Studies in Social Science Research
ISSN 2690-0793 (Print) ISSN 2690-0785 (Online)
Vol. 4, No. 2, 2023
www.scholink.org/ojs/index.php/sssr

Case Study

Factors Influencing Students' Participation in Scientific Research: Case Study at Pedagogical Universities in Vietnam

Cao Tien Khoa[1], Nguyen Quang Linh[1*], Nguyen Thi Bich[1] & Nguyen Van Quyet[1]

[1] Thai Nguyen University of Education, Vietnam

[*] Corresponding author, E-mail: linhnq@tnue.edu.vn

Abstract

Students' scientific research receives a lot of attention from universities and colleges. However, getting students to participate in research is not easy at all. As a result, the purpose of this research is to identify the factors that influence students' participation in scientific research. The study was conducted for students at pedagogical universities in Vietnam. The study employed a quantitative approach and a survey sample of 298 students. Cronbach's Alpha and Exploratory Factor Analysis (EFA) were used in the study to test and develop the scales. Furthermore, Multiple Linear Regression is used to determine the factors influencing students' participation in scientific research. According to the findings of the study, three groups of factors influencing students' participation in scientific research include internal factors, external factors, and student characteristics. The external factors have the greatest influence, while the internal factors have the least influence on students' participation in scientific research.

Keywords

Scientific research, students, pedagogy, influence, Vietnam

1. Introduction

Involving students in scientific research has actually become an important educational goal for universities, including pedagogical universities (Sadler & McKinney, 2010). It plays an important role for students (Ünver, Semers, Özkan, & Avcibasi, 2018; Salgueira, Costa, & Gonçalves, 2012). Scientific research teaches students how to think analytically, evaluate, comprehend, and solve problems correctly, scientifically, and creatively (Hang, Hanh, & Giang, 2010). The reason for this is that students have the opportunity to practice research skills such as designing research, collecting and analyzing data, drawing conclusions, and reporting results during the implementation of scientific research. The habit of effectively managing and organizing time is also gradually formed. Students can learn how to deepen and update their professional knowledge through scientific research. This activity teaches students how to write scientific documents and present reports in a clear, logical, and persuasive manner (Ruchina, Kuimova, & Polyushko, 2015). Students have the opportunity to approach lecturers and experts during

the research process and learn from their experiences. As apprentices, students can also participate in projects, research groups, and practical experiences. Students' scientific research activities also contribute to better scientist training. Students at pedagogical universities who have scientific research skills and later become teachers will teach their students how to conduct scientific research (Feldman, Divoll, & Rogan-Klyve, 2013). These are the abilities and experiences required for study, research, and later work (Tiganoaia, Gavrila, Mihai, Ionescu, & Niculescu, 2018).

Many universities in Vietnam pay attention to students' scientific research through national student scientific research competitions and seminars (Son & Mai, 2019). However, the percentage of students in Vietnamese universities who participate in scientific research is low. In fact, some students have outstanding research qualifications and achievements in scientific research, but the number of these students is small (Huong, 2016). Many students are capable of conducting scientific research but lack experience, in-depth knowledge, time, teacher and school orientation, and so on, or are unaware of the importance of scientific research (Ünver, Semers, Özkan, & Avcibasi, 2018), or lack motivation to conduct scientific research (Ha, Hoa, Khoa, & Cuong, 2022). Students' participation in scientific research at pedagogical universities in Vietnam is not an exception to this reality; policies to encourage students to participate in this meaningful activity are required.

Universities are responsible for encouraging and motivating students to participate in scientific research. The school must create a positive scientific learning and research environment by: (i) developing a scientific research training program, encouraging students to register for research projects and providing them with the necessary resources; and (ii) designing scholarship programs, scientific research awards, and providing resources and financial support; (iii) developing a specific plan to assist students in finding suitable instructors; (iv) organizing scientific research events and seminars to help students better understand the significance of this activity and motivate students to participate in research (Thang, 2016).

Thus, students' scientific research is a critical activity. Students' lack of interest in scientific research should be considered and learned in order to take measures to attract and encourage them. To do so, it is necessary to identify the factors that influence student participation in scientific research. Based on the issues raised above, this study considers and evaluates the impact of various factors on students' participation in scientific research at pedagogical universities in Vietnam. The study's findings will help to increase student participation in scientific research at these schools.

2. Literature Review

Students' scientific research is an important activity in a university's educational plan (Sadler & McKinney, 2010). Hands-on learning is an effective method for developing students' scientific research capacity (Ruslan I. Bazhenov, 2019; Davidson & Palermo, 2015; Sadler & McKinney, 2010). Participating in research activities as an apprentice increases motivation and interest in science, which benefits students' scientific research capacity (Wei & Woodin., 2011; Linn, Palmer, Baranger, Gerard, &

Stone, 2015). The organization of classes using an open access online research journal also increases students' exposure to scientific research (Sun, Graves, & David C. Oliver, 2020). Students can join research groups, which are both a community of practice and a community of knowledge, where they will be trained in research methods and thinking in order to become independent scientific researchers in the future (Feldman, Divoll, & Rogan-Klyve, 2013). Moreover, lecturers play an important role in assisting, orienting, and promoting students' scientific research capacity (Webber, Nelson Laird, & BrckaLorenz, 2013; Huong, 2016).

