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A Study of Influences of the Research Ethic Affecting the Attitudes towards STEM Education

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บทคัดย่อ

การวิจัยครั้งนี้ มีวัตถุประสงค์เพื่อ 1) ศึกษาความสัมพันธ์ของจริยธรรมในกระบวนการวิจัยกับเจตคติทางสะเต็มศึกษา และ 2) สร้างสมการพยากรณ์เจตคติทางสะเต็มศึกษาของนิสิตปริญญาตรี วิทยาลัยการศึกษา มหาวิทยาลัยพะเยา กลุ่มตัวอย่างเป็นนิสิตปริญญาตรี ชั้นปีที่ 2 ปีการศึกษา 2562 จำนวนทั้งสิ้น 83 คน ได้มาโดยวิธีการเลือกแบบเจาะจงเครื่องมือที่ใช้ในการวิจัย ได้แก่ แบบวัดจริยธรรมในกระบวนการวิจัยและแบบวัดเจตคติทางสะเต็มศึกษา ที่ผ่านการตรวจสอบความตรงเชิงเนื้อหาโดยผู้ทรงคุณวุฒิจำนวน 5 ท่าน มีค่าความเที่ยงเท่ากับ 0.80 สถิติที่ใช้ในการวิเคราะห์ข้อมูล คือ ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน สัมประสิทธิ์สหสัมพันธ์เพียร์สัน และการวิเคราะห์ถดถอยพหุคูณ ผลการวิจัยพบว่า

1. ความสัมพันธ์ระหว่างตัวแปรจริยธรรมในกระบวนการวิจัยกับเจตคติทางสะเต็มศึกษา พบว่า ไม่มีความสัมพันธ์กัน เมื่อพิจารณาขนาดความสัมพันธ์ของตัวแปรทั้งหมดต่อเจตคติทางสะเต็มศึกษา ถือได้ว่าสัมพันธ์กันน้อย (r<.40) โดยตัวแปรที่สัมพันธ์ในทิศทางเดียวกัน ได้แก่ 1) การตั้งคำถามวิจัย (RE1) 2) การออกแบบการวิจัย (RE3) 3) การวิเคราะห์ข้อมูลในการวิจัย (RE5) และ 4) การนำเสนอผลการวิจัย (RE7) ส่วนตัวแปรที่สัมพันธ์ในทิศทางตรงกันข้าม ได้แก่ 1) การสืบค้นข้อมูลและสารสนเทศในการวิจัย (RE2) 2) การเก็บรวบรวมข้อมูลในการวิจัย (RE4) และ 3) การสรุปผลการวิจัย (RE6)

2. ผลการวิเคราะห์สัมประสิทธิ์การถดถอยพหุคูณแบบขั้นตอนเพื่อพยากรณ์เจตคติทางสะเต็มศึกษา พบว่า ค่าน้ำหนักความสำคัญของตัวแปรพยากรณ์ จริยธรรมในกระบวนการวิจัยที่มีผลต่อเจตคติทางสะเต็มศึกษา อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 มี 2 ตัวแปร คือ การสืบค้นข้อมูลและสารสนเทศในการวิจัย (RE2) และ การเก็บรวบรวมข้อมูลในการวิจัย (RE4) โดยมีค่าสัมประสิทธิ์การถดถอยพหุคูณ เท่ากับ 0.334 และสามารถพยากรณ์เจตคติทางสะเต็มศึกษาร้อยละ 11.2

