Partial Least Squares Structural Equation Modeling (PLS-SEM): the influence of autonomy and relatedness on student competence in English learning

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Article Info	ABSTRACT
	This study aims to examine the influence of psychological factors of autonomy, relatedness on improving academic competence in learning English among elementary school students. This study used a quantitative approach with survey method and used Partial Least Squares Structural Equation Modeling (PLS-SEM) for data analysis. The sample consisted of 240 students from three primary schools in Cirebon consisting of SDN 2 Kedungdawa, SDN Karang Mulya, and SDN Sukasari in grades IV, V and VI. Data were collected through a validated and reliable Likert scale questionnaire measuring the three factors of autonomy, relatedness, and competence. Results showed that the autonomy factor has a positive influence on students' competence in learning English. The findings highlight the importance of considering psychological aspects in designing effective English learning strategies for young learners to improve students' competence and learning outcomes.

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1. INTRODUCTION

English is a universal language because it is used by most countries in the world as their primary language. In addition, English is one of the important international languages to master or learn (Maduwu Byslina, 2016). English should be taught and introduced to children at the elementary school level, where the teaching of English as one of the local curriculum subjects in elementary schools should use teaching methods that are easily accepted by children (Hambali, 2021). English language learning at the primary school level has become one of the main focuses in the development of the education system in various countries, including Indonesia. This is due to the importance of English as an international language that can open global access for the younger generation. (Akhyar Rido, 2016) state that English is needed to be able to compete at the international level, especially for students. In today's era of globalization and instant gratification, students from elementary school and even kindergarten are already required to compete in English language subjects. (Nur Aedi, 2016) English is no longer considered as a subject as usual, but as a skill that must be possessed from an early age in order to prepare them to enter the increasingly competitive era of globalization.

English has become one of the determining factors of human resource quality in the current 4.0 era. English language education is already being taught to students from secondary school through to university level. The aim of English language education is to produce graduates who can use English actively and compete globally (Mandasari & Aminatun, 2020). Along with the changing times and technological advances, the need for mastery of English at the basic level is increasing. In the context of Indonesian education, strengthening English language learning from an early age is believed to improve students competence in communicating using the foreign language. Mastery of English from an early age has broad benefits, ranging from improving academic skills to preparing for future global challenges (Rohmah et al., 2023).

English language learning has become an essential skill for students in today's globalized world Crytal in (Wright, 2016). English has become a global language that connects people from different countries and cultures. Learning English can open up opportunities for communication and collaboration with people from all over the world. In today's globalized world, the ability to speak and understand English is essential for success and personal growth.

As a fundamental aspect of language proficiency, understanding the various factors that influence English language learning outcomes is crucial for educators and policymakers. A number of studies have highlighted the important role of psychological factors in the language learning process, particularly basic needs such as autonomy, competence, and relatedness (Ryan & Deci, 2000). The three needs are competence (Harter, 1978), relatedness (Baumeister & Leary, 1995), and autonomy (de Charms, 2013). Autonomy, competence, and relatedness are key components of Self-Determination Theory (SDT), which states that these psychological needs are essential for intrinsic motivation and optimal functioning (Ryan & Deci, 2000). SDT is an approach to individual motivation and personality using traditional empirical methods with a meta-theory that emphasizes the importance of an individual's internal resources for personality development and behavioral self-regulation (Ryan & Kuhl, 1997). Support for basic psychological needs such as autonomy, competence, and relatedness has been shown to contribute positively to motivation and language learning outcomes (Noels, 2015). However, the complex relationship between these factors and their impact on English language learning outcomes among primary school students remains under-explored.

Autonomy refers to the sense of personal control and independence that students feel over their learning activities (Deci & Ryan, 1987). Autonomy is also an attitude whereby students are prepared to take responsibility for their own learning. Responsibility here basically relates to decision-making about their own learning (Dickinson, 1993). Students who feel they have the right and freedom to choose their learning activities tend to have higher motivation and behave more actively in the learning process. Therefore, in learning activities, teachers must utilize media and facilities and also be able to motivate students to learn (Sari & Wahyudin, 2019). In English learning activities, it is stated that people who have desires, encouragement, and goals will tend to be more successful in learning English than those who learn without motivation or encouragement (Noviana & Ayu, 2022). Competence relates to students self-belief in their ability to complete certain tasks and achieve learning targets (Deci et al., 2001). This feeling of capability is a determining factor in maintaining internal motivation and overcoming frustration when facing learning challenges. Meanwhile, relatedness, which refers to the social need to feel connected and accepted by others, has a major impact on creating a supportive and comfortable learning environment (Baumeister & Leary, 1995).