Students' decision to participate in scientific research is influenced by many factors. Academic achievement, in particular, is an important factor that influences students' decision to participate in scientific research (Quang, Trong, Kiet, & Xuan, 2018). In aSCition, student characteristics such as gender and personality govern this voluntary participation. When it comes to scientific research, the male gender has it easier than the female gender. Students who are open, extroverted, optimistic, and positive in their thinking will be more interested in participating in scientific research (Salgueira, Costa, & Gonçalves, 2012). Creating a hands-on learning program is an important factor in building student trust in scientific research (Davidson & Palermo, 2015). Students develop a positive attitude toward research as part of the learning process (Ruslan I. Bazhenov, 2019; Ünver, Semers, Özkan, & Avcibasi, 2018). When the results of student scientific research are transferred into technology, it serves as motivation for students to take on larger research projects (Quang, Trong, Kiet, & Xuan, 2018; Tu, 2017). Participating in training courses and mastering learning and research methods also helps pedagogical university students feel confident and motivated to engage in scientific research (Huong, 2016). To attract students to do scientific research, educational activities must focus on improving students' attitudes, knowledge, and skills (Huong, 2016). Furthermore, schools must foster a positive research practice environment in order to attract students to conduct research (Lee, et al., 2022; Thang, 2016). For example, conflicts between instructors and research students will have a negative impact on research effectiveness and students' willingness to participate in advanced research (Morales, Grineski, & Collins, 2021). Students' future career orientation and aspirations are also important factors in determining their participation in scientific research (Conner, Oxtoby, & Perin, 2021).

According to research, it can be said that the following factors influence students' participation in scientific research: career aspirations; confidence; wisdom; knowledge; skills; and research experience: career aspirations; confidence; wisdom; knowledge; skills and research experience (Muñoz-Leija, et al., 2021). Besides, factors influencing students' decision to participate in scientific research include: research ability and orientation of students; research environment; Faculty concern; and school encouragement (Son & Mai, 2019). Technical facilities, student management systems, and lecturers' roles all influence students' creativity and sense of participation in scientific research (Hang, Hanh, & Giang, 2010). Along with these factors, other factors influencing student motivation to participate in scientific research include students' awareness of scientific research (Duyen & Ton, 2022); internship environment, agency, and enterprises (Ha, Hoa, Khoa, & Cuong, 2022); scientific research policies and

scientific research benefits (Quang, Trong, Kiet, & Xuan, 2018). The student's ability, in particular, is identified as the most powerful factor influencing student motivation to participate in scientific research (Son & Mai, 2019; Hang, Hanh, & Giang, 2010; Duyen & Ton, 2022)

According to the authors' review of previous theories and studies, the following factors influence students' participation in scientific research: students' capacity and awareness; the research environment; the school's encouragement and attention; lecturers; and career aspirations. In this article, we look at three groups of factors that influence students' participation in scientific research at pedagogical universities in Vietnam: *internal factors* (students' capacity, scientific research motivation); *external factors* (policies and programs of the school such as funding, rewards, and so on; lecturers; scientific research clubs/groups at the school; scientific research support systems such as libraries, laboratories, and so on; family support and encouragement; training programs) *and student characteristics* (gender, academic ability, student age, major).

3. Material and Methods

3.1 Theoretical Basis

Theory of Planned Behavior (TPB)

The Theory of Planning Behaviour is a theory that demonstrates the relationship between a person's beliefs and behavior, in which beliefs are divided into three components: attitude, subjective norms, and perceived behavioral control (Figure 1).

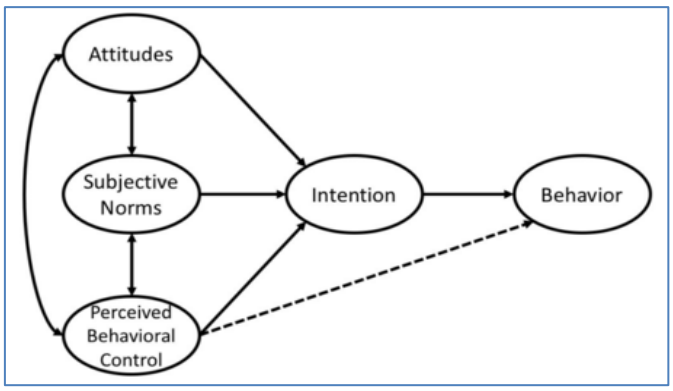

Figure 1. The Theory of Planning Behaviour (Ajzen, 1985)

This theory can predict and explain the behavior of researchers in a wide range of content and contexts. This theory overcomes the disadvantage of Theory of Reasoned Action (TRA) by including a perceptual behavior control factor, which allows for more accurate evaluation of behavior intent. TPB can explain why students are motivated to participate in scientific research. TPB assumes that the intention (motive) to perform a behavior can be predicted or explained. Intentions are defined as the amount of effort that people put into the behavior and are assumed to include the factors and motivations that influence the behavior (Ajzen, 1985).

TPB can be used to evaluate a student's scientific research capacity by examining the factors that influence the student's intention and attitude toward scientific research (Son & Mai, 2019). For example, surveys can be conducted to determine the benefits, risks, difficulties, and desires of students when participating in scientific research activities; people who have a positive or negative influence on students' decisions; and factors that increase or decrease students' confidence and scientific research capacity. For example, scientific research will provide students with opportunities to find good jobs and advance in their careers (Cargile & Bublitz, 1986), or policy regimes, funding for scientific research (Jacob & Lefgren, 2011), conditions and research environment (Chen, Gupta, & Hoshower, 2006) are all factors influencing students' participation in scientific research.

Self-Determination Theory of Deci and Ryan

According to Deci and Ryan's 1985 Self-Determination Theory, human motivations are classified as extrinsic motivation, intrinsic motivation and no motivation, with extrinsic motivation and intrinsic motivation being the most decisive (Ryan & Deci, 2000).