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สมการพยากรณ์เจตคติทางสะเต็มศึกษาในรูปแบบคะแนนดิบ คือ

$$ATTEN = 6.211_{Constant} - 3.229_{RE4} - 0.953_{RE2}$$

สมการพยากรณ์เจตคติทางสะเต็มศึกษาในรูปแบบคะแนนมาตรฐาน คือ

$$Z_{ATTEN} = -0.369_{RE4} - 0.292_{RE2}$$

คำสำคัญ: จริยธรรมในกระบวนการวิจัย, เจตคติต่อสะเต็มศึกษา, การวิจัย

Abstract

The objectives of this study were to 1) examine the relationship between the research ethic and the attitudes towards STEM and 2) develop the equation of the attitudes towards STEM of undergraduate students of School of Education, University of Phayao. The samples consisted of 83 second-year students taught with STEM approach during semester the second of academic year 2019. They were selected by using purposive sampling. The customized research instrument was the research ethic affecting the attitudes towards STEM test having content validity rated by the experts at 0.80. The data were analyzed by using descriptive statistics including mean, standard deviation, Pearson correlation coefficient and multiple regression analysis. The results showed that;

1. The relationship of variables between research ethic and attitudes towards STEM found no relationship when analyzing relationships among all variables affected attitudes towards STEM. It was revealed that r score was lower than .40 (r<.40) as a small relationship. Obviously, Research Questions (RE1), Research Design (RE3), Data Analysis (RE5) and Research Presentation (RE7) were at a statistically significant level in the same direction. On the contrary, Information Retrieval (RE2), Data Collection (RE4) and Conclusion (RE6) were in the opposite direction.

2. The findings of multiple regression analysis using stepwise regression to predict the attitudes towards STEM represented the correlation of the predictor variables of the research ethic and the attitudes towards STEM was statistically significant at 0.05 containing two variables, Information Retrieval (RE2) and Data Collection (RE4). They had the multiple correlation coefficient at 0.334 and could predict the attitudes towards STEM at 11.2%.

The prediction equation in raw score was

$$ATTEN = 6.211_{Constant} - 3.229_{RE4} - 0.953_{RE2}$$

The prediction equation result of the attitudes towards STEM in standard score was

$$Z_{ATTEN} = -0.369_{RE4} - 0.292_{RE2}.$$

Keywords: Research ethic, Attitudes towards STEM Education, Research

Introduction

The learning management for students in the 21st century should enhance them to have an essential learning skills consisting of knowledge or hard skills (Reading, Writing and Arithmetics) and soft skills (Critical thinking and problem solving, Creativity and innovation, Cross-cultural understanding, Collaboration teamwork and leadership, Communications information and media literacy, Computing and ICT literacy and Career learning skills) and competencies which specify our students to carry out in the modern world. (Wongnapa and Nuntarat, 2018) It is vital that the teachers develop the students to gain these learning skills using an effective teaching method. Research based learning is one of the teaching methods that tend the students to learn by doing based on the research procedure emphasizing on the systematical inquiry to figure out the constructed answers through the results of the research in any subject matters. (Paitoon, 2014) Moreover using STEM Education is quite good since it is an interdisciplinary and applied approach in four specific subjects composing of science, technology, engineering and mathematics. It can let students not only comprehend the subject contents but also realize the cohesive learning paradigm focusing on both real- world applications and real-life situations by applying STEM Education in class. (Srikoon et al, 2020) It supports students to do some activities along with developing their thinking skills using questioning, problem solving, information retrieving and new data analyzing leading to integrated utilization for their daily lives. (Vasquez et al, 2013)

Apart from this appropriate teaching approach, the students' attitudes influenced the students' achievement. There were various studies confirmed that the positive attitudes towards work had strong positive relation with task performance and task satisfaction. The positive attitudes for the work and affiliation with the organization increased students' satisfaction and performance. Besides it was noted that negative attitudes obstructed the achievements in learning and in research activities resulting in students' low performance. (Ahmed et al, 2010) Relating to the findings of Wongnapa and Nuntarat (2018) revealed that the students who were taught by using STEM Education approach had a higher achievement and positive attitudes and could apply learning and working skills in their lives usefully and effectively. Hence, the attitudes towards research play an important role in the whole processes of research.