Studies have shown that these three factors are positively related to student learning outcomes and competencies. (Ryan & Deci, 2000) states that the fulfillment of these psychological needs is critical in creating sustained internal motivation and improving academic achievement. Research by (Reeve & Jang, 2006) reveals that students who are given space to be creative and have autonomy in their learning perform better and are more motivated than those who are not.

In addition, another study by (Vallerand et al., 1997) found that support for competence and positive social relationships play an important role in promoting intrinsic motivation, which ultimately impacts long-term learning and academic achievement. In the context of English language learning in primary schools, these psychological factors are very important considering that early childhood is a period of rapid social, cognitive and emotional development. Students who feel independent, confident and have positive relationships with teachers and peers are more likely to be actively engaged and achieve optimal results in learning the foreign language (Akbari et al., 2015).

Similarly, according to (Black & Deci, 2000), the success of educators in creating a learning atmosphere that supports the fulfillment of students psychological needs will have a positive effect on internal motivation, which leads to improved learning outcomes. In the context of the use of technology and digital media, (Bullock, 2013) mentions that technology can act as a major support in creating an independent and enjoyable learning experience, depending on how teachers integrate it into English language learning.

But in the field, there are still many challenges faced in optimizing these psychological factors. Many teachers tend to focus more on cognitive aspects and mastery of academic material, while the psychological aspects of students are often forgotten. As a result, student motivation tends to be low, and learning success is not maximized (Wigfield & Eccles, 2000). In fact, high motivation is the main key in maintaining consistency and sustainability of the learning process (Eccles & Wigfield, 2002).

In order to overcome these problems, an approach is needed that is able to measure and analyze the relationship between these psychological variables empirically and comprehensively. One approach that is starting to be widely used in education and psychology studies is the Partial Least Squares Structural Equation Modeling (PLS-SEM) model. This method is able to test the relationship between latent variables and their

indicators and the relationship between variables in complex models, even with small samples (Henseler et al., 2015)

The use of PLS-SEM in education is growing due to its ability to cope with non-normal models and imperfect data, which are often encountered in field research (Sarstedt et al., 2020). In addition, a key advantage of PLS-SEM is its ability to model both direct and indirect relationships between variables, thus offering a deeper understanding of factors in the learning process (Chin, 1998).

In the context of this research, the application of PLS-SEM is directed to empirically test the influence of the psychological needs of autonomy, relatedness on competence and success in learning English in elementary school students. The results of this study are expected to enrich the literature on learning competence and provide practical recommendations for educators to create a learning environment that supports these psychological needs. The results of this study are expected to be a reference in designing learning programs that are more comprehensive and oriented to the psychological needs of students, so as to improve competence and learning outcomes.

Thus, the use of SDT theory and PLS-SEM analysis is a powerful combination in examining the influence of psychological factors on English language learning success in early childhood. Through this approach, it is expected that empirical findings can be found that support the importance of paying attention to students' psychological aspects as an integral part of effective learning strategies. (Figure 1). This research is based on the following hypothesis:
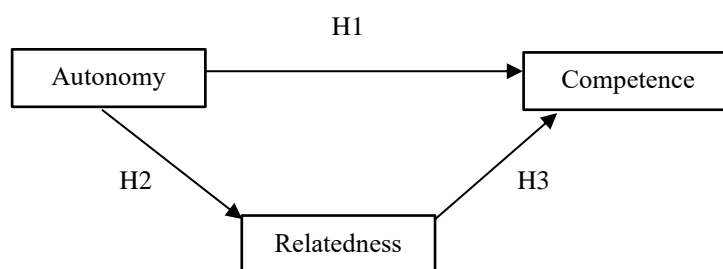
Hypothesis 1:	Autonomy affects students' competence increase.
Hypothesis 2:	Autonomy affects students' relatedness in learning.
Hypothesis 3:	Relatedness affects students' competence increase.

