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JUNIOR STUDENTS' INTEREST IN SCIENCE COURSES BASED ON HOTS LITERACY PROGRAM: MODELING OF SCIENTIFIC INTEREST AND ITS RELATIONSHIPS WITH OTHER COMPONENTS

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ABSTRACT

This study aims to describe the pattern of relationships between several factors supporting interest (interest) in science subjects. Students get an Exercise Program to improve scientific literacy. This training program aims to improve students' scientific literacy skills. The training program is carried out after the teachers receive the training program. The study of students' interest in science was revealed by conducting a survey related to several factors supporting interest in science. Several factors in the study of supporting scientific interests include the role of teachers, parental support, school roles, peer support, physics, chemistry and biology materials. Research participants were taken using random sampling technique, totaling 39 students. The developed scientific literacy assistance program seeks to improve the quality of learning outcomes. The success of the scientific literacy training program is related to students' scientific interest. The results showed that the multiple linear regression model provides a descriptive numerical description of the empirical relationship between the value of interest in science and its supporting components. Likewise, interest has a role in learning achievement.

Keywords: Modelling, Scientific Interest, Science

1. INTRODUCTION

The implementation of the Literacy Hots Assistance initiated by the Ministry and several LPTKs in Indonesia currently aims to develop three literacy skills, namely scientific, mathematical, and language literacy. In the field, especially SMPN 2, 3, and 14 Medan City is a pilot project of the implementation. Activities ranging from pre-test and post-test to get a picture about the rate Higher Order Thinking Skills (HOTS) literacy competencies have been carried out. In addition, the assistance in the implementation of learning and development of learning tools is also carried out by teachers in the field of hots literacy-based learning for students of Science Education students during Training of Trainer (ToT) activities. From the series of activities show the stage in ways of achieving learning outcomes to the effect of the cognitive and skills fields of students, teachers, students, and lecturers. However, one important aspect to fill the empty space is an activity, namely the interest aspect as requested by the OECD (2015).

Examining the important role of the interest aspect is as an aspect of driving academic activities that is very essential to support the success of activities on the other.

The OECD (2015) mandates the attitude field as an important part of the PISA program to focus on four aspects, namely: interest in science (1), valuing scientific approaches to inquiry (3) and environmental awareness (4). This attitude field directly supports competence in the field of scientific literacy as shown in Figure 1.

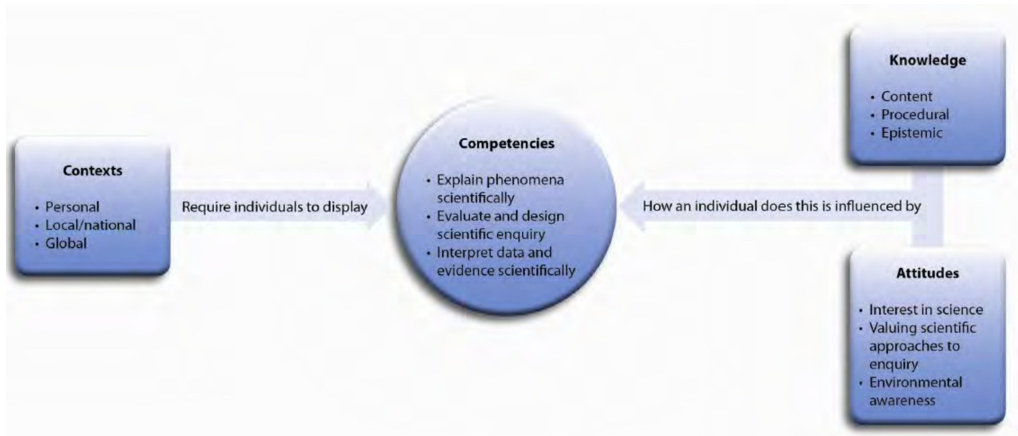

Figure 1 Assessment framework based on PISA 2015 OECD (2015)

Marshall et al. (2002), Millar (2006). Knowledge and attitudes are seen as relevant components of scientific literacy within the framework of the Program for International Student Assessment (PISA) 2015. While interest in science as one aspect of scientific literacy attitudes becomes the focus of this research. In line with what was conveyed by the OECD (2006), evaluating the important role of interest in science and technology for the younger generation. The data shows a decline in interest and attention to science and technology. Consequently, this becomes an obstacle for the economic development and the nation progress OECD (2006).

The mentoring program of HOTS literacy learning (science, numeric, language) was already completed during three months. During the period, the students and teachers experienced a series of cognitive assessment activities; the pretest, the assessment process and the posttest carried out by the National Testing Institute. The success of the mentoring program has not involved an assessment of the participants' specific interests and interests in the field of science. Students' interest in science certainly has a very important role in the present and future for students, schools and the wider community Lavonen et al. (2021).

