with their talents and interests through the optimization of family roles. The limitations of this study lie in the small sample size, which makes generalization challenging. Therefore, further research with a larger sample is needed for a more comprehensive understanding.

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