



International Journal of Technology in Education

www.ijte.net

Research Attitudes, Motivations, and Challenges of STEM Education Researchers

Christoper Jan B. Landicho

Science Department, Xavier School Nuvali, Philippines

To cite this article:

Landicho, C.J.B. (2020). Research attitudes, motivations, and challenges of STEM education researchers. *International Journal of Technology in Education (IJTE)*, 3(1), 49-61.

International Journal of Technology in Education (IJTE) is a peer-reviewed scholarly online journal. This article may be used for research, teaching, and private study purposes. Authors alone are responsible for the contents of their articles. The journal owns the copyright of the articles. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of the research material. All authors are requested to disclose any actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations regarding the submitted work.

Research Attitudes, Motivations, and Challenges of STEM Education Researchers

Christopher Jan B. Landicho

Article Info

Article History

Received:
01 September 2019

Accepted:
09 December 2019

Keywords

STEM education
Research attitude
Challenges
Motivations

Abstract

The value of Science, Technology, Engineering, and Mathematics (STEM) education and the significance of conducting research motivated the conduct of this study. As teachers take on a more active role in knowledge generation, studying their research attitudes, motivations, and challenges has become more relevant and timely. This paper aimed to describe Filipino STEM education researchers based on the three aforementioned parameters. To achieve this goal, a total of 46 STEM teacher-researchers were purposively sampled to answer an online survey. Three of the responses, however, were excluded due to incomplete answers. Results revealed that the respondents held a positive outlook towards research and consider it as an avenue for professional growth. They also recognized the positive impacts of research on their teaching skills and in their students' learning experiences. Both extrinsic and intrinsic motivations were reported to be the main stimuli in doing research. Time and financial constraints, heavy workload, and lack of exposure and experience in research were some of the challenges identified by the respondents. Suggestions for future research and policy directions were provided.

Introduction

Studies have shown the positive impact of doing research on the teaching practices and professional development of teachers (Ulla, 2018). By conducting research, teachers are allowed to engage reflectively and systematically in evaluating classroom practices, systems, and beliefs. These researches have been labeled differently yet share the same goal of identifying classroom and school problems and appropriately addressing these concerns using investigative methods (Chow et al. 2015). Some of the many terms used to describe these self-reflexive studies include action research, self-study, and teacher research (Campbell, 2013). In the present study, these categories will be used to refer to the different types of teacher-initiated researches aimed to improve the learning and teaching process in the classroom.

In general, different categories of evidence-based practices in education may be delineated. Abukari and Abubakar (2018) identified at least three dimensions of these approaches based on who provides the 'evidences.' The first dimension includes the evidences provided by researchers who are usually associated with higher education institutions. Second, the studies conducted by other educators in the context of their practice. And third, the evidences that may emanate from the research conducted by the teaching professional himself/herself to inform practice. This last dimension reflects the discerning character of teacher researches.

Traditionally, the identities of researchers and teachers have been viewed distinctly. In this old paradigm, researchers are seen as the producers of knowledge which the teacher-practitioners simply apply in their schools and classrooms (Robinson, 2003). Today, such a divide has attenuated owing to the impact that research has not only in the education sector but in almost all aspects of our daily lives. Research has become an indispensable human intellectual possession needed to adapt to the needs and demands of the society in this fast-changing world (Oguan, Bernal, & Pinca, 2014). As a tool to address education for sustainable development, research develops among teachers the essential skills of cooperating, critical thinking, decision-making, and problem-solving (Iliško, Ignatjeva, & Mičule, 2010).

Research has become a significant asset among teachers. Aside from the prospect of professional development and promotion, other benefits of doing research include intellectual and emotional growth as well as improved practice through knowledge generation and dissemination. In a study conducted among a group of teacher-researchers, Ulla, Barrera, and Acompanado (2017) reported that the respondents had positive perceptions of the

benefits of researching the teachers' practices and the students' learning process. In this manner, teachers are considered as active agents of knowledge creation and not mere consumers of information.

Through action research (AR) and participatory action research (PAR), teachers become more aware of how to make their class more learner-centered, interactive, meaningful and productive by combining theory and practice (Morales, 2016). As the name suggests, AR is a form of inquiry targeted to improve and refine the actions of the 'actor' (Sagor, 2000). It employs a cyclical process of diagnosing, action planning, action taking, evaluating, and specifying learning (Järvinen, 2009). When applied in the classroom, AR aims to improve the learners' achievement through solving real classroom problems or the development of collaborative classroom practices (Mariyam & Ullah, 2015). Through PAR and AR, teachers become more reflective in the classroom since reflection and self-evaluation are emphasized in these research methods (Morales, 2016).

Teacher research is another type of AR that originates from the teachers' daily reflections and is aimed to solve problems in their professional and community lives (Stremmel, 2007). Teacher research as a means to practice self-inquiry and exploration has slowly gained traction in contemporary society (Hong & Lawrence, 2011). As a type of self-initiated inquiry by teachers in their professional context, teacher researches are reflective, systematic, and aims to deepen one's understanding of his/her practice (Patsko, 2015).

