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Evaluating the Structural Model of IPAS Learning in Elementary Education: A PLS-SEM Approach to Influence Attention, Invested Learning, and Perceived Behavioral Control

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Abstract: This study aims to empirically test the relationship between attention, invested learning in acquiring skills and knowledge, control perceived behavior, and results Study in context basic education. The method used in this study is Partial Least Structural Equation Modeling (PLS-SEM), which allows analysis complex relationships between variables. Data were obtained from 240 elementary school students in Cirebon City through questionnaire scale Likert. The results of the analysis show that attention has significant influence to control behavior ($\beta = 0.274$; $t = 4.763$; $p = 0.000$) and learning engagement also showed a significant influence ($\beta = 0.154$; $t = 2.256$; $p = 0.024$). The R^2 value of 0.103 identified that the model was only able to explains 10.3% of the variance in control perceived behavior, which means that Still There is other variables outside the model that affect the dependent variable. The research findings indicate that the attention given to students, the learning invested , and control perceived behavior own significant influence and positive on learning outcomes. The practical implications of these findings encourage learning development strategies that focus on optimizing student attention and participation to improve learning effectiveness at the elementary education level.

Keywords: Attention, Integrated Learning, Perceived Behavioral Control, Elementary Education, PLS-SEM.

INTRODUCTION

Education at the elementary school level plays a very crucial role in forming the foundation of knowledge, attitudes, and basic skills of students. One of the subjects that has a strategic role in building science and social literacy from an early age is Natural and Social Sciences (IPA). This subject is an integration between the concepts of Natural Sciences (IPA) and Social Sciences (IPS) which aims to develop critical and logical thinking skills and increase students' social sensitivity. The combination of these two subjects is carried out with the consideration that elementary school students are more focused on observing concrete things. In addition, students at this stage are still in a more concrete or simple thinking process, with a holistic and comprehensive approach, but not yet detailed (Purwanto, 2022). However, in its implementation, not a few elementary school students have difficulty understanding science material. These obstacles can be caused by a lack of student attention, low motivation to be actively involved in the learning process, and negative perceptions of their ability to complete academic tasks. Numerous studies have confirmed that

psychological factors such as attention, internal motivation, and perceived control over learning play an important role in determining the quality of learning outcomes (Zimmerman, 2000). In fact, empirical research shows that students who are able to maintain attentional focus in learning activities, actively invest in the learning process, and feel in control of their learning experiences tend to achieve better academic outcomes (Schunk, 2012).

Attention is considered a major cognitive aspect that influences the efficiency of the learning process. There was a reliably negative relationship between the influence of sustained attention on long-term memory and average long-term memory response error, a stronger influence of sustained attention correlates with better overall long-term memory performance (DeBettencourt et al., 2021). In the context of learning, good attention allows individuals to understand the material better and reduce interference from external factors(Klem & Connell, 2004). Conversely, distracted or unfocused attention significantly hinders the learning process. Furthermore, focus on invested learning, defined as active effort, persistence, and self-commitment in participating in learning activities, is a major indicator of the success of the long-term learning process (Schunk, 2012). This investment is not only in the form of physical effort, but also emotional and mental effort that shows the level of intrinsic motivation of students in achieving their learning goals (Ryan et al., 2021). The higher the attention given to students, the more likely students are to invest time and effort in their learning.

Learners who actively invest in their learning are better able to overcome challenges and obstacles, and maintain their passion for learning despite obstacles (Schunk & DiBenedetto, 2020). High student engagement in science was shown to be positively correlated with perceived control over learning behaviors (Wang et al., 2019). In addition to attention and investment in learning, the third important aspect is perceived behavioral control (PBC), which is the learner's perception of their ability and self-control in carrying out the learning process. According to Ajzen (1991), PBC is one of the main factors that shape human behavior, including in the context of learning. Within the framework of planned behavior theory, PBC influences the intentions and actual behavior of learners in achieving the expected learning targets (Ajzen, 1991). If the attention given to learners is optimal and learners can invest time and effort in participating in learning activities, then the behavioral control felt by learners tends to be more confident in their ability to do tasks and is motivated to continue to improve their understanding of the learning being carried out. Students who feel capable and confident in their ability to do tasks and overcome learning obstacles will view themselves more positively and behave proactively in learning (Bandura, 1997).