2. METHOD

This study used a quantitative approach with a correlational survey design. This approach was chosen because it is able to empirically examine the relationship between psychological variables (autonomy, relatedness, and competence) to the success of learning English in elementary school students. This approach allows researchers to obtain an objective picture based on numerical data from respondents (Creswell, 2014). The survey method enables the collection of large amounts of data systematically and analytically, and facilitates the testing of relationships between constructs in complex models.

The population in this study were elementary school students from grade IV to grade VI from 3 different elementary schools. The sampling technique was carried out by purposive sampling by considering the representation of the three schools, namely SD Negeri 2 Kedungdawa (Jl. Arya Kemuning, Kedungdawa Village, Kedawung District, Cirebon Regency), SD Negeri Karang Mulya (Jl. Pangeran Drajat, No. 25, Drajat Village, Kesambi District, Cirebon City), and SD Negeri Sukasari (Jl. Sukasari, No. 10, Sukapura Village, Kejaksan District, Cirebon City). The number of respondents involved was 240 students, with each proportionally representing grades IV, V, and VI. The sampling technique used was purposive sampling with the following criteria: (1) students in grades IV, V, and VI who actively participated in English lessons, (2) were willing to be respondents, and (3) had permission from the teacher.

This study uses a reflective measurement model to assess the three core constructs: students autonomy, relatedness, and competence in the context of English language learning at the primary school level. The instruments used in this study were adapted from validated instruments that have been used in previous studies, with modifications that have been adjusted to the characteristics of elementary school students and the conditions of English learning in schools.

Autonomy and relatedness affect the improvement of students' competence in learning English. This instrument is an adaptation of the questionnaire developed by Joe Hair and Abdullah Alamer (2022), with language and

context adjustments for elementary school students. Research on the basic psychological needs scale to improve competence in English language learning.

The main instrument in this study was a questionnaire based on a 1-4 point Likert scale (1 = Strongly Disagree to 4 = Strongly Agree). The questionnaire consists of 45 statements that have been compiled based on the indicators in the evaluation model used. The data were compiled based on the theoretical framework and previous studies. The questionnaire consists of several main sections:

Table 1. Questions Item

Variables	Questions	Items
Autonomy	"I feel free to choose English learning activities that I like."	15 items
Relatedness	"I feel accepted and supported by my teacher in learning English."	15 items
Competence	"I feel capable of using English well."	15 items

1. Autonomy variable - measures students' level of independence in learning English, related to freedom to choose learning activities and involvement in decision-making related to their learning process (Kimberly A. Noels, 2000).
2. Relatedness variable - measures the sense of social attachment with teachers and friends in the process of learning English (Ryan & Deci, 2000).
3. Competence variable - measures students' confidence and ability to use English (Deci et al., 2001).

Table 2. Descriptive Statistics and Correlations

Variables	Means	SD	t-statistics	p-value
AU	0.368	0.057	6.224	0.000
RE	0.036	0.072	0.461	0.645
CO	0.141	0.061	2.210	0.027

Notes. AU = Autonomy; RE = Relatedness; CO = Competence.

The data obtained were analyzed using SmartPLS 4.1.1.2 software, considering that PLS-SEM is an analytical method suitable for testing the construct model and the relationship between latent variables and their indicators. Before testing the relationship between variables, indicator validity is tested through loading factor analysis above 0.70 valid, Validity Average Variance Extracted (AVE) above 0.50 valid, Heterotrait-Monotrait Ratio (HTMT) below 0.90 valid and Fornell-Larcker Criterion. Reliability is tested using, Cronbach's Alpha (CA), and Composite Reliability, both of which must reach a minimum of 0.07 according to the standard (Nunnally & Bernstein, 1994). After the measurement model is valid and reliable, the relationship between the main constructs (autonomy, relatedness, competence) on learning success is tested. The main parameters obtained are the path coefficient (β) value and its significance level (p-value). Significance testing was conducted using bootstrap 5000 resampling and validating the content based on theoretical basis and empirical evidence. Evaluation of the structural model, which includes analyzing the relationship between indicators and latent variables (loadings and path coefficients) using the path coefficient t-statistic, and p-value, as well as calculating the effect size (f^2) and coefficient of determination (R^2) to determine the strength of latent variables and their indicators.