For Babkie and Provost (2004), the idea of teachers engaging in research is nothing new. Becoming a practitioner and a researcher should no longer be considered as separate personalities but as different roles that a teacher can assume (Robinson, 2003). This combines the teacher's first-hand experiences in the classroom as well as the researcher's ability to draw connections among these encounters. Robinson (2003) listed three reasons why the role of practitioners as researchers must be strengthened. First, teachers have the moral and professional responsibility of making the right decisions on what to teach and how to teach them. Second, teachers must be able to create the conditions that will yield the desired outcomes and make evidence-based decisions on how best practices will be implemented in their own classrooms. Lastly, conducting research is an effective platform for the professional development of teachers. Aside from professional advancement, the involvement of teachers in conducting first-hand researches is viewed to bolster innovative teaching (Chow et al., 2015). Research could also enhance teachers' capacity to independently and professionally judge their classroom practices (Iliško, Ignatjeva, & Mičule, 2010).

In the Philippines, the Department of Education (DepEd), through its Department Order No. 16 series of 2017, has emphasized the significance of research in crafting educational programs and policies. This order outlines the department's research management guidelines, research management cycles, funding provisions and other salient stipulations which were all intended to promote and strengthen the culture of research in basic education (DepEd, 2017). In higher education institutions, the 'publish or perish' mindset has also pushed educators to improve not only their teaching practices but also their performance in terms of academic publications (Ulla, Barrera, & Acompanado, 2017). The Commission on Higher Education or CHED has emphasized the need to enable the country's higher education institutions to help in national transformation through knowledge production and transfer (CHED, 2016).

As in all disciplines, educators in the field of Science, Technology, Engineering, and Mathematics (STEM) education are also expected to immerse themselves in the pursuit of generating new knowledge and improving teaching practices. This is particularly crucial given that integration of STEM education has increasingly been growing in both developed and developing countries (El-Deghaidy & Mansour, 2015). Kaleci and Korkmaz (2018) have identified STEM education's contributions to society which include the development of scientific and technological skills, contribution to sustainable growth, and the improvement of STEM literacy while drawing its connection to the society, school, and work, among others. Given this role played by STEM education in the global community, one cannot deny the need to pay attention to it.

A literature review of 40 articles and papers on STEM education published in both national and international journals conducted by Kaleci and Korkmaz (2018) revealed that the majority (65%) of these studies were conducted in formal education settings and have used qualitative methods. Specifically, the most preferred research methods include case studies and experimental research design while research instruments such as documents, interviews, different types of tests, observation/surveys, questionnaires, and alternative assessments and evaluations were utilized (Kaleci & Korkmaz, 2018). In a similar literature search of STEM education intervention in primary years, Rosicka (2016) indicated that the most common themes in the articles reviewed include teacher capacity, integration of STEM disciplines, active learning, and student engagement and participation.

STEM educators who are actively engaged in research should embrace an attitude of openness and willingness to learn. Research findings on how STEM education practices may be further improved will only be useful if education professionals in STEM are willing to integrate them into their practice. This atmosphere of learning, collaboration, and communication was noted in a study conducted among the teachers at emerging STEM schools who viewed themselves as learners and considered flexibility and openness as the main characteristics of STEM teachers (El Nagdi, Leammukda, & Roehrig, 2018).

Doing research, however, is not free from challenges and barriers. In the Philippines, for example, teachers are embattled by different concerns that affect their drive to engage in research (Ulla, 2018). Educators need enough technical knowledge on conducting research. In a study by Naz and Malik (2014), public sector college instructors in Pakistan revealed that they do AR to improve the quality of teaching and learning in class yet lack knowledge of the technical aspect of AR. The time needed to carry out data collection and analyses as well as the heavy workload and different job-related responsibilities further adds to the list of the hindrances for teachers to do research (Iliško, Ignatjeva, & Mičule, 2010).

Teachers also need to be motivated and supported by their school administration in terms of finances, training, and workshops to begin with their research (Ulla, 2018). Determination and encouragement are also instrumental for the completion of research projects as illustrated by the experience of a group of English as a Foreign Language teachers in a Chilean university who underwent a new AR program aimed to be more actively engaged in research and research publication (Burns & Westmacott, 2018). For Filipino faculty members of various colleges and universities, factors such as time, positive perception of research, funding and clear system of research incentives, decentralization of research policies, and maintenance of positive and conducive work environment are considered essential in boosting research productivity (Salazar-Clemeña & Almonte-Acosta, 2007).

Based on the foregoing discussion, teacher-initiated research, regardless of the name given to it, entails a self-motivated goal of understanding, evaluating, and improving one's teaching practice. The result, therefore, of this type of study depends heavily on factors that could affect the researchers' commitment to do research. Pamatmat (2016) underscored how the success of one's research is significantly affected by feelings, ways of thinking, and motivations. Positive attitudes toward research are essential to succeed in the knowledge-based society (Tariq et al. 2016). Thus, understanding the researcher's attitudes, motivations, and challenges are critical parameters that may have notable consequences on the outcomes of teacher-initiated research.

The value of STEM education in the society and the aforementioned benefits of teacher research on the professional growth of educators provided the impetus for the present study. Similar studies conducted in the Philippines have tried to describe teachers' perceptions of the benefits, challenges, and motivations in doing research (Salazar-Clemeña & Almonte-Acosta, 2007; Pamatmat, 2016; Ulla, 2018). These studies, however, did not specifically target STEM education researchers.