The role of perceived control is also supported by Bandura's (1997) self-efficacy theory, which states that self-confidence in personal abilities directly contributes to academic achievement and learning motivation. In the context of elementary education, perceived control plays an important role because children at this stage are still learning to build self-confidence and master the basics of learning skills that will be used at the next level (Grolnick & Ryan, 1987). According to the Theory of Planned Behavior, an individual's intention towards a particular behavior can be determined by factors such as the person's attitude towards the behavior (behavioral attitude), pressure or influence from people around them (subjective norms), and the person's belief in their ability to manage or control the situation (perceived behavioral control). Skinner and Belmont (1993) once stated that students' perceptions of teacher support are interrelated with their behavioral intentions to learn. Thus, there is a relationship between students' growth mindsets, perceived support from teachers, and their intentions towards learning behavior, including for self-regulated learning. Support from teachers not only increases motivation, but also encourages students to take an active role and feel in control of their learning process. Support from teachers plus

adequate structure increases students' engagement and behavioral control directly (Jang et al., 2010).

According to Schunk (2012), these three factors interact and reinforce each other attention helps focus and direct effort, invested learning ensures the sustainability and depth of the learning process, while perceived behavioral control builds self-confidence and self-control that accelerates the achievement of results. Previous research shows that attention is highly positively correlated with academic achievement, as students who are able to maintain focus tend to gain better mastery of the material (Mcclelland et al., 2012). Meanwhile, learning investment, which includes active effort and persistence, is closely related to long-term success and competence development (Fredricks et al., 2004). Likewise, perceived control over the learning process motivates students to learn independently and proactively, which in turn improves their academic performance (Schunk & DiBenedetto, 2020).

Thus, this study aims to evaluate the structural model that explains the relationship between attention, invested learning, and perceived behavioral control in the science learning process. This study uses the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach, with the help of SmartPLS software, to analyze the influence of each latent variable. The use of statistical analysis such as Partial Least Squares Structural Equation Modeling (PLS-SEM) is an appropriate approach to test this relationship simultaneously and realistically (Henseler et al., 2009). Data were collected by distributing questionnaires to 240 elementary school students from several schools that have been determined as research samples. Data from questionnaires cannot be obtained from other sources (Pandey, P.; Pandey, 2015). By understanding the influence of these three variables, the results of this study are expected to contribute to the development of more interactive, adaptive science learning strategies that are able to meet the psychological and motivational needs of students at the elementary school level.

METHOD

This study uses a quantitative approach with a survey design to evaluate the structural model of Natural Science and Social Science learning at the elementary education level. The main focus of this study is to identify and analyze the influence of attention, learning engagement, and perceived behavioral control on student learning outcomes. By understanding the relationship between these variables, it is hoped that more effective strategies can be found to improve the quality of learning in the classroom. The use of quantitative methods allows researchers to collect data that can be measured objectively. Quantitative research can be defined as one of the research methodology that prioritizes the use of mathematical, statistical, and numerical approaches in studying a phenomenon (Aziza et al., 2024). By utilizing instruments such as questionnaires using a Likert scale, researchers can measure variables such as attention, learning engagement, and perceived behavioral control systematically and standardized, researchers can also obtain data that directly reflect the dynamics and challenges of science learning. The study population included students in grades 4 to 6 in several elementary schools in the Cirebon area, which is an area with rich social and cultural diversity. This facilitates the sampling process and ensures that the data collected is relevant to the research objectives. The sample was selected purposively by considering the availability and willingness of participation from schools and students, so that a total of 240 respondents were obtained from 3 different elementary schools.