3. RESULT AND DISCUSSION

Based on the results of the bootstrapping analysis presented in Table 2, the Autonomy (AU) variable has an average value of 0.368 with a standard deviation of 0.057. The t-statistic value of 6.224 and the p-value of 0.000 indicate that AU has a significant effect ($p < 0.05$) in the model. In contrast, the Relatedness (RE) variable shows a mean value of 0.036 with a standard deviation of 0.072. However, the t-statistic value of 0.461 and p-value of 0.645 indicate that the effect of RE is not significant ($p > 0.05$). Meanwhile, the Competence (CO) variable has an average value of 0.141 and a standard deviation of 0.061. The t-statistic value of 2.210 and p-value of 0.027 indicate that this variable has a significant effect in the model ($p < 0.05$). This finding is consistent with the views of Ryan and Deci (2000), who emphasize that the fulfillment of basic psychological needs autonomy, relatedness, and competence is a key prerequisite in the formation of sustainable intrinsic motivation and has a positive impact on academic achievement.

However, interpretation of these results needs to consider the limitations of the statistical model used. The model does not fully accommodate the influence of external variables that have the potential to be significant in

improving students competence in English learning outcomes, such as learning environment conditions, cultural background, and individual characteristics of learners such as self-efficacy and emotion regulation. The insignificance of the relatedness variable does not mean that this variable is not important. However, the real world is often more complex and influenced by various factors that cannot always be accommodated in the model. Therefore, further research is needed with a more comprehensive and integrative conceptual model to provide a more comprehensive picture of the contribution of basic psychological needs in the context of English language learning.

3.1. Measurement Model

SmartPLS software version 4.1.1.2 was used to psychometrically evaluate the tools used to assess the underlying psychology in second language learning, namely autonomy, relatedness, and competence (Ryan & Deci, 2000) . Item loadings should be higher than 0.70 and Average Variance Extracted (AVE) and indicator reliabilities should be higher than 0.50 to confirm convergent validity. The Fornell-Larcker Criterion is used to evaluate discriminant validity, stating that the square root of the AVE of each latent construct should be greater than its correlation with other latent constructs.

All indicators in the Autonomy (AU), Relatedness (RE), and Competence (CO) constructs have a loading value above 0.07, which indicates that each indicator has a good contribution to the construct it represents. Construct reliability has also been met, as indicated by Cronbach's Alpha values above 0.90 each. This indicates that each construct has high internal reliability. The AVE values for the three constructs are also above the minimum limit of 0.05, which indicates that this model meets the convergent validation requirements (AU = 0.585; RE = 0.816; CO = 0.599). However, the discriminant validity test using the Fornell-Larcker method shows that the three constructs have not met the criteria (indicated by the value "No"), although discriminant validity can still be maintained based on the cross-loading results which show higher values in the origin construct than other constructs. The full results are presented in table 3.

Table 3. Summary of Measurement Model Quality.

Latens Variables	Indicators	Loadings	Cronbach's Alpha	CR	AVE	Fornell-Larcker validity	Cross-Loadings
AU	AU_1	0.771	0.946	0.952	0.585	No.	Yes
	AU_2	0.787					
	AU_3	0.771					
	AU_4	0.762					
	AU_5	0.761					
	AU_6	0.743					
	AU_7	0.723					
	AU_8	0.810					
	AU_9	0.739					
	AU_10	0.756					
	AU_11	0.788					
	AU_12	0.762					
	AU_14	0.790					
	AU_15	0.745					
RE	RE_31	0.938	0.982	0.984	0.861	No.	Yes
	RE_33	0.942					
	RE_34	0.910					
	RE_35	0.916					
	RE_36	0.943					
	RE_37	0.913					
	RE_38	0.937					
	RE_39	0.961					
	RE_40	0.881					
	RE_42	0.935					
CO	CO_17	0.859	0.949	0.954	0.599	No.	Yes
	CO_18	0.842					

CO_20	0.852	
CO_21	0.853	
CO_22	0.712	
CO_23	0.719	
CO_24	0.854	
CO_26	0.729	
CO_27	0.720	
CO_28	0.718	
CO_30	0.859	

Notes. AU = Autonomy; RE= Relatedness; CO = Competence.