The scientific method or research is the process of seeking for novel knowledge and reliable truth which uses the systematical means including questioning, investigating the assumptions, collecting and analyzing the data and concluding. (Uthen and Sudawadee, 2016) Furthermore the ethic is the principles either in belief and value or laws that have been determined whether it was correct. (The Office of the Civil Service Commission, 2018) Therefore, it is imperative that using research ethic be in the research procedure. However, there were plenty of theories of the research procedure according to the educators. In this study, the researchers decided to use the research procedures consisting of seven aspects: 1) the Research Questions, 2) the Information Retrieval, 3) the Research Design, 4) the Data Collection, 5) the Data Analysis, 6) the Conclusion and 7) the Research Presentation (Srikoon et al, 2016) linked to the current learning management concentrating on developing students to be and adapt in the 21st century. Consequently, the researchers would like to study the variables affecting the students' attitudes towards STEM Education based on the seven variables mentioned above. These seven variables will be used in the conceptual framework to examine the influence of research ethic affecting the attitudes towards STEM Education of the second-year students, school of Education, the University of Phayao during the second semester of academic year 2019.

Significant of the Study

The results of this study can be the handy information which will be used and adjusted in teaching focusing on the research procedure of the undergraduate students. The findings are able to lead the students realize how important research ethic is and what the effective attitudes towards STEM Education are.

Objectives of the Research

The objectives of this study were 1) to examine the relationship between the research ethic and the attitudes towards STEM Education and 2) to develop the equation of the attitudes towards STEM Education of undergraduate students of the School of Education, the University of Phayao during the second semester of academic year 2019.

Conceptual Framework

The research ethic is a crucial doctrine that every researcher should have and follow in each step in the research processes. Nonetheless there have been several concepts of the research ethic based on each of the experts or educators. This study has adapted the research procedures of Srikoon et al. (2016) having seven aspects containing 1) the Research Questions (RE1), 2) the Information Retrieval (RE2), 3) the Research Design (RE3), 4) the Data Collection (RE4), 5) the Data Analysis (RE5), 6) the Conclusion (RE6), and 7) the Research Presentation (RE 7). These procedures were set as a conceptual content in learning with STEM Education approach. Also, these research procedures were defined as a conceptual framework so as to study the influence of the research ethic affecting attitudes towards STEM Education. In addition, it was the analyzed data used to prepare our students to overcome learning skills in the 21st century. The conceptual framework was illustrated in Figure 1.