The instrument used in this study was a questionnaire consisting of 45 statements, which were divided proportionally into three main variables, namely attention, invested learning, and perceived behavioral control. Each item in the questionnaire was arranged

using a 4-point Likert scale, with response options: 1= strongly disagree, 2= disagree, 3= agree, and 4= strongly agree. This instrument was developed based on a review of literature and previous research relevant to the three variables, in order to ensure the validity of the content and conceptual relevance of each statement to the construct being measured. This questionnaire was carefully designed to measure students' perceptions of various factors that influence science learning, with the hope of providing in-depth insight into the dynamics of learning in the classroom. One approach to developing science learning motivation instruments is through indicators of students' perceptions of learning and their engagement in classroom activities (Tuan et al., 2005).

Table 1. Questions Item

Variables	Questions	Items
Attention	Includes indicators about students' ability to maintain focus during the learning process.	15 items
Invested	Measuring the level of effort, persistence, and activeness of students in participating in learning.	15 items
PBC	Measuring students' beliefs and perceptions about their ability to overcome learning challenges.	15 items

This research began with the preparation and coordination stage, where the researcher first coordinated with the school and asked for written permission to conduct the research. The school was also given information about the purpose and procedures for data collection. Furthermore, at the implementation stage, data collection was carried out by giving students the opportunity to fill out questionnaires independently in the classroom, under the supervision of teachers and researchers. Before filling out the questionnaire, the researcher provided a brief explanation so that students understood each question asked. Respondents were also reminded that all data they provided would be kept confidential and used anonymously. After the data was collected, verification was carried out to ensure its completeness and validity. Incomplete or ambiguous data was then deleted so that the research results remained accurate and accountable.

Data collection was conducted over a two-week period to ensure the consistency and validity of the data obtained. The collected data were then analyzed using Structural Equation Modeling (SEM) based on Partial Least Squares (PLS) with the help of the SmartPLS version 4.0 application which allows researchers to explore complex relationships between the variables studied and provide a clearer picture of the factors that contribute to student learning outcomes at the elementary education level. Data analysis was carried out using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method. The main reason for using PLS-SEM is its ability to test complex structural models, with many latent variable indicators, and does not require strict normal data distribution assumptions (Henseler et al., 2009). In addition, PLS-SEM is able to provide accurate estimates on small to medium sized samples, making it suitable for use in this study involving 240 respondents.

The data analysis technique used in this study is hypothesis testing. Before conducting a hypothesis, a normality test, validity test, reliability test, heteroscedasticity test and multicollinearity test are first carried out. After that, a hypothesis test is carried out, namely the coefficient of determination test and partial test (t). The validity test is to measure whether the questionnaire has been able to reveal something that is measured through a Likert scale and is suitable for use (Ghozali, 2011). The reliability test is a test to show the extent to which the results obtained using the questionnaire can be trusted and relied on for accuracy. The heteroscedasticity test is to find out that the regression model obtained does

not have similarities from one observation to another (Ghozali, 2011). While the multicollinearity test is to see whether there is a correlation between independent variables in the regression model. Partial tests and coefficient of determination tests are used to test whether the independent variables affect the dependent variable and how much influence the independent variables have on the dependent variable.