3.2. Structural Model

The Structural Model is assessed after the validity of the measurement model is established. The extent to which external latent variables influence variation in endogenous latent variables is measured by the coefficient of determination (R2) (Hair et al., 2019).

Table 4. Structural Model Assessment

Variables	AU		RE		CO	
	Path coeff	f^2 effect size	Path coeff	f^2 effect size	Path coeff	f^2 effect size
AU	-	-	0.135	0.018	0.356	0.143
RE	-	-	-	-	0.033	-
CO	-	-	-	-	-	-
R^2 variables	-	-	0.018	-	0.131	-

Notes. AU = Autonomy; RE = Relatedness; CO = Competence.

The results of the structural model evaluation as shown in Table 4 indicate that the variable Autonomy (AU) affects Relatedness (RE) with a path coefficient value of 0.135 and an f^2 effect size of 0.018, which indicates a small effect. In addition, AU also has an effect on Competence (CO) with a path coefficient of 0.356 and an f^2 effect size of 1.143, which indicates an effect close to medium. Meanwhile, RE also has an influence on CO, but only with a path coefficient of 0.033, with no f^2 value indicating an insignificant effect. The R^2 value for the RE construct is 0.018, which indicates that AU only explains 1.8% of the variance of RE. Meanwhile, the R^2 for CO is 0.131, which means that the combination of AU and RE explains 13.1% of the variance of CO. The AU to CO relationship is the strongest and most meaningful. Meanwhile, AU → RE → CO contributed little. The R^2 value indicates the predictive ability of the model is low, but still acceptable.

Following the steps described by (Hair et al., 2019), a bootstrapping technique with 5,000 sub-samples was used to assess the statistical significance of the path coefficients. This analysis yielded estimates of the direct and indirect effects in the mediation framework, which are detailed in Table 4. The significance of the path coefficients was determined using bootstrapping confidence intervals. Since the bootstrapping method empirically constructs the sampling distribution, it eliminates the need for the normality assumption. A path is considered statistically significant if the 97.5% confidence interval does not include zero. In addition, a t-statistic exceeding 1.96 corresponds to a significance level of $p < 0.05$ in a two-sided test. These findings indicate that Autonomy (AU) has a noticeable direct impact on Competence (CO), with a coefficient β = 0, 356. In addition, AU also has a significant effect on Relatedness (RE) with a coefficient of β = 0.135, RE and CO with β = 0.033. Although the mediation effect through AU is statistically significant and positive, the influence through RE is negligible and does not have a large impact. These results validate hypotheses 1 and 2, which show that the direct and mediating effects of autonomy significantly increase students' competence and relatedness.
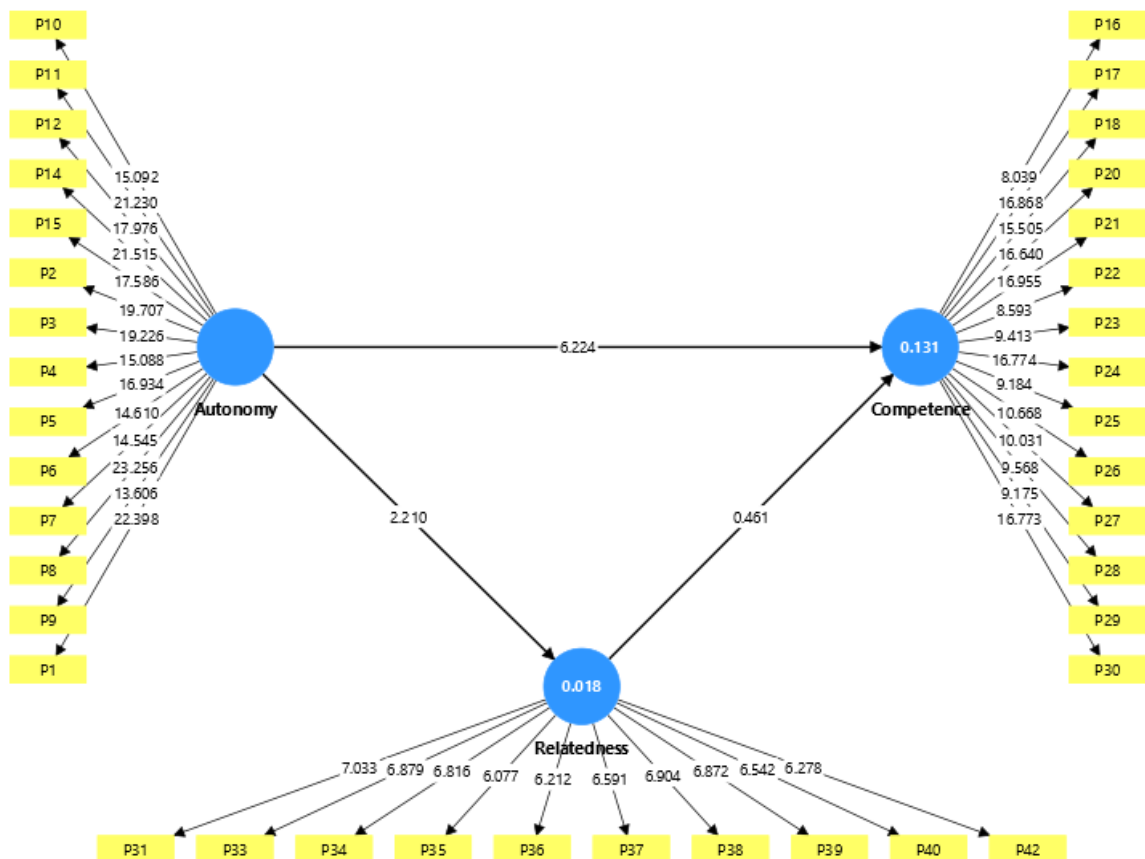
Figure 2. Structural model of the relationship between autonomy, relatedness, and competence