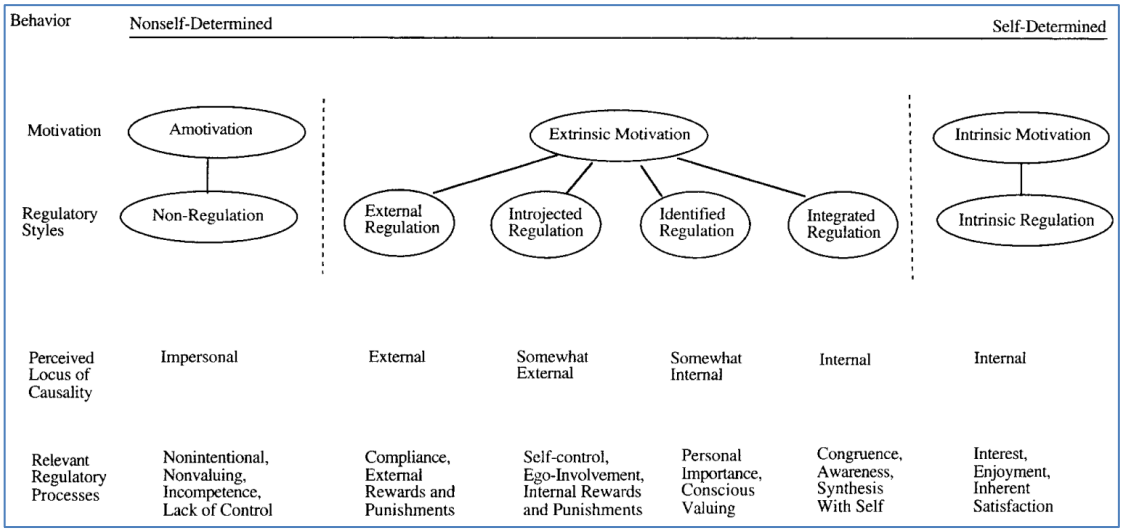

Figure 2. Self-Determination Theory (Ryan & Deci, 2000)

According to this theory, extrinsic motivation is the motivation that drives pupils to engage in activities that result in outcomes such as successes, awards, and so on. In contrast, intrinsic motivation is the motivation that drives students to engage in activities that they enjoy. Intrinsic and extrinsic motivation are not mutually exclusive, but they are reciprocal in the decision-making process for each activity.

3.2 Proposal Research Model

Figure 3 depicts the study's hypothetical model. Endogenous variables are factors that influence students' participation in scientific research. Three groups of factors determine students' participation in scientific research include internal factors, external factors and student characteristics.

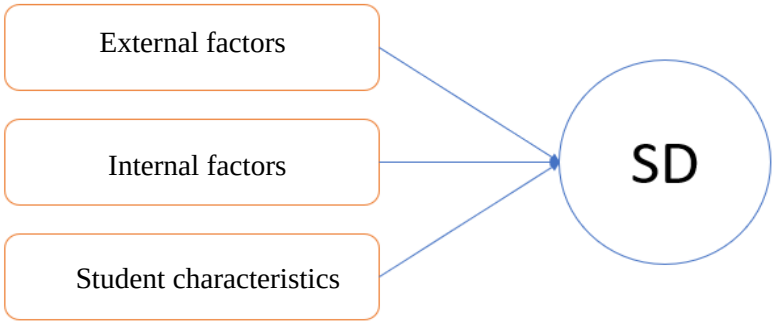

Figure 3. Research Model

SD is a dependent variable in this model that corresponds to the scientific research factors of students. It consists of (SD1) scientific research to increase one's self-capacity; (SD2) scientific research to improve learning outcomes; (SD3) scientific research to assert oneself; and (SD4) scientific research to have a good profile when applying for a job.

EF, IF, and SC are independent variables that influence students' participation in scientific research presented in Table 1.

Table 1. Factors that Influence Students' Participation in Scientific Research at Pedagogical Universities in Vietnam

Factor group	Code	Interpretation of attribute elements
Internal factors	IF1	Students' capacity
	IF2	Scientific research motivation
External factors	EF1	Regimes and policies of the school (policies, funding, rewards, etc.)
	EF2	Lecturers
	EF3	Research science clubs/groups at the school
	EF4	Scientific research support systems (libraries, laboratories, etc.)
	EF5	Family support and encouragement
	EF6	Training programs
Student characteristics	SC1	Gender
	SC2	Academic ability
	SC3	Student age
	SC4	Major

With the above research model, we have carried out exploratory research to test the hypothesis:

H1: Internal factors positively influence students' participation in scientific research.

H2: External factors positively influence students' participation in scientific research.

H3: Student characteristics positively influence students' participation in scientific research.

The test findings will be used to answer the following study questions: (1) What factors influence students' participation in scientific research at pedagogical universities in Vietnam? (2) How much influence do these factors have?

3.3 Research Methodology

In this study, the Exploratory Factor Analysis (EFA) method (Hair, 2011; Haig, 2005) is used to analyze the impact of factors influencing students' participation in scientific research at pedagogical universities in Vietnam. The study is carried out in the following steps: (1) The study investigates secondary data from the theoretical basis and studies connected to factors influencing students' participation in scientific research in order to develop a preliminary research scale. (2) To guarantee the accuracy of the scale contents, the authors interview ten students who have been studying at the school. The adjusted scale from the preliminary study is then made the official scale. (3) Normal research is carried out using quantitative research, which collects primary data through online surveys with questionnaires based on past research findings. The study examines the factors that influence students' participation in scientific research.

The study data from the survey was cleaned and analyzed using SPSS 22 software. The EFA is used to shorten the measured variables, and multiple regression analysis is then utilized to estimate the impact of factors influencing students' participation in scientific research.

The scale in this study is based on theoretical and qualitative research findings, and it has been adjusted to account for the factors influencing students' participation in scientific research. The observed variables were scored on a 5-point Likert scale, with 1 being strongly disagree and 5 being strongly agree. The study proposes 12 independent factors divided into 3 groups: Internal factors influencing students' participation in scientific research are measured by 5 observed variables; Internal factors influencing students' participation in scientific research are measured by 2 observed variables; The student characteristics are measured by 4 observed variables (Table 1).