The research focuses on describing the support of scientific interest in the components of learning outcomes. Next, describe mathematically the supporting factors of interest based on several supporting components. The research questions are aimed at providing an overview of the main problem:

1) How is the interaction model between scientific literacy interest in subject matters and its content knowledge?
2) How is the interaction model between students' scientific literacy interest, school and family background?

3) How is the interaction model of the relationship between science interest and learning outcomes?

2. LITERATURE REVIEW AND METHODS OF RESEARCH

2.1. THE ROLE OF SCHOOL TOWARD STUDENTS' SCIENCE INTEREST

Basl (2011) has conducted data analysis based on PISA 2006 which states that students' interest in science and technology impacts on the future and for future careers. The achievement of student scientific literacy is closely related to school background like in several countries, including the Czech Republic, Germany, Finland and Norway. This fact shows how important the role of schools in preparing the future of students' educational programs, and the career opportunities they will pursue. Regression model analysis was applied to analyze the data. Based on the research results, the influence of parents is almost negligible in relation to students' interest in science and technology.

The school's role has an impact on students' interest in conducting experiments and designing research. Students' interest in knowledge, values, feelings, motivation, and self-esteem will shape an individual's personal view of a particular subject Kind et al. (2007), Van et al. (2012). Science interest can be described in terms of three components: cognitive, affective and behavioral components Eagly and Chaiken (1993). For example, a person's interest in science would involve his knowledge of something, how he feels about science, and how a person is willing to act in a certain way toward science (eg taking a science course, or being a member of a science club).

2.2. SCIENCE COMPETENCY DOMAIN

According to Renninger et al (2015), the way to find the answers from questions or problems is an appropriate activity to support the development of scientific interest than simply to receive the information. The use of scientific inquiry through asking questions or providing solutions by modeling (Inkinen et al., 2020), can contribute to the development of scientific interest. In addition, the lack of understanding of scientific competence in general (Anderson, 2007; Minner et al., 2010), makes it difficult to analyze and compare research results pertaining to interest in the context of inquiry-based science learning studies.

The use of scientific inquiry is important in learning science in schools. Krajcik and Czerniak (2013) argue that students cannot learn scientific content disciplines alone without engaging in scientific practice and actively building their understanding through working and using ideas in real-world contexts. Scientific inquiry can practically be interpreted as the work of a scientist or an expert in a scientific discipline. A series of inquiries involves asking questions, planning and conducting investigations, analyzing and interpreting data, developing explanations and building models based on the data. Scientific practicum is not the same as inquiry, nor does it replace questions. Scientific practicum and scientific inquiry are a combination of activities in teaching and learning situations carried out in the classroom Miller et al. (2018).

2.3. COMPONENTS OF INTEREST IN SCIENCE BASED ON SCIENTIFIC ATTITUDE

Aalderen-Smeets et al. (2012) built a framework for defining attitudes towards science based on the context of primary school teachers. The framework was adapted from the traditional "tripatrid attitude model" Eagly and Chaiken (1993) by adding a new main category as control, and sub categories of self-efficacy and context dependence (Figure 2).

A review of attitudes shows that a person's cognitive, attitudes, behaviors and beliefs can be successful in the term of performing certain tasks (self-efficacy, Bandura 1997). Likewise, the learning context such as the availability of teaching materials and time allocation also play a role in the construction of attitudes towards science teaching.

