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Effects of Metacognition and Academic Resilience on Self-Regulated Learning in University Students: The Moderating Role of Gender

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Abstract

Research on the predictive roles of metacognition and academic resilience on self-regulated learning among undergraduate university students are scarce. Therefore, the current study investigated the effects of metacognition and academic resilience on self-regulated learning. A sample of 805 undergraduate students (female = 38.67%, male = 61.1%) with an average age of 22.52 years ($SD_{=}$2.34) was recruited. The data for the study were gathered with questionnaires. The covariance-based structural equation model was used to analyse the relationship between the study variables. The analysis showed that metacognition and academic resilience predicted self-regulated learning, while gender moderated the predictive relationship between academic resilience and self-regulated learning. Interventions to promote self-regulated learning among university students should consider metacognition and academic resilience skills training. In addition, such interventions should also account for gender variabilities in the predictive relationship between academic resilience and self-regulated learning.

Introduction

Metacognition, academic resilience, and self-regulated learning are crucial constructs that influence academic achievement and performance (Ali et al., 2022; Cetin et al., 2017; Chen et al., 2022). However, there is a paucity of research investigating the predictive roles of metacognition and academic resilience on self-regulated learning, especially among undergraduate university students (Annalakshmi, 2019; Annalakshmi et al., 2017). Additionally, the potential moderating role of gender in these predictive relationships remains underexplored in the literature.

To address these gaps, the current study aimed to examine the effects of metacognition and academic resilience on self-regulated learning among Ghanaian undergraduate university students. Furthermore, the study investigated whether gender moderated the predictive relationship between academic resilience and self-regulated learning.

Regarding the effect of metacognition on self-regulated learning, previous studies, albeit with limitations such as small sample sizes and indirect measurement of self-regulated learning (Akamatsu et al., 2019; Cera et al., 2013; Chen et al., 2022; Follmer & Sperling, 2016), have consistently reported positive associations between these two constructs among undergraduate students (Akamatsu et al., 2019; Cetin et al., 2017; Follmer & Sperling, 2016). Cera et al. (2013) corroborated these findings, demonstrating a positive relationship between metacognition and self-regulated learning among high school students.

While these studies have established the positive relationship between metacognition and self-regulated learning, fewer investigations have explicitly examined the predictive role of metacognition on self-regulated learning (Akamatsu et al., 2019; Saraff et al., 2020). Akamatsu et al. (2019) stands out as one of the few studies that demonstrated metacognition as a predictor of self-regulated learning among

undergraduate students. However, their study also highlighted the mediating role of self-efficacy in this relationship.

Considering the limitations of previous research, such as small sample sizes, indirect measurement of self-regulated learning, and limited exploration of moderating and mediating variables (Akamatsu et al., 2019; Cera et al., 2013), the current study aimed to investigate the predictive role (effect) of metacognition on self-regulated learning among a large sample of Ghanaian undergraduate students, using direct measures of both constructs. Additionally, the study examined the relationship between metacognition and self-regulated learning in this understudied population, contributing to the scarce research from the African context.

Effect/influence (predict) (relationship) of academic resilience on self-regulated learning of undergraduate university students

Research examining the relationship between academic resilience and self-regulated learning among undergraduate university students is limited (Ataii et al., 2021). The few available studies have reported positive associations between these constructs. Ataii et al. (2021) found a positive relationship between self-regulation and academic resilience in undergraduate students, with perceived competence mediating this relationship. Similarly, Mohan and Verma (2020) demonstrated positive correlations between dimensions of self-regulated learning strategies and academic resilience among adolescents. Artuch-Garde et al. (2017) further corroborated these findings by illustrating a positive relationship between resilience and self-regulation in vocational students aged 15 to 21.

Despite these initial findings, there is a lack of research investigating the predictive role of academic resilience on self-regulated learning among undergraduate university students (Annalakshmi et al., 2019; Artuch-Garde et al., 2017; Ataii et al., 2020; Sabrillah et al., 2021). Existing studies have primarily focused on examining self-regulation or self-regulated learning as predictors of resilience (Annalakshmi et al., 2019; Artuch-Garde et al., 2017; Ataii et al., 2020; Sabrillah et al., 2021). For instance, Artuch-Garde et al. (2017) and Annalakshmi (8) found that self-regulation predicted resilience among vocational students and adolescents, respectively. Similarly, Ataii et al. (2020) reported that self-regulation predicted academic resilience in undergraduate students, while Sabrillah et al. (2021) demonstrated that self-regulated learning predicted academic resilience in university students.