Table 5. Significance Analysis of Total, Derect and Indirect Effects

Paths	Parths coefficients(β)	t-value	p-value	2.5%	97.5%
AU → CO	0.356	6.224	0.000	0.255	0.477
AU → RE	0.135	2.210	0.027	0.021	0.264
RE → CO	0.033	0.461	0.645	-0.118	0.166
	Indirect effect	Derect effect	Total effect	2.5%	97.5%
AU → RE → CO	0.004	0.368	0.372	0.263	0.481

The results of path analysis using bootstrapping in SmartPLS Table 5 show that in the context of basic education, the variable Autonomy (AU) has a significant direct effect on Competence (CO) with a path coefficient of 0, 356, t-value = 6.224, and p-value 0.000. AU also has a significant effect on Relatedness (RE) (β = 0.135, p = 0.027). However, the relationship between RE and CO was not significant (β = 0.033, p = 0.645), so RE did not significantly mediate the relationship between AU and CO. The indirect effect of AU and CO was 0.372, with a 95% confidence interval between 0.263 to 0.481, indicating a stable and significant influence overall.

With a particular focus on the role of autonomy and relatedness, this study attempts to investigate their relationship with students' competence enhancement. The main objective is to understand how these two variables function as channels through which autonomy and relatedness influence students' competence enhancement. (Ryan & Deci, 2000) states that the fulfillment of these psychological needs is crucial in creating sustained internal motivation and improving academic achievement. The results of this study underscore the important role of autonomy and relatedness in improving student competence.

The findings of this study confirm previous research which shows that autonomy has a positive impact on learning activities, where they will tend to be motivated in the learning process. Our findings confirm the positive correlation between autonomy and relatedness in improving students' competence. Relatedness refers to students need to feel accepted by others, this has an impact with an environment that supports comfort in the learning process (Baumeister & Leary, 1995). In this context, competence is related to students' ability to complete tasks

to achieve learning targets (Deci et al., 2001). All three are interrelated to form a comfortable learning process for students. The results of this study support the hypothesis that autonomy and relatedness have an influence on student competence in learning.