4. Results and Discussion

4.1 The Research Sample

For Exploratory Factor Analysis (EFA), the sample size can be determined by the formula n = 50 + 8 * m (where m is the number of independent variables) (Tabachnick & Fidell, 2019). Thus, the minimum sample in this study was determined to be 50 + 8*12= 146 samples.

The research sample consists of students enrolled in pedagogical universities in Vietnam, with a total student population of around 150,000 students (General Statistics Office of Vietnam, The results of the survey on income information and socio-economic status of 53 ethnic minorities, 2020). Multistage and stratified sampling methods are used. The authors choose students from all 3 regions of Vietnam (North, Central, and South). The survey questionnaire was distributed to collaborators at the pedagogical universities. The study team communicates the essential survey information to the collaborators, who then transmit these contents to the students. This enables the study team to receive the most objective and

reliable research outcomes. Questions are sent to students online via the Google Form platform. The data was collected between February 13, 2023 and February 27, 2023. Survey respondents provided the team with 306 responses. We preserved 298 votes for analysis after cleaning the data to remove missing and inaccurate answers (Table 2).

Table 2. Respondents

Sample	Gender		Survey area			Student age		Academic ability	
	Male	Female	The North	The Central	The South	1st-2nd years	3rd-4th years	Fair - good	Below Fair
Quantity (Students)	102	196	142	76	80	150	148	136	162
Percentage (%)	34.2	65.8	47.7	25.5	26.8	50.3	49.7	45.6	54.4

Table 1 shows that, except from a significant disparity in the gender ratio of survey participants (the female gender ratio accounts for 65.8%), other characteristics are pretty appropriate. The large number of female students is also usual because this is one of the key characteristics in the choice of pedagogical profession in Vietnam, where women always account for the majority, accounting for an average of 86.1% in pedagogical universities (General Statistics Office of Vietnam, The results of the survey on income information and socio-economic status of 53 ethnic minorities, 2020). As a result, despite significant disparity in gender characteristics, the data oIFained ensures the study's objectivity.

4.2 Reliability of the Scale

The scale is put to the test using reliability analysis and exploratory factor analysis. Cronbach's Alpha confidence coefficient is used to examine the correlation between observed variables in the scale test. The observed variable will be excluded if its correlation with the overall variable is less than 0.3 (Hair, 2011). The Cronbach's Alpha analysis of external factors, internal factors, and student characteristics reveals that all scales meet the Cronbach's Alpha confidence coefficient requirements (Table 3). It demonstrates that the observed variables in the factors are consistent, that the factor scale is highly reliable and no observed variables are excluded from the scale.

Table 3. Cronbach's Alpha Analysis Results

No.	Factors	Observed variables	Cronbach's Alpha	Min-Max Corrected Item – Total Correlation
1	Internal factors	IF1, IF2	.714	0.653-0.766
2	External factors	EF1, EF2, EF3, EF4, EF5, EF6	.808	0.576-0.723
3	Student characteristics	SC1, SC2, SC3, SC4	.724	0.517-0.722
4	Participation in scientific research	SD1, SD2, SD3, SD4	.717	0.616-0.785

Cronbach's Alpha for all scales for IF, EF, and SC factors is more than 0.6, and Min-Max Corrected Item - Total Correlation is greater than 0.3, as shown in Table 2. As a result, the variables observed are very reliable, and no variables are excluded from the scale.

4.3 Relevance of Observed Variables and Factors in the Model

To determine the relevance of the observed variables and factors in the model, the study conducted KMO and Bartlett's Test (Table 4).

Table 4. KMO and Bartlett's Test

		EFA for Independent Variables	EFA for Dependent Variables
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.768	.753
Bartlett's Test of Sphericity	Approx. Chi-Square	824.290	210.747
	df	66	6
	Sig.	.000	.000
Eigenvalue		8.333	25.010
Total Variance Explained		73.029	77.904
Minimum factor loading		0.559	0.798

Table 4 shows that the parameters in the exploratory factor analysis (EFA) are all satisfactory with KMO of $0.5 < KMO < 1.0$, indicating that the exploratory factor analysis is appropriate for actual data. At the same time, Bartlett's Test has a significance of < 0.05, indicating that the observed variables are linearly correlated with the representative factor. Furthermore, the Eigenvalues are all greater than one, the data draws independent factors with a cumulative total variance of 73.029% and dependent factors with a cumulative total variance of 77.904% (satisfying the condition greater than 50%); the minimum multiplier load factor is 0.559, satisfying the minimum condition to retain all observed variables and no variables are excluded; and no variables are excluded.

Table 5. Table of Rotated Component Matrix

Observed variables	Components			
	EF	SC	IF	SD
EF6	.726			
EF5	.724			
EF4	.722			
EF3	.715			
EF2	.708			
EF1	.688			

SC4	.792		
SC1	.756		
SC2	.746		
SC3	.659		
IF2		.880	
IF1		.880	
SD1			.777
SD3			.745
SD4			.714
SD2			.705

At the conclusion of the EFA process, we identified the four factors—IF, EF, SC, and SD—that complemented the 16 best-observed variables the best (Table 5). Therefore, we proceeded to establish representative factors and ran Pearson correlation and linear regression analysis to change the measurement of observed variables to the measurement of factors to test the suggested hypotheses.

4.4 Correlation and Regression Analysis

We tested the independent and dependent variables' correlation using Pearson's formula. According to Table 6's results, all variables exhibited fairly close linear relationships (correlation coefficients r are all more than 0), and the findings were statistically significant (Sig. 0.05).