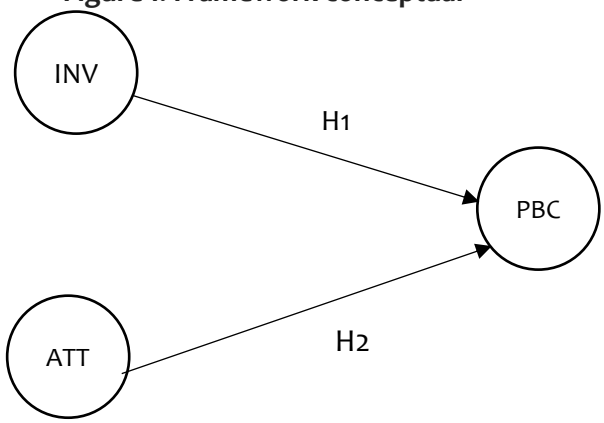
Before being widely used, this instrument went through a validation and reliability process through trials in different schools to ensure that the indicators were able to measure the constructs accurately and consistently. Construct validity was tested using factor loading and AVE analysis, ensuring that all indicators had loadings above 0.7 and AVE above 0.5. Instrument reliability was also ensured through Cronbach's alpha and composite reliability, both above 0.70. An instrument is said to be valid if the data it produces reflects the concept or phenomenon being measured accurately (Bushmakin & Cappelleri, 2023; Heale & Twycross, 2015).

Research has shown that psychological factors such as attention, invested learning, and perceived behavioral control have a significant influence on the success of the learning process. These three variables affect how students interpret the subject matter, their level of engagement in learning, and the extent to which they feel capable of completing the assigned tasks. Therefore, understanding the role of these three factors is important in improving the effectiveness of science learning at the elementary school level. Thus, this study proposes the following hypothesis:

H1: Invested learning has a positive effect on perceived behavioral control.

H2: Attention has a positive effect on perceived behavioral control.

Figure 1. Framework conceptual



Notes. INV: invested ; ATT: attention ; PBC: perceived behavioral control

RESULTS AND DISCUSSION

Before conducting structural analysis, descriptive analysis and correlation between latent variables were first conducted to determine the extent of the relationship between constructs used in the model. The results of the correlation between latent variables are presented in the following table.

Table 2. Descriptive Statistics and Correlation

Variables	Method	SD	ATT	INV	PBC
ATT	0.000	1,000	1,000	0.049	0.282
INV	-0,000	1,000	0.049	1,000	0.168
PBC	0.000	1,000	0.282	0.168	1,000

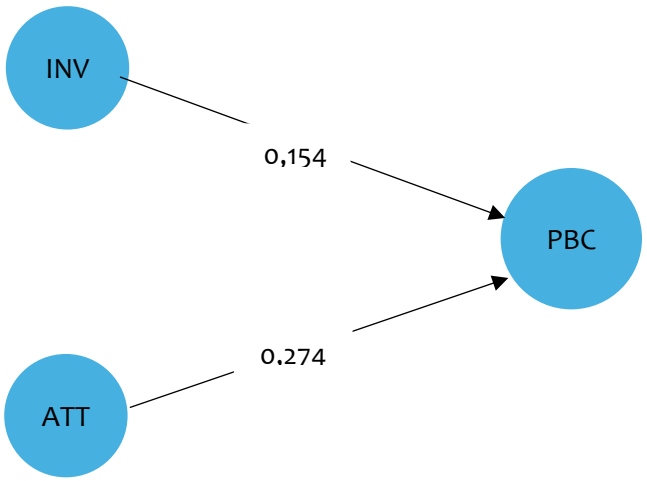
The first step taken in this study was to test the validity and reliability of the measurement instrument. Table 2 provides the Cronbach's alpha value, composite reliability, and average variance extracted (AVE). Hair et al., (2017) stated that construct reliability is assessed by examining Cronbach's alpha and composite reliability. Convergent validity is the extent to which a measure correlates positively with alternative measures of the same construct (Hair, Hult, et al., 2017).

Table 3. Results Reliability And Validity

Construction	Alpha Cronbach	Composite Reliability	TRACK
Investing	0.982	0.984	0.801
Attention	0.951	0.989	0.585
PBC	0.962	0.969	0.657

In addition, the Average Variance Extracted (AVE) value for each construct ranges from 0.58 to 0.80, which meets the criteria of AVE > 0.5, thus indicating fairly good convergent validity. The reliability of the instrument is also satisfactory, with Cronbach's alpha values ranging from 0.95 to 0.98 and composite reliability above 0.85 for all constructs, confirming the internal consistency of each measurement instrument.