This paper aims to determine Filipino STEM education researchers' attitudes towards research, sources of motivations, and challenges encountered in their studies. Given the deficit in the available literature describing how these factors affect STEM education researchers in the country; this study might bridge the gap in understanding the beliefs, needs, and aspirations of local STEM education practitioners. This may also provide baseline information for STEM education authorities on how to formulate policies and programs that will capacitate and secure STEM researchers to continue their work and augment their knowledge dissemination.

Specifically, this research aims to answer the following questions:

1. What are the attitudes and beliefs of Filipino STEM education researchers towards research?
2. What motivates Filipino STEM education researchers to pursue their studies?
3. What were the barriers and sources of anxiety that they encountered in conducting research?

Method

Research Design

This study employed the research survey design. An online survey was administered to gather both quantitative and qualitative information describing the respondents' attitudes towards research as well as their perceived motivations, challenges, and sources of anxiety in this endeavor. Online surveys have been deemed

advantageous due to their low administration cost, speed, timeliness, ease of follow-up, convenience, and the flexibility they give for researchers to start, pause, or resume data collection (Evans & Mathur, 2005; Nayak & Narayan, 2019). Nonetheless, some of the downsides attributed to internet-based surveys include the tendency of surveys to be considered as junk mails, non-representative sampling of those with internet access, respondent's lack of technological tools and knowledge, low response rate, privacy and security issues, and ethical concerns (Evans & Mathur, 2005; Ward et al. 2014). These qualities associated with online surveys are considered in the scope and limitations of the present study.

Research Participants and Ethical Considerations

A total of 46 teachers who have been involved in STEM education research were purposively sampled to answer in the survey. However, only 43 responses are reported here due to the incomplete answers of three respondents. The incomplete responses stemmed from an error in the survey form which was rectified immediately during the initial phase of data collection. The respondents have been identified through online searches of published STEM education researches as well as the book of abstracts of national and international research congresses and conferences. These conferences were in the fields of science education, biology, chemistry, and mathematics. Invitations to participate in the online survey were sent through e-mails indicated in the aforementioned documents.

Upon acceptance of the invitation, the respondents were informed that participation in this study is purely voluntary and that all data collected, especially personal information, will be handled with utmost confidentiality. To ensure that the respondents were aware of these conditions, an agreement clause was required to be answered at the start of the survey.

Research Instruments and Data Analysis

An online survey, composed of adopted instruments as well as researcher-made scales, was administered to collect information describing the respondents' attitude towards research and the factors that motivate and challenge them in this endeavor (see Appendix for the survey). Open-ended questions were also included to further elucidate the answers of the respondents. The online survey consisted of five parts. The first part sought the demographic information of the respondents such as their age, number of years in service, number of researches presented and/or published in the past five years, source of funding of their study, highest academic degree attained, subjects taught, and the type of school where they are currently teaching. The second part of the survey sought the respondents' attitudes towards research using the scale adapted from Shafiqat, Manzoor, and Tariq (2018). Items in this instrument and in the succeeding parts of the survey followed a five-point Likert scale format (1 = strongly disagree, 2 = agree, 3 = neutral, 4 = agree, 5 = strongly agree). The third part of the survey was a researcher-made questionnaire inquiring about the respondents' motivations in doing research while the fourth part was an adopted research anxiety scale from the study of Rezaei and Zamani-Miandashti (2013). Finally, the last part of the survey asked for the respondents' perceived challenges in research. The Cronbach's alpha values for the second, third, fourth, and fifth parts of this online survey were determined to be 0.99, 0.75, 0.79, and 0.81, respectively. These values suggest high internal consistency.

Results and Discussion

This study explored the research attitude, motivations, and challenges of Filipino STEM education researchers. Results collected from the online survey were tabulated and summarized using descriptive statistics such as frequencies, percentages, means, and standard deviations. The mean age of the respondents was 32.8 years (SD = 8.28). All of the respondents have conducted at least one research project in the last five years. Twenty-five out of 43 mentioned that they have published their studies during the same period. Table 1 presents the other details of the demographic profile of the respondents.

The majority of the respondents (88.4%) indicated that they have either earned units or completed graduate studies. Thirteen (30.2%) have finished their master's degree while eight (18.6%) are doctorate holders. Around 72% of the respondents are teaching in public schools while 28% are affiliated with private learning institutions. Subjects taught range from grade school (GS) science and math to specialized STEM subjects in senior high school (SHS) such as physics, biology, chemistry, calculus, as well as research.

Table 1. Respondents' Demographic Profile

		Frequency	Percentage
Age	20-24	10	23.3%
	25-29	6	14.0%
	30-34	10	23.3%
	35-40	9	20.9%
	More than 40	8	18.6%
Location of school	NCR	5	11.6%
	Luzon	19	44.2%
	Visayas	6	14.0%
	Mindanao	13	30.2%
Number of years in teaching	1-5	12	27.9%
	6-10	11	25.6%
	More than 10	20	46.5%
Subjects Taught	GS Science	3	7.0%
	GS Math	8	18.6%
	Junior High School (JHS) Science	12	27.9%
	JHS Math	13	30.2%
	SHS Biology	5	11.6%
	SHS Chemistry	4	9.30%
	SHS Physics	5	11.6%
	SHS Math	16	37.2%
	(General Math, Pre-Calculus, Calculus, Statistics)		
	Research	21	48.8%
	Other subjects	6	14.0%
Highest Academic Degree Earned	Bachelor's Degree	5	11.6%
	Master's Degree (units)	2	4.7%
	Master's Degree (completed)	13	30.2%
	Doctorate (units)	15	34.9%
	Doctorate (completed)	8	18.6%
Type of School Where the Respondent is Teaching	Public	31	72.1%
	Private	12	27.9%
Number of Research Conducted in the Past Five Years	1	15	34.9%
	2-5	19	44.2%
	6-10	4	9.30%
	More than 10	5	11.6%
Number of Research Published in the Past Five Years	0	18	41.9%
	1	13	30.2%
	2-5	9	20.9%
	More than five	3	7.0%