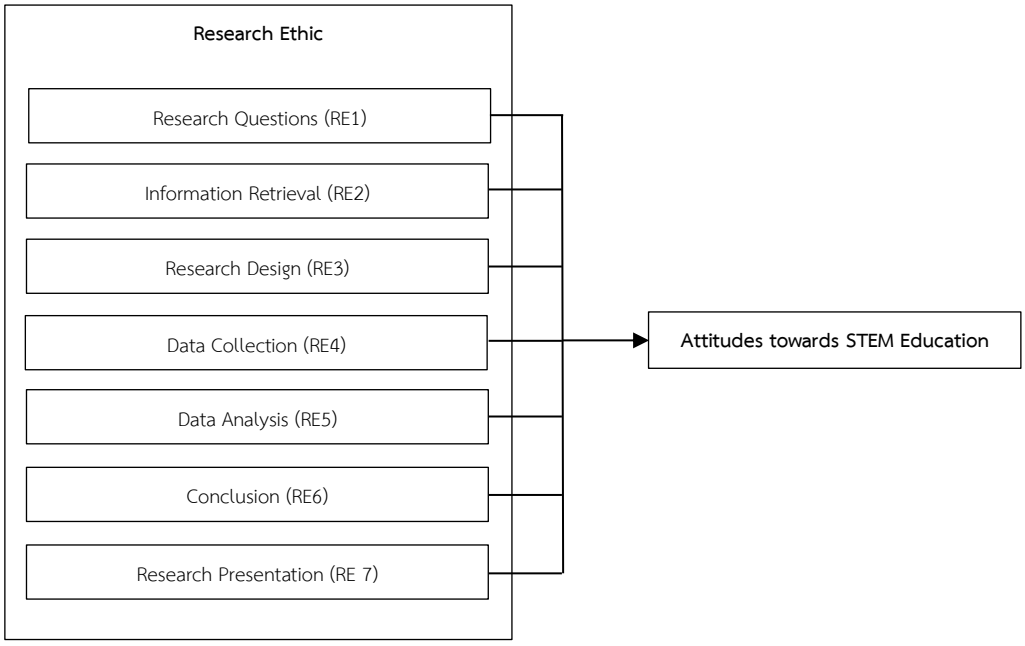

Figure 1 The conceptual framework

Research Methodology

This study was the survey research having the qualified method including the sample group, the research instrument and the data analysis as follows.

Sample group

The sample of 83 undergraduate students who were the second-year students of the School of Education, the University of Phayao. These participants were a highly homogenous group since all participants were taught by using STEM Education approach during 25th November 2019 to 10th January 2020.

Research instrument

The research ethic affecting the attitudes towards STEM Education test was used in this study. It was a checklist test with seven variables composing of 1) the Research Questions (RE1), 2) the Information Retrieval (RE2), 3) the Research Design (RE3), 4) the Data Collection (RE4), 5) the Data Analysis (RE5), 6) the Conclusion (RE6) and 7) the Research Presentation (RE 7) adapted from Srikoon et al. (2016). There were 10 questions each variable along with a content validity rated by the experts at 0.80 indicating higher than the acceptable level of 0.50.

Data Analysis

After the data had been collected, they were analyzed by using descriptive statistics including mean, standard deviation, Pearson's correlation coefficient and multiple regression analysis.

Results

The findings of this study were divided into two parts based on the objective of this research as follows.

1. The result of a study of the relationship between the research ethic and the attitudes towards STEM Education.

The finding revealed that there was no relationship when analyzing the relationships among all variables that affected the attitudes towards STEM Education. It was noted that the r score was lower than .40 ($r<.40$) which was a small relationship. Apparently, there were four variables which were the Research Questions (RE1), the Research Design (RE3), the Data Analysis (RE5) and the Research Presentation (RE7) became at a statistically significant level in the same direction. While the rest of variables which were the Information Retrieval (RE2), the Data

Collection (RE4) and the Conclusion (RE6) remained at the statistically significant level in the opposite direction. The result was presented in Table 1 below.

Table 1 Mean, Standard deviations (S.D.), and correlation between the variables (N=83)

Variables	ATTEN	RE1	RE2	RE3	RE4	RE5	RE6	RE7
ATTEN	1							
RE1	0.064	1						
RE2	-0.133	-0.044	1					
RE3	0.073	-0.074	0.122	1				
RE4	-0.086	0.630**	-0.041	0.090	1			
RE5	0.032	0.196	0.323**	0.348**	0.204	1		
RE6	-0.001	-0.025	-0.039	0.237*	-0.023	0.355**	1	
RE7	0.076	-0.047	0.379**	0.539**	0.260*	0.119	-0.042	1
Mean	4.430	0.980	0.964	0.928	0.992	0.831	0.988	0.976
S.D.	0.451	0.120	0.138	0.165	0.051	0.257	0.081	0.087

Note: *p<0.05, **p<0.01

2. The result of the influences of the research ethic and the attitudes towards STEM Education.

The result of model summary analysis between the research ethic and the attitudes towards STEM Education showed that the variables regrading to research ethic did not have the multiple correlation with the attitudes towards STEM Education. It was related to the variables in research ethic which could predict the attitudes towards STEM Education at the less level (11.2%) showed in Table 2.

Table 2 The result of the correlation coefficient analysis in the variables of research ethic affecting the attitudes towards STEM Education.