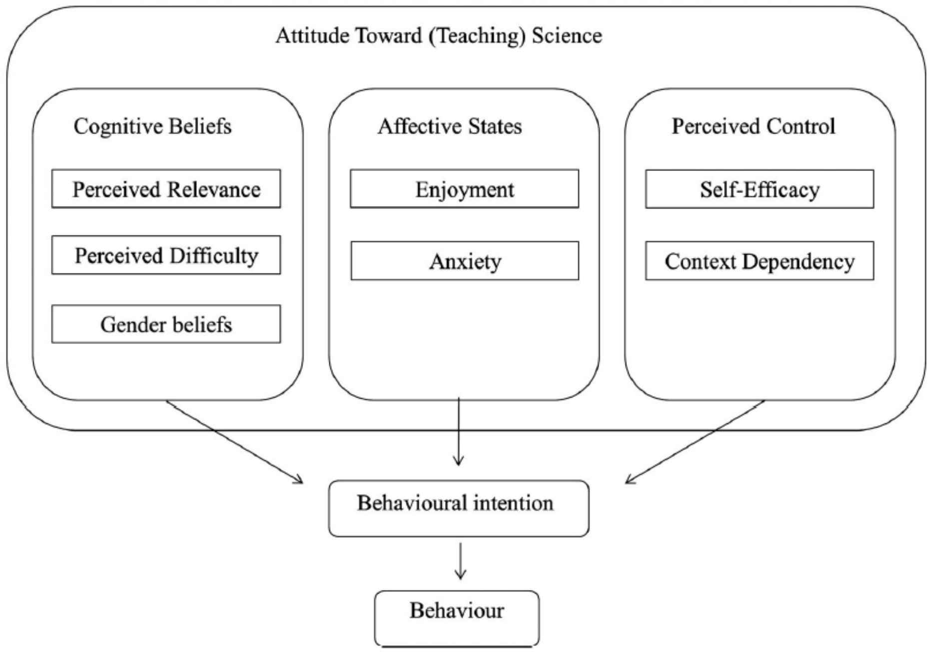

Figure 2 Attitudes towards science learning Aalderen-Smeets et al. (2012)

The concept of interest is used in various fields of educational research ranging from psychology, educational psychology, sociology, science and technology education Krapp and Prenzel (2011). The current study focuses on interest science, the focus is on understanding phenomena related to science and technology and making a few empirical contributions to the theory of interest in science.

The conceptual framework is applied to the interest tools to determine the main dimensions and indicators that will be used to develop data collection instrument that refers to Renninger and Hidi (2011)'s instrument. Such instrument is needed to emphasize the importance of the construction aspect and to measure interest and its indicators as the basis for its operations. The synthesis published by the authors Renninger and Hidi (2011) clearly shows that there is no stable and fully agreed theoretical orientation towards the concept of interest. However, mutual agreement can be found in regarding the central characteristics of the construct of interest Krapp and Prenzel (2011).

Three sets of characteristics can be found in various references and will be used as the basis for operationalizing the concepts in this study. The characteristics of interest include: a) attributes of the concept of interest; b) the dimensions that make up the construction of interest; and c) the analytical level used. Silvia (2001) describes theoretically how students' interest is formed as shown in Figure 3 Interest is formed on the basis of previous activities including the internalization of values, transformation processes, and other variables. These three main components form an emotional experience that builds interest and continues to develop according to experience.

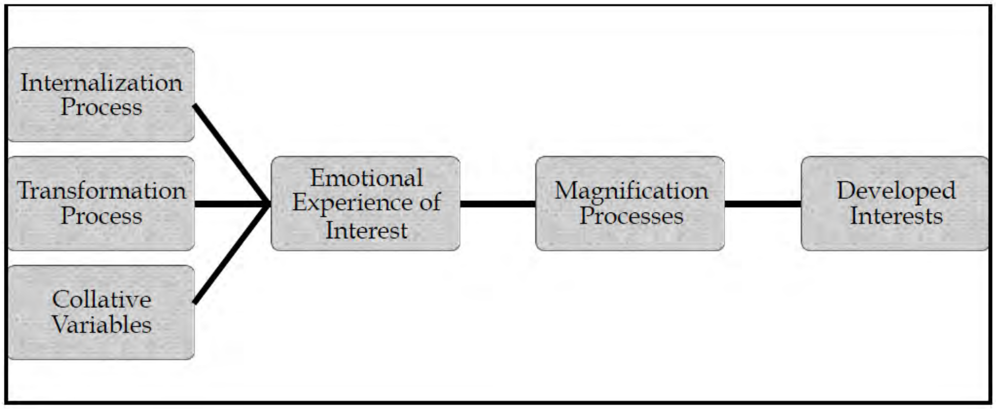

Figure 3 Construction theory of interest development Silvia (2001)

2.4. CHARACTERISTICS OF THE CONCEPT OF INTEREST

Based on Gardner (1996, in Krapp (2007)) and other authors (Hidi, Renninger & Krapp, 2004; Krapp (2007), Krapp and Prenzel (2011),Renninger and Hidi (2011) consider that the criteria determining the construct of interest with the concept of attitude and motivation lies in the specificity of its content. The concept of interest has a close relationship with attitude and motivation, but differs in the term of something specific only the interest part.

One cannot simply have an interest, one must be interested in something (Gardner, 1996, in Krapp (2007)). The construct of interest is conceptualized as a relational concept. Interest represents or describes a specific relationship that will last a long time between a person and an object in his or her life space (Krapp (2007)). Objects of interest in the field of science and technology can be in the form of subjects (biology, physics, chemistry, etc.), certain fields of study (study of energy conservation), operations or concrete objects (laboratory manipulation), and scientific research activities (formulating problems or questions). scientific research, or analyzing data) (Häussler, 1987; Häussler & Hofmann, 2000; Krapp (2007), Krapp and Prenzel (2011). When discussing science and technology as objects of interest, it is also important to distinguish the way science and technology is perceived in society (outside of school), science is taught and learned in the school context.