The respondents' attitude towards research was determined using the adapted scale of Shafqat, Manzoor, and Tariq (2018). This instrument originally consisted of 22 items divided into six factors namely *research orientation*, *rewards influence research*, *personal interests*, *mission of university*, *research use*, and *research anxiety* (Shafqat, Manzoor, & Tariq, 2018). The last factor has been omitted since a different research anxiety scale (Rezaei & Zamani-Miandashti, 2013) was used in this study.

As shown in Table 2, the respondents indicated a positive slant towards research activities. They showed a positive view of research as a valuable contribution to the school's performance as well as a source of professional satisfaction and inspiration to work harder. The respondents also believed that faculty members who are productive in research deserve to be retained in their teaching positions. These results agree with Ulla, Barrera, and Acompañado's (2017) findings among Philippine classroom teachers who held research in high regard and believed that research stimulates critical self-reflection in the classroom. The same positive

sentiment towards research has been noted among university professors in Pakistan (Shafqat, Manzoor, & Tariq, 2018) and local universities in the Philippines (Ramirez, 2010; Pamatmat, 2016). Vecaldo, Asuncion, and Ulla (2019) noted that teacher education researchers in northern Philippines were driven to write and present research articles by the desire to generate knowledge, gain learning experiences, and address community concerns through their ideas.

Table 2. Responses to the Research Attitude Scale adopted from Shafqat, Manzoor, and Tariq (2018)

	<i>M</i>	<i>SD</i>
Factor I – Research Orientation		
I view myself primarily as researcher.	3.81	0.79
I feel professional satisfaction by conducting research.	4.26	0.90
I believe that universities/schools should retain faculty members who exhibit research production.	4.70	0.46
I can contribute to my university's rank/school's performance by publishing research papers.	4.35	0.81
The intellectual challenge of academic research inspires me to work harder.	4.35	0.78
Factor II – Rewards Influence Research		
I think rewards are effective means of influencing faculty performance in research.	4.40	0.88
I think reward influences faculty for research activities.	4.33	0.94
I think faculty members must be productive researchers or lose their jobs.	2.98	1.10
I think that if tenure/promotions were not binding on research, most faculty would devote less time and effort to research	3.69	1.01
I can become an effective professional if I am able to have an educated critique about the quality of research.	4.21	0.74
Factor III – Personal Interests		
I think that personal Interests are the most important factor in determining the allocation of time to research.	4.30	0.77
I feel free to pursue my academic interests (within the context of research).	4.51	0.55
I think sharing research results with colleagues is self-satisfying.	4.47	0.63
I want to build up my reputation as an academic scholar through research.	4.40	0.85
Factor IV – Mission of (University) School		
Research is a motivating factor to the mission of my university/school.	4.19	0.91
I believe that research and teaching are mutually supportive activities.	4.47	0.74
Factor V – Research Use		
In my opinion research should be mandatory for professional training.	4.07	1.10
I think research is useful to every professional.	4.70	0.51
In my opinion research-oriented thinking plays an important role in everyday life.	4.47	0.55

Rewards and incentives were seen as effective stimuli in doing research. These incentives may come in the form of research funding, publication awards, and points for promotion in rank. For example, among colleges and universities in the CALABARZON region in the Philippines, rewards, incentives, and recognitions are given to faculty members who engage in research (Ayala & Garcia, 2013). While acknowledging the ambivalence in the perceived effect of monetary rewards for teachers, Imberman (2015) underscored that well-designed financial incentives for teachers may positively impact student performance. Tahira et al. (2017) corroborated in their conclusion that the performance of elementary school teachers was positively affected by reward systems. Ayala and Garcia (2013) considered the inclusion of research productivity in the promotion scheme as the best financial reward for college and university faculty-researchers.

Aside from extrinsic satisfaction associated with research, the respondents indicated that their involvement in research is propelled by intrinsic motives and shared school mission. They described research as a source of “self-fulfillment,” “professional health,” and “self-worth.” One of the respondents even mentioned that research is “an experience worth taking.” Together with the improvement of their own research skills, the participants considered research to have a positive impact on their teaching skills. In the past, teacher-initiated researches have been linked with improved students’ performance, revised teaching practices using newly acquired knowledge, and increased critical learning skills among teachers (Babkie & Provost, 2004). Identifying teachers’ motivations in assuming the role of researchers is critical. Encouraging teachers to do research in their schools entails changes in their motivational behaviors (Meerah, Johar, & Ahmad, 2001). In this study, the respondents’ perceived motivations are summarized in Table 3.