The results of this study show that, in the context of primary education, both autonomy and relatedness play an important role in improving students' competence in learning English. These findings highlight the importance of psychological factors in language learning, including autonomy, competence and relatedness (Ryan & Deci, 2000). Autonomy refers to the sense of personal control and independence students feel over their learning activities (Deci & Ryan, 1987). Students who feel they have the right and freedom to choose their learning activities tend to have higher motivation and behave more actively in the learning process. Students who feel independent, confident, and have positive relationships with teachers and peers are more likely to be actively engaged and achieve optimal results in their foreign language learning (Reinders & White, 2011). Therefore, this finding supports hypothesis H1 that autonomy has a significant positive influence on increasing students competence in learning English. This provides an opportunity for future research to further explore the influence of students' basic psychology in the learning process in primary education.

This finding suggests that autonomy influences students' relatedness in learning English language learning at primary school. Relatedness, which refers to the social need to feel connected and accepted by others, has a major impact on creating a supportive and comfortable learning environment (Baumeister & Leary, 1995). In line with relatedness theory which asserts that successful second language learning does not only depend on methods or materials, but also on social relationships and a sense of belonging in the learning environment. When students feel emotionally and socially connected, they will be more encouraged to learn actively and sustainably (Ryan & Deci, 1985). Therefore, this finding supports hypothesis H2 that autonomy has an influence on students' relatedness. This provides an opportunity for future research to further explore the influence of students' basic psychology on learning in primary education.

The results of this study indicate that Autonomy (AU) has a significant influence on Competence (CO), both directly and through the total effect. This is in line with the basic concept in Self-Determination Theory (SDT) proposed by (Ryan & Deci, 2000) , that autonomy is one of the basic psychological needs that can increase the perception of individual competence. In detail, this finding indicates that the higher the level of autonomy felt by students, the higher their perception of personal competence. This reflects that when people feel they have control over their own actions, they tend to feel more capable and effective in their learning.

In contrast, the Relatedness (RE) variable, although predicted to play a mediating role, did not show a significant effect on competence. AU→ RE pathway is significant, but RE→ CO is not significant. This indicates that in the context of English language learning, social relationships do not directly strengthen perceptions of competence. This could be due to cultural context, social interaction patterns, or individual preferences that prioritize autonomy over social connections. Statistically, the relatively low R^2 value indicates that there are other factors beyond autonomy and relatedness that influence competence. This finding leaves room for further research to explore additional variables such as self-efficacy and environmental support.

This study adds to existing research by examining how autonomy and relatedness are interrelated in improving students' competence in learning English. This study emphasizes the important role of the basic psychological factors of autonomy and relatedness on the effect of increasing student competence in supporting students' success in learning English in basic education to foster comfort and increase positive student academic achievement. Student autonomy support characterized by a sense of personal control and having freedom in constructive learning activities has been shown to improve student academic achievement, which influences better learning outcomes. This result is in line with the opinion of Ryan and Deci (2000), which states that the fulfillment of students' basic psychological needs is very important in creating sustainability and increasing students' academic achievement in learning a second language.

4. CONCLUSION

The results showed that autonomy has a significant positive effect on increasing students learning competence. When students have a high level of independence and have freedom in learning activities, it is proven to increase student competence in learning. Meanwhile, the results showed that relatedness did not have a significant positive effect on increasing student competence. Relatedness or feeling accepted, valued, and supported by teachers and peers, then they feel a sense of security and comfort during the learning process. Teachers are expected to be able to create a pleasant and socially supported learning environment to increase students' desire to engage in the learning process, and increase student competence. During the learning process, if students are given the opportunity to choose activities and organize how they learn, they tend to be internally driven to achieve success. Improving competence starts with providing tasks that are appropriate to their abilities, positive feedback, and a supportive learning environment, thus increasing students self-confidence.

Practically, these findings provide guidance for schools, teachers, and parents to develop intervention programs that emphasize the importance of social support in reducing academic burnout. Additionally, it is essential to design learning strategies that specifically aim to enhance self-efficacy, enabling students to become more confident and resilient in facing future academic challenges. Thus, a combination of social support and appropriate psychological interventions can contribute to improving both the quality of education and students' overall well-being.

5. ACKNOWLEDGEMENTS

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