Evidently, previous research has overlooked the predictive role of academic resilience on self-regulated learning among undergraduate university students (Annalakshmi et al., 2019; Artuch-Garde et al., 2017; Ataii et al., 2020; Sabrillah et al., 2021). Furthermore, studies examining potential moderating or mediating variables in this predictive relationship are scarce, with Ataii et al. (2020) being one of the few exceptions by exploring perceived competence as a mediator. Gender is an important socio-cultural variable that can influence cognitive, motivational, and behavioural processes involved in learning and academic performance (Mohan & Verma, 2020). Prior research has suggested that gender differences may exist in the development and deployment of metacognitive skills, resilience capacities, and self-

regulatory strategies among students (Sabrillah et al., 2021). Some studies have found gender differences in certain aspects of metacognition, such as monitoring accuracy, with females tending to better calibrate their metacognitive judgments compared to males (Gutierrez de Blume et al., 2023; Gutierrez & Price, 2017). However, other work has reported no significant gender differences in overall metacognitive abilities (Händel et al., 2020; Lemieux, 2018). Given the mixed evidence, examining gender as a potential moderator can shed light on whether metacognition differentially predicts self-regulated learning for male versus female university students.

Research indicates that the strategies and processes underlying academic resilience may differ across gender groups due to socio-cultural factors. For instance, some work suggests females tend to use more support-seeking and adaptive help-seeking strategies, while males may rely more on perseverance-oriented coping (Nierenberg & Dahl, 2023). As such, the relationship between academic resilience and self-regulated learning could potentially vary based on gender.

To address these gaps, the present study aimed to investigate the predictive role of academic resilience on self-regulated learning among undergraduate university students. Additionally, the study examined the moderating role of gender in this predictive relationship. By utilizing a larger sample size than previous studies and a consistent population of undergraduate university students, the present research aimed to provide more robust findings in this underexplored area.

The Present Study

Although, metacognition, academic resilience and self-regulated learning are essential for academic achievement or performance (Ali et al., 2022; Çetin, 2017; Chen et al., 2022), research on the predictive roles of metacognition and academic resilience on self-regulated learning among undergraduate university students is scarce (Annalakshmi, 2019; Artuch-Garde et al., 2017). Moreover, studies examining moderating or mediating variables in the predictive relationship between academic resilience and self-regulated learning in undergraduate university students are limited (Ataii et al., 2021). Another limitation in the prior studies is that smaller sample sizes were utilised. In some of the past studies, questionnaires which does not directly measure self-regulated learning were utilised (Akamatsu et al., 2019; Cera et al., 2013).

To address these gaps in the literature, the present research examined the predictive roles of metacognition and academic resilience on self-regulated learning among Ghanaian undergraduate university students by using a larger sample size. Furthermore, the moderating role of gender in the predictive relationship between academic resilience and self-regulated learning was also investigated. This research tested the following hypotheses:

H1: Metacognition will predict self-regulated learning in university students.

H2: Academic resilience will predict self-regulated learning in university students.

H3: Gender will moderate the predictive relationship between academic resilience and self-regulated learning of university students.

Methods

Participants and Procedures

An analytical cross-sectional design was employed in this study involving 805 (female = 38.67%, male = 61.1%) undergraduate students from three public universities in Ghana. The cross-sectional approach was used given the exploratory nature of this initial investigation in the Ghanaian context, but the limitations around temporality are clearly acknowledged. In this study, gender was made a covariate in response to sociocultural factors and expectations surrounding how men and women could vary meaningfully in exploring the variables under investigation. So, unpacking potential gender influence in the study helped strengthened the findings and their interpretability. These undergraduate students were pursuing different programmes at different levels (Level 100 to Level 400). The average age of the students was 22.52 years ($SD_{=}$2.34). The students were recruited from their various universities after their lecture hours. For the purposes of ethics, informed consent was made as preliminary information before respondents could complete the survey. Ethical approval for the study was granted by the College of Education Studies Ethical Review Board at the University of Cape Coast in Ghana (reference: CES/ERB/UCC/EDU/08–23/69). The survey was conducted in accordance with the requirements of the Declaration of Helsinki.