Figure 2. Structural model of the relationship between investment, attention, and control. perceived behavior



To evaluate the discriminant validity between latent constructs in the model, it is used two method, namely HTMT (Heterotrait -Monotrait Ratio of Correlations). The HTMT method is used to ensure that each construct is truly empirically different from other constructs, by comparing the correlation ratio between indicators derived from different constructs.

Table 4. Discriminant Validity- Heterotrait-Monotrait Ratio (HTMT)

Construction	Attention	Invested	PBC
Attention	-	-	-
Invested	0.059	-	-
PBC	0.281	0.144	-

Discriminant validity measures the degree to which one item in a set can be distinguished from another. To measure the discriminant validity of a construct, we mainly adopt the Heterotrait-Monotrait (HTMT) ratio. Validity will be confirmed when the HTMT value does not exceed the recommended standard of 0.90. Discriminant validity in this study is acceptable because the inter-construct HTMT values of the research results are all below the threshold of 0.9 (see Table 4). Thus, the internal consistency, reliability of each item of discriminant validity are all confirmed in this study.

To evaluate the model fit, several common indicators are used in the PLS-SEM approach. One of the measures used is SRMR (Standardized Root Mean Square Residual), which reflects the average difference between observed and predicted correlations. SRMR values below 0.08 are considered to indicate a model that has a high level of good fit (Henseler et al., 2016). In addition, other indicators such as NFI (Normed Fit Index) and Chi-square are also used as a complement in assessing the overall feasibility of the model. These values provide an overview of whether the structural model built is statistically acceptable.

Table 5. Model Fit

	Saturated model	Estimated model
SRMR	0.072	0.072
d_ULS	5,361	5,361

The SRMR value in this model is 0.072, which is below the threshold of 0.08 as recommended by Henseler et al. (2016), indicating that the model has an adequate level of fit. In addition, the d_ULS value of 5.361 provides additional support for the model's goodness of fit, as it reflects the degree of difference between the empirical covariance matrix and the estimated model. Although some other indices such as Chi-square and NFI are not available, the SRMR and d_ULS results are sufficient to conclude that the model is suitable for use in PLS-SEM analysis. Structural model testing was conducted by path analysis using the bootstrapping method of 5000 resamplings. The results of the analysis showed that the three variables, namely Attention, Invested Learning, and Perceived Behavioral Control (PBC), had a significant relationship with each other.

Table 6. Path Coefficients

Connection	Original Sample	Standard Deviation	T Statistics	P Value
Attention→PBC	0.274	0.058	4.763	0.000
Invested→PBC	0.154	0.068	2.256	0.024

Referring to Cohen (1988) guidelines, the ATT path coefficient value on PBC of 0.274 can be categorized as a moderate effect, while the INV coefficient value on PBC of 0.154 is categorized as a small effect. This shows that student attention practically contributes more to the perception of behavioral control than invested learning. The R-squared (R^2) value for the PBC variable of 0.103 indicates that the relationship between the independent variables (such as attention and invested learning) and the dependent variable (PBC) is relatively weak. Only 10.3% of the variation in PBC can be explained by these variables. Although this value is relatively low, it suggests that there are other factors outside of this model that also influence PBC but have not been included in this study. Therefore, future research is recommended to consider additional predictor variables such as intrinsic motivation, self-efficacy, or environmental support as factors that may explain the dependent variable more comprehensively.