2.5. STUDY OF GENDER GROUP DIFFERENCES ON SCIENTIFIC INTEREST

The difference between the decline in interest in girls and boys is not well understood. For very young male students aged 4-7 years, empirical data revealed a significant decrease, but not a significant decrease for girls." Alexander et al. (2012). Another study reported that the gender factor did not decrease inters among Chinese students related to chemistry lessons Cheung (2007).

Francis and Greer (2001). Most of the articles dealing with this issue report very small or insignificant differences in the interest of boys and girls in science and technology. When general differences were reported for the primary school level, it was mostly favorable for boys with a few exceptions Potvin and Hasni (2014).

2.6. RESEARCH METHODOLOGY

The HOTS literacy learning mentoring program is implemented in collaboration between higher education institutions, 3 schools and from government agencies. Representatives from the University involved 9 lecturers from the Department of Science, Mathematics, Biology, Physics and Language Education. The number of students participating in this program are 18 students and 18 teachers as well as 120 junior high school students.

The mentoring program is carried out through joint planning in the form of workshops to provide learning tools, each candidate works together to produce training program materials including instructional design, teaching materials, assessment systems, learning media and components of science laboratory practicums.

The implementation stage is carried out based on the documents that have been produced previously. Students are guided to carry out HOTS literacy learning, carry out the process of scientific inquiry in the laboratory. Students intensively learn to know science more deeply, inspire thoughts, actions, and attitudes how scientists work. Based on observations, there were changes in students such as seriousness, integrity, and patterns of carrying out work based on science inquiry. The assessment system is developed at an early stage through pre-test, process assessment (rubric), and product assessment or posttest. The role of students' scientific interest is measured towards the end of the activity (Likert scale) and during the process for context interest by observation and interviews (personal and situational interest).

3. RESULT AND DISCUSSION

3.1. INSTRUMENT OF INTEREST SCIENCE

Instrument interest in science involves 20 questions with 5 components of interest (factors of teachers, friends, family, school, and environment). Instrument reliability was calculated using the Cronbach Alpha formula with an index of 0.70 in Table 1 and Table 2. The instrument was developed using a Likert scale (5 intervals). The reliability index of the scientific interest instrument of 0.70 meets a reliable instrument. The average of the scientific interest instrument items is 3.77 with a variance of 0.20.

Table 1 Instrument Reliability

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.70	.69	20

Table 2 Descriptive instrument of Interest Science

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.767	2.949	4.308	1.359	1.461	.200	20

Item Variances	.423	.167	.993	.826	5.935	.043	20

3.2. INTEREST RELATED TO THE FORMING FACTOR

The student interest factor in science learning after receiving the mentoring program can be described in Table 3. The average scientific interest score is 70.02 with a standard deviation of 4.72. The number of students who responded amounted to 39 students. The science interest component that is calculated based on family background has an average that is not much different from the school factor. The biggest student interest in science comes from the teacher factor, this is in accordance with the intrinsic motivation and aspirations of students after receiving treatment Narangodaa et al. (2021), Lavonen et al. (2021). The lowest factor in building students' interest in science comes from factors around students' lives.

Table 3 Descriptive Data of Interest

Component	Means	Std. Deviation	N
Interest	70.02	4.72	39
Family	14.58	1.09	39
Friends	11.4103	1.69702	39
Teacher	15.7436	1.84559	39
Around	7.7692	1.15762	39
School	14.0769	2.47498	39

Table 4 Correlation between Component of Interest

Pearson Corr	Interest	Family	Friends	Teacher	Around	School
Interest	1.00	0.29	0.43	0.67	0.67	0.65
Sig.(1-tailed)		0.03	0.00	0.00	0.00	0.00
N		39	39	39	39	39

The relationship between the student's scientific interest factor and the supporting components that make up the interest can be expressed by the correlation between the components as shown in Table 4. The student's family factor in building interest (r = 0.29, sig. 0.03 < 0.05) significantly supports students' interests. The teacher factor has the biggest role in building student interest as well as the learning environment provided by the school (r = 0.67, sig. 0.00 < 0.05). Factors from schools in building student interest have a very strong impact such as teacher factors and the learning environment (r = 0.65, sig. 0.00 < 0.05). the student community in student life plays an active role in supporting science interest with a fairly good correlation (r = 0.43, sig. 0.00 < 0.05). These four factors outside the family have a high correlation in shaping students' interest in science, with good family support, of course, students' interest in learning science will be higher.