Measures

Metacognition

The metacognitive abilities of the participants were assessed with the metacognition self-assessment [MSAS] scale (Pedone et al., 2017). The MSAS is an 18-item scale loaded on five dimensions: monitoring (6-items); differentiation (2-items); integration (2-tems); decentration (3-items); and mastery (5-items). The scale was scored based on a 5-point Likert-type scale from never = 1 to almost always = 5. This scale had a Cronbach's alpha of .88. The use of MSAS is based on the fact that it has demonstrated strong reliability and validity across prior research studies. The MSAS provides a relatively brief yet comprehensive assessment of metacognitive abilities suitable for the study constraints. Furthermore, metacognitive processes occur at a meta-level involving awareness of one's thinking, therefore, the use of MSAS for the data collection was appropriate.

Academic resilience

The academic resilience abilities of the participants were assessed with Cassidy's (2016) academic resilience scale (ARS-30). The ARS-30 is a 30-item scale loaded on three dimensions: perseverance (14-items); reflecting and adaptive help-seeking (9-items); and negative affect and emotional response (7-

items). The scale was scored based on a five-point Likert-type scale from very likely = 1 to unlikely = 5. Participants responded to the items on the scale after reading a short vignette developed by the authors of this questionnaire. The scale produced an acceptable internal consistency reliability index of .85. The ARS-30 is specifically designed to assess resilience in the academic domain versus general life resilience. The use of ARS-30 in this study is based on the fact that participant responses are anchored to hypothetical academic setback scenarios described in vignettes and this better reflect resilience capabilities compared to decontextualized self-report items. Again, the ARS-30 demonstrates acceptable reliability in capturing an underlying academic resilience trait, hence its usage in this study is justified.

Self-regulated learning

The self-regulated learning abilities of the participants were assessed with the self-regulated knowledge scale-university [SRKS-U] (Manganelli et al., 2015). The SRKS-U is a 15-item scale loaded on five dimensions: knowledge extraction (3-items); knowledge networking (3-items); knowledge practice (3-items); knowledge critique (3-items); and knowledge monitoring (3-items). The scale was scored based on a five-point Likert-type scale from never = 1 to almost always = 5. Cronbach's alpha for this scale was of .93. The SRKS-U was specifically developed and validated for assessing these skills in university/college populations, hence its applicability in this study is justified. Furthermore, the SRKS-U demonstrates excellent reliability in consistently capturing an underlying self-regulated learning trait/ability across its items. As a self-report questionnaire, the SRKS-U can efficiently assess students' subjective awareness and deployment of self-regulatory processes.

Statistical Analysis

The covariance-based structural equation modelling (CB-SEM) was performed using SPSS-AMOS v23. Among statistical regression tools, CB-SEM stands as one of the robust tools in modelling statistical regressions. CB-SEM is able to cater for statistical errors in estimating regression coefficients. We chose this statistical method over other possible methods because it offered us the opportunity to control latent errors in reporting the results. Above all, the CB-SEM was selected because of its user-friendliness and global reach (Dash & Paul, 2021).

Results

Effect of metacognition on self-regulated learning in university students.

The objective was to examine the effect of metacognition on self-regulated learning among the university students. Covariance-based SEM (i.e., AMOS) with 5000 bootstrap samples and bias corrected accelerated confidence intervals was used. Metacognition was the exogenous variable while self-regulated learning was the endogenous variable. All the variables were measured on continuum. Summary of the analysis is shown in Table 1 and Fig. 1. Results from Table 1 showed that metacognition

was a significant predictor of self-regulated learning [*B* = .37, *Boot 95%CI* (.305, .426)]. This implies that metacognition had an effect on self-regulated learning in university students.

Table 1
Structural Regression Model for Metacognition and Resilience effect on Self-regulated Learning

				95% Confidence Interval	
Model	B	Std. Error	CR	Lower	Upper
(Constant)	12.508	2.180	5.738	7.793	18.265
Metacog◊ Self-reg. Learn.	.365	.027	13.513	.305	.426
Resilience◊ Self-reg. Learn	.234	.021	11.207	.185	.287

*Significant, p<.05, R= .45; R^2 = .20.

Effect of academic resilience on self-regulated learning in university students.