Table 3. Researcher's Sources of Motivation

	<i>M</i>	<i>SD</i>
Contribution to existing body of knowledge	4.42	0.50
Improvement of research skills	4.63	0.49
Improvement of teaching skills	4.56	0.59
A personal sense of fulfillment	4.47	0.67
Contribution to my school's/university's ranking and performance	3.98	0.86
Motivation from my family	3.67	1.08
Motivation from my colleagues and supervisors	3.98	0.74
Possible promotion or incentives (e.g. publication awards)	4.28	0.73
Conducting research will help me finish my graduate studies	4.44	0.70

The respondents' motivations also included the desire to contribute to the existing body of knowledge, to achieve a personal sense of fulfillment, and to help in the school's ranking and performance. These motivations are consistent with existing literature (e.g. Ulla, Barrera, & Acompañado, 2017; Vecaldo, Asuncion, & Ulla, 2019). Iliško, Ignatjeva, and Mičule (2010) underscored that personal growth was considered by older teachers as their main motivation in doing research. Professional development in terms of promotion and completion of graduate studies were also rated positively in the present study. These observations are consistent with the ratings presented in Table 2. Research is seen not only as an academic activity but as a useful asset in both professional and everyday life. For STEM educators, the practical aspect of research becomes more evident since they are expected to possess the same qualities expected of a STEM student such as the ability to research and draw connections among the types of technology used in their work (El-Nagdi, Leammukda, & Roehrig, 2018).

It is interesting to note that even in terms of their perceived research anxiety the respondents invariably highlighted their need to improve in their research and statistical skills. These two items received the highest ratings as shown in Table 4. The succeeding items with the higher mean scores include the statements "*I produce research that is respected by my peers (M=3.86, SD=1.01),*" "*It bothers me that my research may not be judged as a quality work (M=3.67, SD=1.23),*" "*I am confident when preparing a research methodology of a study for possible publication in a refereed research journal (M=3.65, SD=0.78),*" and "*I am confident when writing the conclusions of a study for possible publication in a refereed research journal (M=3.65, SD=0.84).*" All of these statements reflect the respondents' general sense of confidence in writing research and their high standards of excellence.

Table 4. Research Anxiety Scale

	<i>M</i>	<i>SD</i>
I need to improve my research skills.	4.42	0.76
I need to improve my statistical skills.	4.35	0.92
It bothers me that my research may not be judged as a quality work.	3.67	1.23
When I conduct research, I worry about the possibility of the manuscript not being accepted for publication.	3.49	1.05
When reading research articles, I am apprehensive about being able to synthesize the findings.	3.37	1.07
I produce research that is respected by my peers.	3.86	1.01
When I conduct research, I worry about the possibility of using incorrect data analysis.	3.58	1.28
It bothers me that my research may not be judged as acceptable by reviewers for research journals.	3.49	1.08
When I conduct research, I fear that it is poor compared to others in my field I often feel uncomfortable when discussing research methods.	3.26	1.14
When working on a research project, I experience anxiety.	3.26	1.26
I am confident when preparing a research methodology of a study for possible publication in a refereed research journal.	3.65	0.78
I am confident when conducting the data analysis of a study for possible publication in a refereed research journal.	3.58	0.85
I am confident when writing the theoretical framework for a research study.	3.28	1.03
I am confident when writing the conclusions of a study for possible publication in a refereed research journal.	3.65	0.84

On one hand, maintaining this positive attitude and passion for excellence hopefully translates into future successes. On the other hand, the research anxiety reported by the participants is a call for more intensive research support for STEM education researchers. Training, seminars, and workshops may potentially decrease this anxiety by capacitating teacher-researchers with the necessary content knowledge and skills. Attitude significantly influences achievement (Pamatmat, 2016). Thus, in a more positive sense, this anxiety or eagerness in producing quality researches challenges STEM teachers to improve and be experts in the field of STEM education research.

STEM education researchers, however, are sometimes held up by several impediments. Table 5 summarizes the challenges experienced by the respondents. These include lack of financial support, heavy teaching load and work-related tasks, and limited research experience and exposure. Time and budgetary constraints have been reported in previous studies (Iliško, Ignatjeva, & Mičule, 2010; Ramirez, 2010; Ulla, Barrera, & Acompañado, 2017; Vecaldo, Asuncion, & Ulla, 2019). Aside from classroom teaching, faculty members are usually given additional administrative roles. They also serve as class advisers, club moderators, and members of special committees which would demand a significant amount of their working time. Added to this list are the teachers' inherent responsibilities such as curricular preparation and checking, and their responsibilities at home and in the community. Despite these challenges, the respondents maintained their willingness to do research. This was succinctly reflected by the following responses:

"Many faculty [sic] have research capability and drive but no time to do research."

"As of the moment, time is the main problem why I cannot do the research works that I need or want to do."

Table 5. Challenges Encountered in Doing Research

	<i>M</i>	<i>SD</i>
Limited research knowledge and skills	3.47	1.16
Limited research experience and exposure	3.63	1.23
Limited funding or financial support	4.12	0.93
Low proficiency in the English language	2.86	1.19
Lack of available reference materials and other primary sources	3.53	1.18
Family roles and responsibilities	3.37	1.29
Heavy teaching/workload	4.28	1.05
Unavailability of research mentors/advisers in our area	3.47	1.28

Conclusion and Recommendations

Research is an academic endeavor with profound implications when applied by educators in their schools and classrooms. For STEM educators, research is particularly essential given the demands of a knowledge-driven economy. This study attempted to describe the attitude towards research as well as the motivations and challenges experienced by Filipino STEM educators. Results suggest a positive disposition toward scholarly activities. The respondents regarded research as an experience worth taking and a professional activity that could help improve their teaching skills. Rewards and incentives were seen as key motivations in doing research. Intrinsic motivations such as the opportunity to contribute to the existing knowledge base and grow professionally were also noted. Challenges in doing research include time and financial constraints as well as limited exposure and experience in doing research.