Table 6. Correlation Analysis Results

		EF	IF	SC	SD
EF	Pearson Correlation	1	.620	.645	.459
	Sig. (2-tailed)		.033	.039	.000
	N	298	298	298	298
IF	Pearson Correlation	.720	1	.073	.471
	Sig. (2-tailed)	.033		.002	.000
	N	298	298	298	298
SC	Pearson Correlation	.645	.573	1	.689
	Sig. (2-tailed)	.009	.002		.000
	N	298	298	298	298
SD	Pearson Correlation	.459	.471	.389	1
	Sig. (2-tailed)	.000	.000	.000	
	N	298	298	298	298

Table 7. Regression Results

Variables	SD			
	Std. Error	Standardized Beta coefficient	Sig.	VIF
(Constrant)	.195		.000	
IF	.031	.487	.000	1.002
EF	.027	.480	.001	1.000
SC	.031	.410	.000	1.002
Number of observations	298			
Adjusted R2	.609			
Sig. of the F test	.000			
Durbin-Watson value	1.947			

The theoretical model's four hypotheses were put to the test through analysis. The results of multivariable regression analysis are shown in Table 7. The Durbin-Watson value is 1.947 satisfying the condition in the range of 1.5-2.5, which indicates that the first-order sequence autocorrelation does not appear in the model; the significance test value of the regression coefficients Sig. 0.05 shows that the regression coefficient is significant and the regression model is appropriate with the oIFained data set. All independent variables' VIF coefficients are below 10 at the same time. As a result, the evidence does not contradict the multicollinearity premise. The hypotheses H1, H2, and H3 have all been accepted based on the positive values of the standardized regression coefficient Beta in Table 7, which demonstrates that the independent factors have a positive effect on the dependent variables. According to the standardized regression equation, the research model is reformulated as follows: SD = 0.487*IF + 0.480*EF + 0.410*SC + ε

Of which ε is the remainder. The equation's adjusted R2 value of 0.609 indicates that the independent variables IF, EF, and SC have a good explanation for 60.9% of the change in the dependent variable SD, and that the remaining 39.1% is a result of random errors and out-of-model variables.

The aforementioned regression equation also shows the strength of the influence that independent variables have on the dependent variable. In particular, the component having the greatest impact is IF (internal factors), and the factor with the least impact is SC, both of which have maximum Beta coefficients of 0.487 (student characteristics) (Beta coefficient equal to 0.410).

4.5 Discussion

Participating in scientific research activities teaches students how to think critically, collect and analyze data, assess, solve problems and draw conclusions. Students will gain logical thinking, creativity, and teamwork skills by participating in scientific research projects. Students gain new specialized knowledge and have numerous opportunities to interact with and learn from experts and scientists through scientific research activities. Students will be instructed in boldness, communication skills, and how to speak

effectively, scientifically, and convincingly when reporting research findings. Students' participation in scientific research activities allows them to be considered for future scholarships and research opportunities, and serves as the foundation for their future careers.

So the question is, how can students be encouraged to actively participate in scientific research? Or, what factors influence students' participation in scientific research? How influential are these factors? According to the research findings, there are three groups of factors influencing students' participation in scientific research at pedagogical universities in Vietnam: internal factors, external factors and student characteristics.

Internal factors (IF) include students' capacity and scientific research motivation. Students' capacity plays a very important role in their participation in scientific research activities (Hang, Hanh, & Giang, 2010; Tu, 2017; Ha, Hoa, Khoa, & Cuong, 2022; Son & Mai, 2019; Davidson & Palermo, 2015). Students with outstanding capacity will have a solid foundation of specialized knowledge as well as a thorough comprehension of issues in the field of research. This enables them to ask and construct appropriate study questions. Students' capacity is also demonstrated by their research skills, which include the ability to collect data, analyze it, and draw conclusions. Students with outstanding capacity will approach scientific research with a serious and demanding attitude. It is necessary for exchanging ideas and information with members of the research team, as well as presenting research findings, thinking and coming up with new ideas, and offering solutions to difficult problems.

Students' motivation has a significant impact on their participation in scientific research activities (Ha, Hoa, Khoa, & Cuong, 2022; Hang, Hanh, & Giang, 2010; Son & Mai, 2019; Ryan & Deci, 2000). Students' motivation manifests itself in a variety of ways, including: interest and passion; a drive for advancement; future responsibility; and a desire to discover and create. Interest and passion, in particular, are the most essential motivating factors for students. Students that are genuinely interested and passionate about their topic of study will be eager to explore new ideas, find creative solutions, and actively participate in research activities.

External factors include regimes, policies of the school (policies, funding, rewards, etc.); lecturers; scientific research clubs/groups at the school; scientific research support systems (libraries, laboratories, etc.); family support and encouragement, and training programs. Many studies have confirmed that regimes and policies (Feldman, Divoll, & Rogan-Klyve, 2013; Son & Mai, 2019), lecturers (Ha, Hoa, Khoa, & Cuong, 2022; Ünver, Semers, Özkan, & Avcibasi, 2018) and training programs (Tu, 2017; Quang, Trong, Kiet, & Xuan, 2018; Sadler & McKinney, 2010) have a positive effect on students' participation in scientific research. The remaining factors, on the other hand, are the new ones found from this study.

Students' participation in scientific research is influenced positively by research clubs and groups. Science research clubs and groups frequently focus on certain fields of science, allowing students to delve deeper into these areas. This can assist students in determining which fields of study they want to pursue further after graduation. Members of science research clubs are frequently required to participate

in research projects, which allows students to practice scientific research skills such as looking for information, analyzing data, and producing reports. Students can exchange knowledge, ideas, and experiences by engaging in science research clubs. This can help students feel supported and motivated as they study and conduct research. Students can broaden their knowledge and learn about the difficulties and opportunities in their field of science by participating in working sessions with experts in the field. Thus, establishing science research groups in schools will assist students gain confidence while also increasing their opportunity to participate in scientific research.