The aim was to examine the effect of academic resilience on self-regulated learning. The variables in the equation were academic resilience and self-regulated learning for both exogenous and endogenous respectively. From Table 1 and Fig. 1, results showed that academic resilience was a significant predictor of self-regulated learning, [*B* = .23, *Boot 95%CI* (.185, .287)]. The implication is that students' ability to engage in self-regulated learning was affected by academic resilience.

Moderating role of gender in the relationship between academic resilience and self-regulated learning of university students.

This study explored the moderating role of gender in the relationship between academic resilience and self-regulated learning. The exogenous variable, that is, academic resilience and the endogenous, that is, self-regulated learning were measured on continuum. Details of the analysis are shown in Table 2.

Table 2
Moderating effect of gender on the relationship between academic resilience and self-regulated learning

	B	**SE**	**T**	***P***	**BootLLCI**	**BootULCI**
Constant	3.965	6.747	.588	.557	-9.279	17.209
Resilience	.531	.058	9.029	.001	.416	.647
Gender	14.051	4.697	2.992	.003	4.831	23.271
Resilience*Gender	− .111	.0408	-2.723	.007	− .191	− .031

Model Summary: R^2=.3296; F(3, 801) = 131.2893, p = .001. Criterion is Self-Regulated Learning; B = unstandardized coefficient; LLCI = Lower Limit Confidence Interval; ULCI = Upper Limit Confidence Interval; SE = Standard Error; Asterisk (*) represents interaction sign.

As shown in Table 2, the outcome of the moderation analysis results showed that gender of students significantly moderated the relationship between academic resilience and self-regulated learning negatively, *B* = − .111, *t* = -2.723, *BootCI* (-.191, − .031). The significant relationship between academic resilience and self-regulated was strong and negative for the male gender; hence, the steeper the slope for those representing that group. The implication of the results is that gender changes the strength or direction of the connection between academic resilience and self-regulated learning. In particular, it is possible that a unit of reduction in academic resilience leads to − .111 reduction in self-regulated learning differently for male and females. In this regard, gender has the potential to reduce the strength of relationship between academic resilience and self-regulated learning among students. For better understanding, the significant negative moderation was further probed using the graph in Fig. 2.

In the processing of the data, the gender components were coded as Male = 1 and Female = 2 for purposes of data interpretation. The findings from the graph showed that academic resilience has a strong negative moderating effect on self-regulated learning for male students than females. This implies that men do relatively better in terms of withstanding academic pressures and other related challenges to pursue academic goals than their counterpart females. This has implication for guidance decision toward improving students self-regulated learning. A little attention on female students than males may be ideal in strengthening the relationship between academic resilience and self-regulated learning among university students.

Discussion

In the present study, the predictive roles of metacognition and academic resilience on self-regulated learning among Ghanaian undergraduate university students were examined with a larger sample size. The results of the present study revealed that metacognition was a significant predictor of self-regulated learning. Thus, metacognition had a direct effect on self-regulated learning. Our finding is in line with the very few recent studies which demonstrated that metacognition predicted self-regulated learning among undergraduate university students (Akamatsu et al., 2019; Saraff et al., 2020). However, in these previous studies smaller sample sizes were used. For example, Akamatsu et al. (2019) used a sample size of one hundred and five (105) undergraduate university students. The current study extended the literature by using 805 undergraduate students from three public universities in Ghana.

The current study also found that academic resilience was a significant predictor of self-regulated learning among the Ghanaian undergraduate university students. This implies that academic resilience had direct influence on self-regulated learning among the university students. Our finding is corroborated by Mohan and Verma (2020) who reported positive relationships between dimensions of self-regulated learning strategies and dimension of academic resilience in 162 adolescents drawn from various public

schools. It is obvious that past research has ignored investigating the predictive role of academic resilience on self-regulated learning in undergraduate university students (Annalakshmi, 2019; Artuch-Garde et al., 2017; Ataii et al., 2021; Sabrillah et al., 2021). Despite this limitation in past studies, some studies have rather demonstrated that self-regulation predicted resilience among samples who were not university students (Annalakshmi, 2019; Artuch-Garde et al., 2017). The present study therefore seems to be the only study which has demonstrated that academic resilience can predict self-regulated learning in university students. This suggests that interventions to promote self-regulated learning in university students should consider finding ways to improve their academic resilience.