While this research highlights the lived experiences of only 43 Filipino STEM teacher-researchers, the results presented may serve as a baseline for future researches on the topic. Further studies involving more researchers and schools could provide a more detailed account of the state of STEM education research in the Philippines. Comparative studies among neighboring countries in the ASEAN region and other parts of the globe may be taken up for a better understanding of regional or global trends. The respondents in this study see the value and benefits of doing research. Schools, research institutions, teacher training institutes, and government agencies should invest in such optimism to espouse a vibrant research culture among STEM educators. School administrators may look into the possibility of crafting policies that will promote research involvement among their faculty members. Publication awards and research grants may also be given to teachers who have consistently delivered meaningful classroom or action researches. The promotion of professional learning communities among teachers could also reinforce existing support systems for both beginning and veteran teacher-researchers. Lastly, capacity building activities for STEM teachers such as the Department of Science

and Technology – Science Education Institute or DOST-SEI’s Science Teacher Academy for the Regions (DOST-SEI, n.d.) should be promoted and optimized. It is hoped that as STEM education research gets more traction in the education landscape, both teachers and students would be able to grow and benefit from it.

Acknowledgements

The author expresses his profound gratitude to Dr. Shafqat Khan and Dr. Naser Zamani-Miandashti for granting him permission to adapt/adopt their research instruments.

References

- Abukari, A. & Abubakar, A.B.K. (2018). Using research to inform practice: the teacher as a practitioner researcher. *Journal for Researching Education Practice and Theory*, 1 (2), 1-5.
- Ayala, C. J. & Garcia, B. H.. (2013). Research productivity and utilization in higher education institutions in the CALABARZON Region. *MSEUF Research Studies*, 15 (1), 2-15.
- Babkie, A.M. & Provost, M.C. (2004). Teachers as researchers. *Intervention in School and Clinic*, 39 (5), 260-268.
- Burns, A. & Westmacott, A. (2018). Teacher to researcher: reflections on a new action research program for university EFL teachers. *Profile: Issues Teach. Prof. Dev.*, 20 (1), 15-23. DOI: 10.15446/profile.v20n1.66236
- Campbell, K.H. (2013). A call to action: why we need more practitioner research. *Democracy & Education*, 21 (2), 1-8.
- CHED. (2016). CHED Memorandum Order No. 52, s. 2016: Pathways to equity, relevance and advancement in research, innovation, and extension in Philippine higher education. Retrieved from <https://ched.gov.ph/wp-content/uploads/2017/10/CMO-52-s.-2016.pdf>
- Chow, K.C.K., Chu, S.K.W., Tavares, N., & Lee, C.W.Y. (2015). Teachers as researchers: a discovery of their emerging role and impact through a school-university collaborative research. *Brock Educational Journal*, 24 (2), 20-39.
- DepEd. (2017). DepEd Order No. 16, s. 2017: Research Management Guidelines. Retrieved from https://www.deped.gov.ph/wp-content/uploads/2017/03/DO_s2017_016.pdf
- DOST-SEI. (n.d.) Science Teacher Academy For The Regions (STAR). Retrieved from <http://www.sei.dost.gov.ph/index.php/programs-and-projects/innovations/256-project-star>
- El-Deghaidy, H. & Mansour, N. (2015). Science teachers’ perceptions of STEM education: possibilities and challenges. *International Journal of Learning and Teaching*, 1 (1), 51-54. DOI: 10.18178/ijlt.1.1.51-54
- El Nagdi, M., Leammukda, F., & Roehrig, G. (2018). Developing identities of STEM teachers at emerging STEM schools. *International Journal of STEM Education*, 5 (36). DOI: 10.1186/s40594-018-0136-1
- Evans, J.R. & Mathur, A. (2005). The value of online surveys. *Internet Research*, 15 (2), 195-219. DOI: 10.1108/10662240510590360
- Hong, C.E. & Lawrence, S.A. (2011). Action research in teacher education: classroom inquiry, reflection, and data-driven decision making. *Journal of Inquiry & Action in Education*, 4 (2), 1-17.
- Iliško, D., Ignatjeva, S., & Mičule, I. (2010). Teachers as researchers: bringing teachers’ voice to the educational landscape. *Journal of Teacher Education for Sustainability*, 12 (1), 51-65. DOI: 10.2478/v10099-009-0046-x
- Imberman, S.A. (2015). How effective are financial incentives for teachers? Linking teacher pay to student performance has become popular, but evidence on its effectiveness is mixed. *IZA World of Labor*, 2015:158, 1-10. DOI: 10.15185/izawol.158
- Järvinen, P. (2009). On various characteristics of action research. Presented in the IRIS32 Conference in Molde, Norway, August 9 - 12, 2009. Retrieved from <https://www.sis.uta.fi/cs/reports/dsarja/D-2009-4.pdf>
- Kaleci, D. & Korkmaz, O. (2018). STEM education research: content analysis. *Universal Journal of Educational Research*, 6 (11), 2404-2412. DOI: 10.13189/ujer.2018.061102
- Mariyam, T. & Ullah, M.M. (2015). When teachers become researchers: the importance of action research. *Global Journal of Human-Social Science: G Linguistics & Education*, 15 (10), 19-27.
- Meerah, T., Johar, A.R., & Ahmad, J. (2001). What motivates teachers to conduct research?. *Paper presented at the Higher Education Close Up Conference 2, Lancaster University, 16-18 July*. Retrieved from <http://www.leeds.ac.uk/educol/documents/00001772.htm>
- Morales, M.P.E. (2016). Participatory Action Research (PAR) cum Action Research (AR) in teacher professional development: a literature review. *International Journal of Research in Education and Science*, 2 (1), 156-165.