Universities (including pedagogical universities) must have a system in place to support students in scientific research, such as computer systems, libraries, laboratories, working rooms, laboratory equipment, research samples, software, and so on. Students can easily carry out their experiments and investigations with a full support system. At the same time, it assists students in saving time and effort, as well as reducing errors in the research process. As a result, scientific research support systems are critical factors in encouraging students to participate in scientific research.

Family support and encouragement can help students feel more motivated to participate in scientific research. This can assist students overcome obstacles during their studies and gain confidence in reaching their research objectives. Family support can assist students have more favorable settings for conducting research. This involves both finance (for research activities) and material conditions (providing students with the necessary equipment, tools, and space to conduct research). Students were able to avoid severe stress during the course of the study with the help of family support and encouragement. This can assist students in focusing and doing research more professionally, boosting the reliability and possibility of success of the study they conduct. Family support and encouragement can help students develop an interest in and comprehension of scientific research. This can make students feel more secure about participating in research, as well as generate excitement and a passion for the topic of research they are interested in. As can be observed, family support and encouragement for scientific research participation has a favorable impact on students' participation in scientific research.

Table 8. Interest in Scientific Research Based on Student Age

Student age	N	Mean	Std. Deviation	Std. Error Mean
1^{st} + 2^{nd} years	150	3.2200	.58871	.04807
3^{rd} + 4^{th} years	148	3.7939	.51402	.04225
Sig.	.025			

Student characteristics (SC) include gender; academic ability; number of years as a student; region. Among these factors, academic ability (Hang, Hanh, & Giang, 2010), gender (Morales, Grineski, & Collins, 2021; Conner, Oxtoby, & Perin, 2021) and region (Quang, Trong, Kiet, & Xuan, 2018; Son & Mai, 2019) are the ones that positively influence students' participation in scientific research, which have

been confirmed previously. However, the student age is the new factor found in this study. Table 8 reveals that there is a difference in interest in scientific research based on student age (sig. = 0.025 < 0.05) with third- and fourth-year students being more engaged than first- and second-year students (higher mean). First- and second-year students may not have a clear vision or career goals as third- and fourth-year students (in Vietnam, students at pedagogical universities frequently spend four years studying), making them less likely to understand the benefit of participating in scientific research. Meanwhile, students of a more mature age might determine their future goals and recognize the worth of participating in scientific research in order to reap more benefits later on. Young students may lack the initiative and desire required to participate in scientific research, whereas older students may have more experience and interest in conducting scientific research.

Table 9. Interest in Scientific Research of Male and Female Students

Gender	N	Mean	Std. Deviation	Std. Error Mean
Male	102	3.8113	.33980	.05345
Female	196	3.3048	.55975	.03998
Sig.	.018			

Table 9 shows the difference in interest in scientific research between male and female students (sig.=0.018 < 0.05). In aSCition, male students are more interested in scientific research than female students (higher mean). This is a difference from some previous studies. Numerous factors contribute to male students being more actively involved in scientific research than female students. However, this is a problem that necessitates a more thorough investigation. The origins of this disparity can be attributed to gender stereotypes. In the domains of science, engineering, and technology, concentration, endurance under extreme pressure, and rigidity in research procedures are necessary. This may discourage some female students from participating in scientific research. It could also be due to gender inequality. Despite numerous gains in gender equality in many industries in Vietnam, there are still gender inequalities in education and employment. As a result, female students may encounter greater challenges in participating in scientific research, as well as several gender barriers. Furthermore, male students are more likely than female students to pursue majors in science, engineering, and technology. Therefore, male students in these majors have more opportunity to participate in scientific research. However, these factors do not apply to all male and female students; students' participation in scientific research is determined by their particular interest, passion, talent, and ability. Thus, all students, particularly female students, should be encouraged and supported to participate in scientific research, so helping to minimize gender inequality in scientific research.

Table 10. Students' Interest in Scientific Research Based on Academic Ability

Academic ability	N	Mean	Std. Deviation	Std. Error Mean
Fair - good	136	3.7776	.40451	.03184
Average, weak, poor	162	3.6318	.50451	.03964
Sig.	.025			

Table 10 shows that there is a difference in terms of in scientific research between students with good academic abilities and the other students (sig. =0.025<0.05). ASCitionally, the findings reveal that students with good academic abilities are more interested in scientific research than the other students. This finding differs from some previous studies (Tiganoaia, Gavrila, Mihai, Ionescu, & Niculescu, 2018; Duyen & Ton, 2022). This is understandable because students with good academic abilities tend to have better study habits, work hard, and take responsibility for their academics. They are frequently self-taught and self-researching, which makes them interested in and participating in scientific research. typically have more defined and ambitious career aspirations. They fully recognize the importance of scientific research in their careers, therefore they will devote more time and effort to it. Students with good academic abilities frequently have a strong interest in science and technology concerns. They can think logically and appropriately assess problems, resulting in new and creative solutions. Scientific research is frequently regarded in academia and can be quite beneficial to students. Students that participate in this activity may receive recognition and reputation in their field of study. Moreover, students with good academic abilities often receive more attention and help from researchers and lecturers.

5. Recommendations

Based on the findings, the authors provided a number of recommendations to encourage student participation in scientific research at pedagogical universities in Vietnam, including:

First: It is vital to develop a favorable scientific research environment for students by analyzing, changing, and designing appropriate curriculum to boost students' scientific research expertise, as well as offering them more time to conduct scientific research. Establish scientific research clubs in the school and plan regular activities to assist students in participating in projects with school instructors. Increased investment in developing a system of libraries, software, accounts to access digital data warehouses, laboratories, and laboratory equipment is required to make scientific research more convenient for students.

Second: Lecturers must help students increase their capacity. Lecturers directly contribute to student capacity development by assigning research projects to individuals or groups of students, encouraging students to read documents and research works in famous scientific publications, and participating in

forums. Furthermore, the school should hold seminars to help students realize the benefits of participation in scientific research.