Another aim of the current study was to examine the moderating role of gender in the predictive relationship between academic resilience and self-regulated learning among Ghanaian university students. This study demonstrated that gender significantly moderated the relationship between academic resilience and self-regulated learning. This finding suggest that gender changes the strength of the relationship between academic resilience and self-regulated learning. Specifically, the findings showed that academic resilience has a strong effect on self-regulated learning for male students than females. This result suggested that males were more academically resilient and therefore were more likely to be able to regulate their learning than females. Therefore, methods to improve academic resilience and self-regulated learning among university students should focus more on females. Studies examining moderating and mediating variables in the relationship between academic resilience and self-regulated learning in undergraduate university students are scarce. In attempt to address this gap, Ataii et al. (2021) reported that perceived competence mediated the relationship between self-regulation and academic resilience.

Conclusions

The goal of this study was to examine the effects of metacognition and academic resilience on self-regulated learning among Ghanaian undergraduate university students. Students' self-regulated learning was found to be explained by both metacognition and academic resilience. This suggests that to improve self-regulated learning among university students, interventions should target metacognitive and academic resilience skills training. Gender moderated the effect of academic resilience on self-regulated learning among Ghanaian university students. As a result, studies and practices involving students' academic resilience and self-regulated learning should account for the impact of gender as a demographic factor.

Implications for Educational Practice

A number of interesting implications for improving classroom instruction were drawn from the study's findings. To better facilitate self-regulated learning, it is recommended that students develop skills such as metacognition and academic resilience. To reach this goal, teachers can give repeated lessons, offer coaching, and teach in the classroom. Al-Baddaren et al. (2014) and Mofrad & Pourghaz (2015) showed that the way students are taught and learn now is not enough for them to succeed. However, self-

regulated learning abilities driven by metacognition and academic resilience are crucial for their success. Lastly, our study findings, when considered as a whole, provide new insight into the ways in which gender acts as a countervailing factor in the interaction effects of three distinct psychological constructs (metacognition, academic resilience, and self-regulated learning). The findings of our research can be used to improve students' ability to self-regulate their learning through metacognitive and academic resilience skills training.

Limitations

Despite the intriguing results, there are a few caveats to keep in mind. Since this study is cross-sectional and there was no manipulation of any variables, the causal relationship between the factors under investigation is inconclusive. Consequently, it would be intriguing to repeat this study using a longitudinal methodology to verify the proposed relationships and the precise weight of each variable going forward. It is easy to overlook the sample size and non-random assignment, so it would be fascinating to see what occurs with a larger sample obtained through random selection. Nonetheless, the study appears to demonstrate good robustness and generalisability, despite the aforementioned limitations.

Declarations

Ethics approval and consent to participate

Ethical approval for the study was granted by the College of Education Studies Ethical Review Board at the University of Cape Coast in Ghana (reference: CES/ERB/UCC/EDU/08–23/69). The survey was conducted in accordance with the requirements of the Declaration of Helsinki.The participants provided their written informed consent to participate in this study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

IM conceptualised the study idea and designed the overall research framework. IM, RK, and JOE contributed to the development of the study methodology and instrumentation approach. JNU and JT supported participant recruitment, field coordination, and data collection across the study sites. IM led the data management and statistical analyses, with input from RK and JOE on interpretation of the findings. Inuusah Mahama drafted the initial manuscript. All authors contributed to critical revision of the manuscript for intellectual content, approved the final version, and agree to be accountable for all aspects of the work.