- Nayak, M.S.D.P. & Narayan, K.A. (2019). Strengths and weakness of online surveys. *IOSR Journal of Humanities and Social Science*, 24 (5), 31-38. DOI: 10.9790/0837-2405053138
- Naz, S., & Malik, S. K. (2014). An analysis of college teachers' awareness about conducting action research for effective teaching. *International Journal of Secondary Education*, 2 (1), 7-10.
- Oguan, F.E. Jr., Bernal, M.M., & Pinca, M.C.D. (2014). Attitude and anxiety towards research, its influence on the students' achievement in the course. *Asian Journal of Management Sciences & Education*, 3 (4), 165-172.
- Pamatmat, F.V. (2016). Research attitudes of teaching personnel in one Philippine state university: basis for development and sustainability towards excellence. *Research Journal of Language, Literature and Humanities*, 3 (3), 12-17.
- Patsko, L. (2015). What is teacher research, and how can you benefit from it?. World of Better Learning. Retrieved from <https://www.cambridge.org/elt/blog/2015/03/16/teacher-research-can-benefit/>
- Ramirez, N. C. (2010). Factors Influencing the Attitudes of University of the East College Faculty toward Research. *UE Research Bulletin*, 12 (1). Retrieved from <http://ejournals.ph/form/cite.php?id=1716>
- Rezaei, M. & Zamani-Miandashti, N. (2013). The relationship between research self-efficacy, research anxiety and attitude toward research: a study of agricultural graduate students. *Journal of Educational and Instructional Studies in the World*, 3 (4), 69-78.
- Robinson, V. (2003). Teachers as researchers: a professional necessity?. *SET: Research Information for Teachers*, 1, 27-29. Retrieved from <https://set.et-foundation.co.uk/digital-assets/qtlsmap/Resources/2/Teachers%20as%20Researchers%20-%20a%20professional%20necessity.pdf>
- Rosicka, C. (2016). From concept to classroom: translating STEM education research into practice. Camberwell: Australian Council for Educational Research. Retrieved from https://research.acer.edu.au/cgi/viewcontent.cgi?article=1010&context=professional_dev
- Sagor, R. (2000). Guiding school improvement with action research. Alexandria: Association for Supervision and Curriculum Development.
- Salazar-Clemeña R.M. & Almonte-Acosta, S.A. (2007). Developing research culture in Philippine higher education institutions: perspectives of university faculty. *Presented at the Regional Seminar "Competition, Cooperation and Change in the Academic Profession: Shaping Higher Education's Contribution to Knowledge and Research," Hangzhou, China*. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000157869>
- Shafqat, K., Manzoor, S., & Tariq, M.K. (2018). An investigation of attitudes towards the research activities of university teachers. *Bulletin and Education Research*, 40 (1), 215-230.
- Stremmel, A.J. (2007). The value of teacher research: nurturing professional and personal growth through inquiry. *Voices of Practitioners*, 2 (3), 1-9.
- Tahira, K., Mumtaz, A., Haseeb, A.M., Amna, S., & Memoona, K. (2017). Teachers' perception regarding effect of reward system on teachers' performance at elementary level. *Bulletin of Education and Research*, 39 (2), 107-118.
- Tariq, H., Qayyum, A.C., Mumtaz, A., Sidra, S., & Nisar, A. (2016). A study on attitude towards research among technology education students in Pakistan. *Bulletin of Education and Research*, 38 (2), 113-122.
- Ulla, M. B. (2018). Benefits and challenges of doing research: experiences from Philippine public school teachers. *Issues in Educational Research*, 28 (3), 797-810.
- Ulla, M. B., Barrera, K. B., & Acompañado, M. M. (2017). Philippine classroom teachers as researchers: teachers' perceptions, motivations, and challenges. *Australian Journal of Teacher Education*, 42 (11), 52-64.
- Vecaldo, R., Asuncion, J.E., & Ulla, M. (2019). From writing to presenting and publishing research articles: experiences of Philippine education faculty-researchers. *Eurasian Journal of Educational Research*, 81, 147-164.
- Ward, P., Clark, T., Zabriskie, R., & Morris, T. (2014). Paper/pencil versus online data collection: an exploratory study. *Journal of Leisure Research*, 46 (1), 84-105.

Author Information

Christopher Jan B. Landicho

Science Department, Xavier School Nuvali
 West Conservation Avenue, Canlubang, Calamba City, Laguna, Philippines
 Contact e-mail: cjblandicho@gmail.com

Appendix. Online Survey for Research Attitudes, Motivations, and Challenges of STEM Education Researchers

Dear fellow STEM educators,

Greetings!