Third: Strengthen the school's interest and encouragement in student scientific research. Facilities and funding for scientific research are essential prerequisites for today's scientific research activities, which require the attention of school administrators. In aSCition to developing the aforementioned ideal scientific research environment, the school should enhance funds to support students doing scientific research based on the project's level of completion. Moreover, lecturers must advise students in conducting scientific research, raise concerns that need to be explored, and encourage students to study, explore, and actively assist students when they encounter obstacles.

6. Conclusion

According to the research findings (Muñoz-Leija, et al., 2021) presented above, there are three groups of factors that influence students' participation in scientific research, namely internal factors, external factors and student characteristics. In particular, the external factors have the most influence and the internal factors have the lowest influence on students' participation in scientific research at pedagogical universities in Vietnam. The research findings help to provide scientific foundations and valuable ideas for universities, particularly pedagogical universities, in the construction of curriculums, training modules, training programs, and so on, in order to boost scientific research among students. This assists pedagogical universities in improving student capacity, meeting the requirements of innovative curriculum and textbooks, and completing Vietnam's general education goals in the current period. The study still has some limitations, such as: (1) the study's time frame is limited; (2) despite the research team's efforts to help students respond to the survey and understand the significance of collecting this data (via collaborators, social networking groups such as facebook, zalo), some students responded without thinking through the questionnaire; and (3) The percentage of students who participate in the study varies by location, gender, and other factors, which more or less influences the statistical results.

In the future, the research team may expand its investigation into the factors that influence students' participation in scientific research at pedagogical universities. The study can investigate and clarify disparities in gender, student age, region, and so on. These will be complimentary studies that will inherit and develop study findings for this article.

Acknowledgements

This research was funded by the Vietnam Ministry of Education and Training under grant number B2021-TNA-10.

References

Ajzen, I. (1985). *From Intentions to Actions: A Theory of Planned Behavior*. Berlin, Heidelberg: SSSP Springer Series in Social Psychology. http://doi.org/10.1007/978-3-642-69746-3_2

Cargile, B. R., & Bublitz, B. (1986). Factors Contributing to Published Research by Accounting Faculties. *The Accounting Review*, *61*(1), 158-178. Retrieved from http://www.jstor.org/stable/247530

Chen, Y., Gupta, A., & Hoshower, L. (2006). Factors That Motivate Business Faculty to Conduct Research: An Expectancy Theory Analysis. *Journal of Education for Business*, *81*(4), 179-189. http://doi.org/10.3200/JOEB.81.4.179-189

Conner, L. D., Oxtoby, L. E., & Perin, S. M. (2021). Power and positionality shape identity work during a science research apprenticeship for girls. *International Journal of Science Education*, *43*(11), 1880-1893. http://doi.org/10.1080/09500693.2021.1940348

Davidson, Z. E., & Palermo, C. (2015). Developing Research Competence in Undergraduate Students through Hands on Learning. *Journal of Biomedical Education*, 1-9. http://doi.org/10.1155/2015/306380

Duyen, N. T., & Ton, N. M. (2022). Exploring factors affecting the motivation of nong lam university's students to participate into scientific researches. *Technology and trade magazine*, *21*(1), 1-6. Retrieved from https://bom.so/3khm7H [Các yếu tố ảnh hưởng đến động cơ tham gia nghiên cứu khoa học của sinh viên trường đại học Nông Lâm]

Feldman, A., Divoll, K., & Rogan-Klyve, A. (2013). Becoming Researchers: The Participation of Undergraduate and Graduate Students in Scientific Research Groups. *Science Education*, *97*(1), 218-243. http://doi.org/10.1002/sce.21051

General Statistics Office of Vietnam. (2020, 3 30). *The results of the survey on income information and socio-economic status of 53 ethnic minorities*. Hanoi: Statistical Publishing House. Retrieved from https://bom.so/Fgac50 [Kết quả điều tra thông tin thu nhập và hiện trạng kinh tế - xã hội của 53 dân tộc thiểu số]

Ha, N. M., Hoa, N. T., Khoa, B. T., & Cuong, D. B. (2022). Scientific research motivation: Perspectives of graduate students in Ho Chi Minh City. *Journal of Science - Ho Chi Minh City Open University*, *17*(3), 5-14. http://doi.org/10.46223/HCMCOUJS.proc.vi.17.3.2566.2022 [Động cơ nghiên cứu khoa học: Góc nhìn của nghiên cứu sinh tại thành phố Hồ Chí Minh]

Haig, B. D. (2005). Exploratory Factor Analysis, Theory Generation, and Scientific Method. *Multivariate Behavioral Research*, *40*(3), 303-329. http://doi.org/10.1207/s15327906mbr4003_2

Hair, J. (2011). Multivariate Data Analysis: An Overview. (M. Lovric, Ed.) *International Encyclopedia of Statistical Science*. http://doi.org/10.1007/978-3-642-04898-2_395

Hang, V. V., Hanh, T. T., & Giang, L. T. (2010). Encouragement for students to participate in scientific research to enhance active capacity and creativity. *Journal of Science - Ho Chi Minh City Open University*, *5*(2), 64-72. Retrieved from https://bom.so/Tsa [Khuyến khích sinh viên tham gia nghiên cứu khoa học nhằm nâng cao năng lực chủ động, sáng tạo]

Huong, N. T. (2016). Current status and solutions to practice scientific research skills for university students. *Quang Binh Journal of Science and Technology*, *3*(1), 48-51. Retrieved from

https://g2.by/8g7p [Thực trạng và giải pháp rèn luyện kỹ năng nghiên cứu khoa học cho sinh viên đại học]

Jacob, B. A., & Lefgren, L. (2011). *The impact of research grant funding on scientific productivity* (Vol. 95). (J. o. Economics, Ed.) Elsevier. http://doi.org/10.1016/j.jpubeco.2011.05.005