Table 5 Anova[b] model of regression interest function

Model	Sum of Squares	Df	Mean Square	F	Sig.
1. Regression	829.08	5	165.82	305.77	0.00[a]
Residual	17.89	33	0.54		
Total	846.97	38			

a. Predictors: (constant), School (x1), Friends (x2), Family (x3), Teacher (x4), Around (x5)

b. Dependent Variable: Interest (y)

Table 6 Coefficients; dependent variable: interest

Model	Unstandardized Coefficients		Standardized coefficients	T	Sig
	B	Std error	Beta		
1 (Constant)	6.07	2.06		2.94	0.01
Family	1.02	0.114	0.23	8.98	0.00
Friends	1.03	0.07	0.37	14.50	0.00
Teacher	1.08	0.07	0.42	14.75	0.00
Around	0.91	0.12	0.22	7.43	0.00
School	0.93	0.05	0.49	18.08	0.00

Based on Table 5. and Table 6 can be built a mathematical model that describes the prediction through the regression equation (1). The equation has met the multiple linear regression model with a significance of 0.00 < 0.05 with all coefficients meeting a significance of 0.00 < 0.05 (Table 6).

$$y = 0.93x_1 + 1.03x_2 + 1.02x_3 + 1.08x_4 + 0.91x_5 + 6.07 \quad (1)$$

Based on Table 7 it can be concluded that the regression model equation (1) has a very high determination of 0.98. This shows that students' interest in science is strongly influenced by factors such as teachers, schools, friends, environment and family, which are very dominant in generating student interest in science lessons after completing the HOTS literacy mentoring program.

Table 7 Model summary of regression interest

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					
				R Square Change	F Change	df1	df2	Sig.F change	Durbin-Watson
.989[a]	.979	.976	.73641	.979	305.767	5	33	.000	2.051

a. Predictors: constant, school, friends, family, teacher, around

b. Dependent variable: interest

3.3. INTEREST RELATED TO CONTENT OF SCIENCE

From the Table 8, it can be seen that the regression has a sum of square of 295.32 and a df of 4 and the mean square has a value of 73.83 and an F value of 5.03 and a sig of 0.003 <0.05. For residuals, the sum of squares has a value of 499.35 and df has a value of 34 and the mean square has a value of 14.68. So, it has a total value of 794.66 and a df of 38. It can be concluded that it meets the linear regression model in equation (2).

Table 8 Anova[b] Interest Related to Content of Science

Model	Sum of Square	Df	Mean Square	F	Sig
Regression	295.32	4	73.83	5.03	0.003[a]
Residual	499.35	34	14.68		
Total	794.66	38			

a. Predictors: constant, Biology (x1), Interest (x4), Chemistry (x2), Physics (x3)

b. Dependent Variable: Science (y)

Table 9 Coefficients of predictor and dependent variable (science score)

Model			Standardized Coefficients	t	Sig
	B	Std.error	Beta		
Constant	29.557	14.206		2.081	.045
Interest	.037	.137	.038	.271	.788
Physics	.365	.224	.358	1.629	.113
Chemistry	.133	.185	.149	.721	.476
Biology	.146	.174	.161	.838	.408

$$\bar{y} = 0.15x_1 + 0.13x_2 + 0.36x_3 + 0.07x_4 + 29.55 \quad (2)$$

Based on Table 9, equation (2) can be generated. The formula provides predictions for the acquisition of science lesson scores ($\bar{y}$) based on the predictors variables: constant, Biology (x_1), Chemistry (x_2), Physics (x_3) and interest (x_4). The model is in accordance with Alhadabi's, the results highlighted science interest and science utility positively influencing science achievement through a sequential pathway of mediators, including science self-efficacy and science identity Alhadabi (2021). The coefficient is not significant in building a predictive equation model, it can be happened because student interest varies based on the difficulty of the subject matter faced.

4. CONCLUSIONS AND RECOMMENDATIONS

Students' interest in science can be built based on the factors of teachers, schools, students' environment, friends and family. Multiple regression equations can describe mathematically each component supporting interest with coefficients that meet the requirements of statistical testing at a significance level of 0.05.

The learning achievement score for science subjects can be described by a regression equation from the supporting factors, including physics, biology, chemistry and inters science student scores. The coefficient of the regression model does not meet the test requirements statistically, even though the regression model meets the test requirements. This can happen because the score of science subjects is dynamic following the rhythm of changes in the scores of the supporting lessons, and is strongly influenced by the level of difficulty of the subject matter of each sub-material studied by students.

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