I am Christopher Jan Landicho, an independent researcher currently working on a research paper characterizing the research attitude, motivations, and challenges of STEM education researchers in the country. This research employs a survey research design and I would greatly appreciate if you could be one of my respondents in this survey. This study is an independent work and is not part of any thesis or dissertation. Rest assured that your data will be treated with utmost confidentiality. Your participation in this survey is purely voluntary.

Agreement Clause:

- I have read the research purpose and I agree to participate in it. I am aware that my participation is voluntary and that all data that will be involved will be treated with utmost confidentiality.

Part 1. Demographic Profile

This section seeks to gather demographic information about you. Please answer the following questions as accurately as possible.

Name (optional) :

Age :

How many years have you been teaching?

1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 / More than 10

Subject/s Taught?

Grade School Science / Grade School Math / JHS Science / JHS Math / SHS Physics / SHS Chemistry / SHS Biology / SHS Math / Research / Others

Type of school where you are teaching:

Private / Public

Where are you teaching?

National Capital Region (NCR) / Luzon / Visayas / Mindanao

Highest academic degree attained:

Bachelor's degree / Post-baccalaureate diploma / Master's degree (units) / Master's degree (completed) / Doctorate (units) / Doctorate (completed)

How many research/es have you conducted in the past five years?

1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 / More than 10

How many of your papers/researches have been published in the past five (5) years?

1 / 2 / 3 / 4 / 5 / More than 5

Were you a recipient of a scholarship grant during the conduct of this/these study/studies?

Yes / No

Were you a recipient of a research grant/funding during the conduct of this/these study/studies?

Yes / No

In relation to the previous question, who financed your research project?

The research grant / Personal money / Family member / Friends / Private organizations / Other benefactors

Part 2. Research Attitude

This section probes your attitude towards research. The survey instrument is adapted from Shafqat, Manzoor, and Tariq (2018).

Scale: 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), 5 (Strongly Agree)

	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Factor I – Research Orientation					
I view myself primarily as researcher.					
I feel professional satisfaction by conducting research.					
I believe that universities/schools should retain faculty members who exhibit research production.					
I can contribute to my university's rank/school's performance by publishing research papers.					
The intellectual challenge of academic research inspires me to work harder.					
Factor II – Rewards Influence Research					
I think rewards are effective means of influencing faculty performance in research.					
I think reward influences faculty for research activities.					
I think faculty members must be productive researchers or lose their jobs.					
I think that if tenure/promotions were not binding on research, most faculty would devote less time and effort to research					
I can become an effective professional if I am able to have an educated critique about the quality of research.					
Factor III – Personal Interests					
I think that personal Interests are the most important factor in determining the allocation of time to research.					
I feel free to pursue my academic interests (within the context of research).					
I think sharing research results with colleagues is self-satisfying.					
I want to build up my reputation as an academic scholar through research.					
Factor IV – Mission of (University) School					
Research is a motivating factor to the mission of my university/school.					
I believe that research and teaching are mutually supportive activities.					
Factor V – Research Use					
In my opinion research should be mandatory for professional training.					
I think research is useful to every professional.					
In my opinion research-oriented thinking plays an important role in everyday life.					

Part 3. Research Motivation

Please describe how much these factors motivate you in conducting research.

Scale: 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), 5 (Strongly Agree)

	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Contribution to existing body of knowledge					
Improvement of research skills					
Improvement of teaching skills					
A personal sense of fulfillment					
Contribution to my school's/university's ranking and performance					
Motivation from my family					
Motivation from my colleagues and supervisors					
Possible promotion or incentives (e.g. publication awards)					
Conducting research will help me finish my graduate studies					

Please identify other factors not included above that motivate you from conducting research.

Part 4. Research Anxiety

This section probes your research anxiety. The survey instrument is adopted from Rezaei and Zamani-Miandashti (2013).

Scale: 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), 5 (Strongly Agree)

	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
I need to improve my research skills.					
I need to improve my statistical skills.					
It bothers me that my research may not be judged as a quality work.					
When I conduct research, I worry about the possibility of the manuscript not being accepted for publication.					
When reading research articles, I am apprehensive about being able to synthesize the findings.					
I produce research that is respected by my peers.					
When I conduct research, I worry about the possibility of using incorrect data analysis.					
It bothers me that my research may not be judged as acceptable by reviewers for research journals.					
When I conduct research, I fear that it is poor compared to others in my field I often feel uncomfortable when discussing research methods.					
When working on a research project, I experience anxiety.					
I am confident when preparing a research methodology of a study for possible publication in a refereed research journal.					
I am confident when conducting the data analysis of a study for possible publication in a refereed research journal.					
I am confident when writing the theoretical framework for a research study.					
I am confident when writing the conclusions of a study for possible publication in a refereed research journal.					

Part 5. Challenges

Please describe how much do these factors hinder you in conducting research.

Scale: 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), 5 (Strongly Agree)

	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Limited research knowledge and skills					
Limited research experience and exposure					
Limited funding or financial support					
Low proficiency in the English language					
Lack of available reference materials and other primary sources					
Family roles and responsibilities					
Heavy teaching/workload					
Unavailability of research mentors/advisers in our area					

Please identify other factors not included above that hinder you from conducting research.