Lee, J. S., Mohindroo, M., Waithaka, E., Carlson, E., Ahouissoussi, J., Alhassani, S., . . . Ihara, E. S. (2022). Teaching Note—Student Satisfaction With an Integrative Research Learning Environment. *Journal of Social Work Education*, 1-8. http://doi.org/10.1080/10437797.2021.2019642

Linn, M. c., Palmer, E., Baranger, A., Gerard, E., & Stone, E. (2015). Undergraduate research experiences: Impacts and opportunities. *Science AAAS*, *347*(6222), 50-62. http://doi.org/10.1126/science.1261757

Morales, D. X., Grineski, S. E., & Collins, T. W. (2021). Effects of mentor-mentee discordance on Latinx undergraduates' intent to pursue graduate school and research productivity. *Annals of the New York Academy of Sciences*, *13*(2), 54-69. http://doi.org/10.1111/nyas.14602

Muñoz-Leija, M. A., Barrera, F. J., Zárate-Garza, P. P., Quiroga-Garza, A., Martínez-Garza, J. H., Fuente-Villarreal, D., . . . Elizondo-Omaña, R. E. (2021). Factors Influencing Scientific Achievements of Medical Students in the Anatomy Research Group: An Analysis From the Autonomous University of Nuevo León in Mexico. *Anatomical Sciences Education*, *15*(2), 369-375. http://doi.org/10.1002/ase.2065

Quang, P. V., Trong, L. V., Kiet, H. V., & Xuan, H. T. (2018). Factors affact students' motivation in scientific research. *Journal of Transportation Science and Technology*, *30*(1), 88-96. Retrieved from https://vjol.info.vn/index.php/ut/article/view/45090 [Các yếu tố ảnh hưởng đến động cơ nghiên cứu khoa học của sinh viên]

Ruchina, A. V., Kuimova, M. V., & Polyushko, D. A. (2015). The role of research work in the training of master students studying at technical university. *Procedia - Social and Behavioral Sciences*, *215*(1), 98-101. http://doi.org/10.1016/j.sbspro.2015.11.580

Ruslan I. Bazhenov. (2019). Arranging Student Scientific Research as an Educational Technology: The Experience of Regional Universities of Russia. *Education Research International*, 1-7. http://doi.org/10.1155/2019/8358954

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68-78. https://doi.org/10.1037/0003-066X.55.1.68

Sadler, T. D., & McKinney, L. (2010). Scientific Research for Undergraduate Students: A Review of the Literature. *Journal of College Science Teaching*, *39*(5), 43-49. Retrieved from https://bom.so/MxVWy0

Salgueira, A., Costa, P., & Gonçalves, M. (2012). Individual characteristics and student's engagement in scientific research: a cross-sectional study. *BMC medical education*, *95*(12), 1-9. http://doi.org/10.1186/1472-6920-12-95

Son, H. D., & Mai, N. T. (2019). Determinants of students' sciencetific research participation - A case study in university of finance - marketing. *Research Journal Financial - Maketing*, *49*, 13-24. Retrieved from https://bom.so/bbPs0S [Các yếu tố quyết định việc tham gia nghiên cứu khoa học của sinh viên - Nghiên cứu trường hợp tại trường đại học Tài chính - Marketing]

Sun, E., Graves, M. L., & David C. Oliver. (2020). Propelling a Course-Based Undergraduate Research Experience Using an Open-Access Online Undergraduate Research Journal. *Frontiers in Microbiology*, 1-11. http://doi.org/10.3389/fmicb.2020.589025

Tabachnick, B. G., & Fidell, L. S. (2019). *Cleaning up your act. Using Multivariate Statistics. 4th ed. Needham Heights, MA: Allyn and Bacon*. Boston: Pearson. Retrieved from https://bom.so/QHTHD3

Thang, N. C. (2016). Fostering the scientific research capacity for students in mathematics pedagogy major. *Journal of Educational Sciences*, *133*(10), 23-27. Retrieved from https://bom.so/U8nTag [Bồi dưỡng năng lực nghiên cứu khoa học cho sinh viên ngành sư phạm toán]

Tiganoaia, B., Gavrila, L., Mihai, P., Ionescu, S., & Niculescu, A. (2018). Students Scientific Research Capacity In The Technical Universities From Romania - Case Study On The Personalization Of It Products. *In 7th icCSBs 2018 The Annual International Conference on Cognitive-Social, and Behavioural Sciences*, *56*, 287-296. European Proceedings of Social and Behavioural Sciences. http://doi.org/10.15405/epsbs.2019.02.02.32

Tu, N. A. (2017). Enhancement of scientific research capacity and technology transfer in higher education and vocational education institutions. *Vietnam Journal of Science and Technology*, *8*(1), 53-56. Retrieved from https://vjol.info.vn/index.php/khcn/article/view/3693 [Nâng cao năng lực nghiên cứu khoa học và chuyển giao công nghệ trong các cơ sở giáo dục đại học và giáo dục nghề nghiệp]

Ünver, S., Semers, R., Özkan, Z. K., & Avcibasi, İ. (2018). Attitude of Nursing Students Toward Scientific Research: A Cross-Sectional Study in Turkey. *Journal of Nursing Research*, *26*(5), 356-361. http://doi.org/10.1097/JNR.0000000

Webber, K., Nelson Laird, T., & BrckaLorenz, A. (2013). Student and Faculty Member Engagement in Undergraduate Research. *Res High Educ*, *54*, 227-249. http://doi.org/10.1007/s11162-012-9280-5

Wei, C. A., & Woodin., T. (2011). Undergraduate Research Experiences in Biology: Alternatives to the Apprenticeship Model. *CBE—Life Sciences Education*, *10*(2), 123-131. http://doi.org/10.1187/cbe.11-03-00282