Overall, the results of the path analysis indicate that attention has a stronger influence on perceived behavioral control than invested learning. This is in line with the findings of İnal et al (2023) who showed that attention control has a significant role in improving students' perceived learning ability and supports that attention control is an important factor in supporting the effectiveness of learning strategies. Furthermore, research by (Sembada & Koay, 2021) confirmed that PBC also influenced students' level of confidence and control in learning decisions. This finding implies that efforts to improve students' perceived behavioral control will be more effective if they focus on improving students' attention during the learning process. The results of testing the structural model using path analysis indicate that the three variables, namely Attention, Invested Learning, and Perceived Behavioral Control (PBC), have a significant relationship. This finding provides important insights into the factors that influence students' behavioral control in the context of science learning in elementary education.

The results also showed that invested learning had a positive effect on perceived behavioral control (β 0.15, $p < 0.001$). This suggests that when students are more engaged in learning, they feel more able to manage and control their behavior (H1). This finding supports the Theory of Planned Behavior, which states that individuals' beliefs in their ability to manage situations are influenced by their learning experiences. Students' perceived behavioral control acts as a mediator between participation intention and learning practice effectiveness (Kang & Lay, 2025). Thus, increasing student engagement in learning can contribute to increasing their behavioral control. In addition, attention also had a positive effect on perceived behavioral control, although the effect was greater than invested learning (β 0.27, $p = 0.024$). This suggests that attention given to students not only increases their engagement in learning but can also increase their sense of control over the learning process. This suggests that attention given by teachers or the learning environment can contribute to the development of students' positive attitudes toward learning (H2). This finding is in line with Bandura's theory (1997) which states that perceived self-confidence and self-control directly motivate someone to take the initiative, overcome obstacles, and maintain effort.

When compared to previous studies, these findings support the research conducted by Schunk and DiBenedetto (2020) which stated that intrinsic motivation and active involvement in learning activities contribute greatly to academic achievement. These findings are also in line with the research of Fenollar et al (2007) which highlights the importance of cognitive involvement in building self-efficacy. However, in the context of elementary education, attention from teachers as an external factor seems to have a more prominent influence, which characterizes the developmental phase of elementary school children. This difference indicates the need to adjust the teaching approach based on the developmental stage of students. In terms of application, the results of this study provide a number of practical implications. Teachers are advised to create a supportive learning atmosphere by providing real attention, such as positive feedback, active communication, and reinforcement of good learning behavior. Curriculum developers can integrate learning strategies that encourage active participation and emotional involvement of students. For policy makers, it is important to encourage teacher training that emphasizes not only academic aspects, but also interpersonal skills and student emotional management, because these things have an impact on the formation of self-control in learning.

However, this study has several limitations that need to be considered. The R^2 value of 0.103 indicates that the model is only able to explain 10.3% of the variation in PBC, so many other potential factors are not accommodated. In addition, the cross-sectional nature of the study approach limits the ability to conclude causal relationships between variables with confidence. This study was also conducted in a limited geographic context, so the results are

not fully representative of the wider student population. In addition, the use of self-report instruments may cause respondent perception bias or common method bias. Therefore, future studies are advised to use longitudinal designs, involve more diverse samples, and utilize multiple data collection methods to increase the external validity and reliability of the findings.

CONCLUSION

Study This in a way theoretical confirm that attention and invested learning play role significant in to form control perceived behavior student in science learning at the level school basic. Although model contribution to Variance control behavior in words limited, findings this give indication beginning about importance second variable the in support the learning process independent and believe self. Contribution main studies this located on mapping beginning connection psychological student in IPAS context and application of PLS-SEM in education basic, which is still seldom conducted. Findings this open opportunity for development strategy learning that fosters involvement, regulation self, and sense of control student on the learning process they. In overall, results study This emphasizes the importance of invested attention and learning, in increase control behavior students. By creating an interesting learning environment and encouraging student involvement, it is expected to improve their learning outcomes in science subjects. This study provides a basis for developing more effective learning strategies at the elementary education level. In addition that, educator Also can facilitate formulation objective individual learning by student as method training regulation sustainable self. Implementation strategy this expected can increase sense of control student towards the ongoing learning process its turn expected will produce good impact on results academic.

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