Variation	SS	df	MS	F	Sig.
Regression	1.859	7	0.266	1.346	0.241*
Residual	14.796	75	0.197		
Total	16.655	82			
R= .334, R^2 = 0.112					

Note: *p<0.05

The findings of multiple regression analysis using stepwise regression to predict the attitudes towards STEM Education showing in Table 3 found that the coefficient of the predictor variables of the research ethic and the attitudes towards STEM Education was statistically significant at 0.05. composing of two variables consisting of the Information Retrieval (RE2) and the Data Collection (RE4) which had the multiple correlation coefficient at 0.334 and they could predict the attitudes towards STEM Education at 11.2%.

The prediction equation of the attitudes towards STEM Education in raw score.

$$ATTEN = 6.211_{Constant} - 3.229_{RE4} - 0.953_{RE2}$$

The prediction equation result of the attitudes towards STEM Education in standard score.

$$Z_{ATTEN} = -0.369_{RE4} - 0.292_{RE2}$$

Table 3 The correlation of the predictor variables of the research ethic and the attitudes towards STEM Education.

Predictor Variables	B	SE	Beta	t	Sig
Constant	6.211	1.309		4.746*	0.000
Research Questions (RE1)	0.992	0.553	0.265	1.795	0.077
Information Retrieval (RE2)	-0.953	0.434	-0.292	-2.196*	0.031
Research Design (RE3)	-0.099	0.399	-0.036	-0.249	0.804
Data Collection (RE4)	-3.229	1.368	-0.369	-2.361*	0.021
Data Analysis (RE5)	0.250	0.244	0.143	1.027	0.308
Conclusion (RE6)	-0.245	0.670	-0.044	-0.366	0.716
Research Presentation (RE7)	1.532	0.817	0.295	1.876	0.065
R= 0.334, R^2 = 0.112, F = 1.346, n= 83, *p< 0.05					

Note: *p<0.05

Discussion

The study of the influences of the research ethnic affecting the attitudes towards STEM Education represented that the best variables working on the attitudes towards STEM Education had two aspects which were the data collection and the information retrieval. Both variables could help predict the attitudes towards STEM Education at 11.2%. What's more, these two

variables including the data collection and the information retrieval were not related with the attitudes towards STEM Education concerning on a small relationship.

Research is crucial in STEM Education which was reflected by increasing attention given to research instruction. (Vossen et al, 2018) It was demonstrated that it had better enhance the students' learning focusing on the research procedures which were a discipline focusing on acquiring and developing knowledge that could be employed in categorizing, describing, explaining, evaluating, correlating, comparing, predicting and controlling situations, phenomena and other observations. (Walliman, 2011) Consequently, the positive conceptions of research among students may be a good start for future research directions. It was vital that the students be gained the positively higher attitudes towards STEM Education. What's more, the positive attitudes also boost resiliency among students until they accomplish the tasks assigned to them. (Habineza, 2018) The teachers or lecturers ought to guide and coach the students to comprehend in the research procedure accurately as the students who had been given research tasks before were generally considered to be more prepared for the future work. (Garg et al, 2018)

According to the result of this study, the undergraduate students perceived the research procedure as a new way of learning that they described as active and challenging. This enhanced students to know how to search and retrieve the information correctly. Also, they were able to collect the data meaningfully and truly. Besides, they could design and develop the validity instruments as well. (Tisana et al, 2015) Relating to Marchaim (2001) who confirmed that doing research allowed students to engage in a systematic way of addressing issues or concerns by gathering information, discriminating findings deemed relevant to the study's objectives and developing the sense of judgement in problem solving and decision making in learning.

However, there were some variables that couldn't predict the attitudes towards STEM Education such as the research questions, the research design, the data analysis, the conclusion and the research presentation. The instructors have to improve their teaching methods or approaches linking to both the learning activities and contents spotlighting the research ethic of the undergraduate students by using different and various means.

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