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Not applicable

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Figures

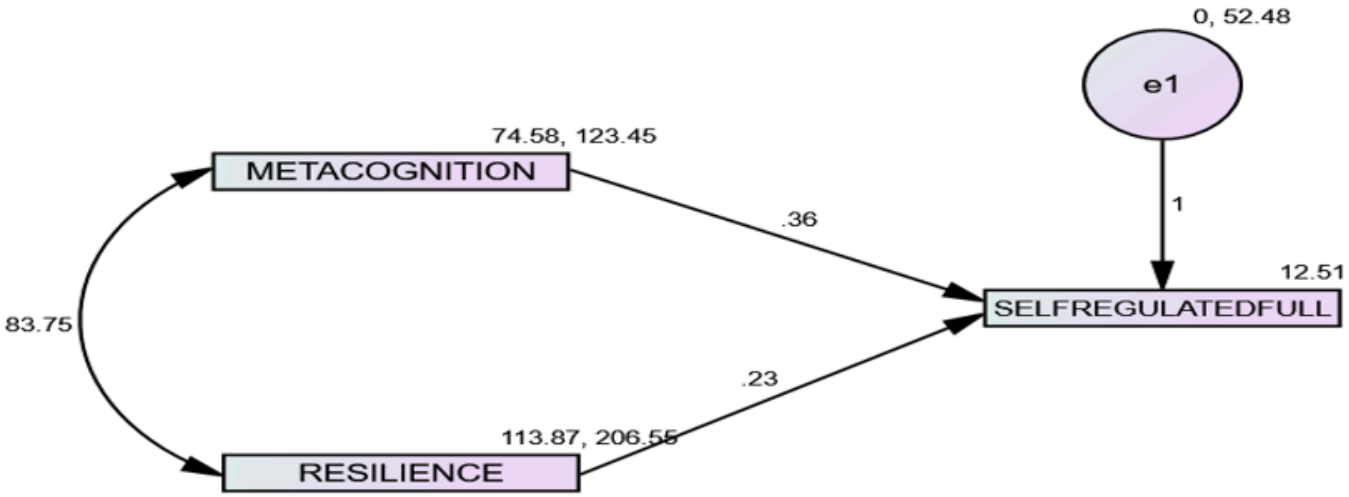


Figure 1

Path Model

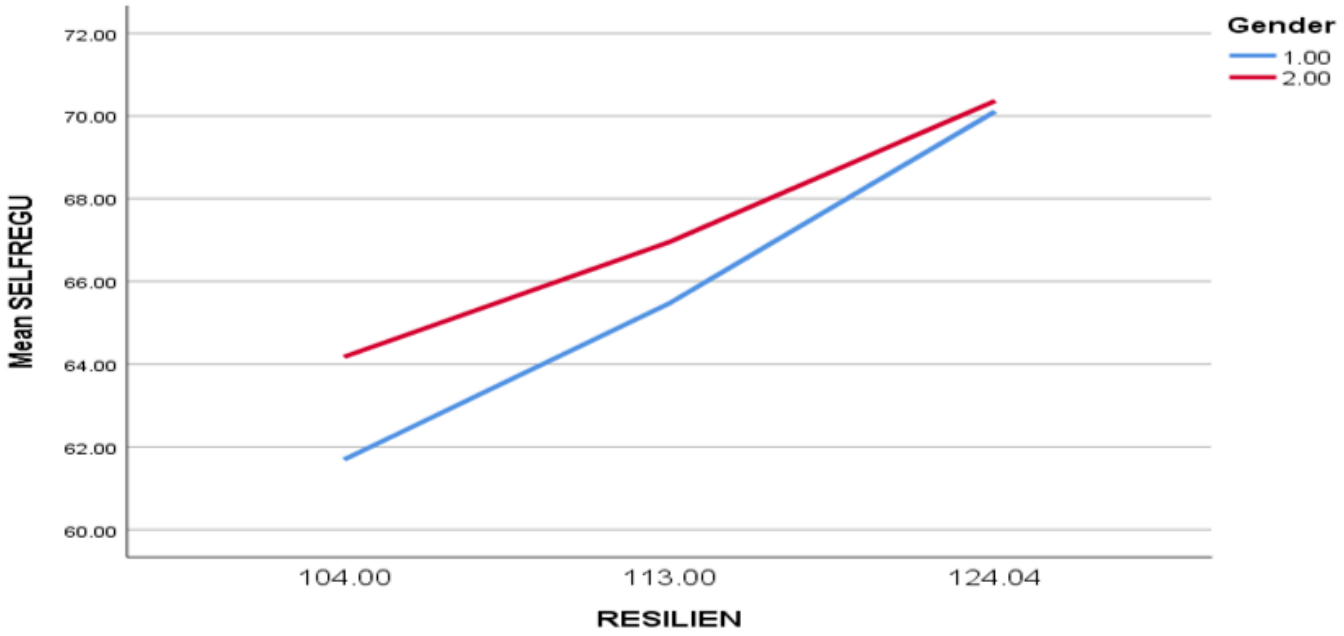


Figure 2

Probing graph on the moderating effect of gender in the connection between resilience and self-regulated learning.