

A Seminar Paper

The attached seminar paper, by Jenna Govier, entitled, Competence in the area of STEM with Pre-Service and In-Service Educators, when completed, is to be submitted to the Graduate Faculty of the University of Wisconsin-Platteville in partial fulfillment of the requirements for the Master of Science in Education Degree, for which three credits shall be allowed, is hereby

Approved __Dr Jodean Grunow_____Date: _October 16, 2016_____

COMPETENCE IN THE AREA OF STEM IN PRE-SERVICE AND IN-SERVICE
EDUCATORS

A Seminar Paper

Presented to

The Graduate Faculty

University of Wisconsin-Platteville

In Partial Fulfillment of the

Requirement for the Degree

Masters of Science

in

Education

by

Jenna Govier
2016

ACKNOWLEDGEMENT

I would like to acknowledge Dr. Timothy Deis and Dr. Jodean Grunow from the University of Wisconsin-Platteville. These two wonderful professors took the initiative to pursue a Science, Technology, Engineering, and Mathematics, (STEM) grant for educators in Wisconsin. The three-year program, currently in its second year, provided me with the drive to further investigate STEM education. Together, through networking and hands-on learning opportunities, educators will gain knowledge related to STEM integration and spread resources to colleagues throughout Wisconsin.

ABSTRACT

Research suggests that educators who have the greatest impact on student learning in science, technology, engineering and mathematics, (STEM) education have competency and confidence in the area of science (Murphy, & Mancini-Samuels, 2012). Despite the many STEM initiatives in full force in the United States, very few educators feel competent in the area of STEM (Hutchinson-Anderson, Johnson, & Craig, 2015). This study addresses the question: do pre-service educators feel more competent than in-service educators in the STEM field? Pre-service educators likely feel competent in the use of technology and are benefiting from universities taking the initiative to implement STEM courses in their undergraduate programs (Murphy, Mancini-Samuels, 2012). Based on Murphy and Mancini-Samuels, (2012), educators who have experienced hands-on, project-based activities in the area of STEM during their undergraduate program feel an increased level of competency moving forward in their careers as educators. It is expected that pre-service educators that actively engage in the use of technology and have experienced hands-on, project-based learning will feel increased levels of competency in the area of STEM education.

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CHAPTER 1

INTRODUCTION

Science, technology, engineering, and mathematics, (STEM), initiatives continue to build momentum in the field of education. STEM education is important. In 2001, educators were introduced to No Child Left Behind (Lott, Wallin, Roghaar, & Price, 2013). This law brought changes in education. No longer were classroom activities based largely on unit themes, creativity, and student interest. Instead, the focus shifted to that of meeting standards and teaching topics for mandated tests (Laursen, 2015). STEM education is modifying that outlook. As the 21st century world continues to change, the United States is falling behind. American students are not confident in the area of STEM and in turn are not actively seeking out STEM related career options (Nadelson, et al., 2012). In addition, current students are lacking the real-world experiences STEM education provides. Given the increase in the need for STEM integration in the classroom setting, educator feelings of competency are critical for the successful implementation of STEM education. The study will assess pre-service and in-service educator feelings of competency in the area of STEM.

Statement of the Problem

Do current pre-service educators feel more competent in teaching STEM than in-service educators?

Definition of Terms

STEM Lessons: student focused activities that integrate science, technology, engineering, and mathematics (Lott, et al., 2013).

Competency: The capacity to successfully implement or complete a skill based on knowledge.

Pre-Service Educators: University level students actively working on an undergraduate degree in education.

In-Service Educators: Educators currently teaching grades kindergarten through grade twelve.

Delimitations of Research

There are several limitations to this research. One limitation is that the data collected from this study is from a relatively small sample. The participants included in this study consist of educators participating in a STEM professional development program at the University of Wisconsin-Platteville and current pre-service educators completing the teacher education program at the University of Wisconsin-Platteville. The data may not generalize to include all educators. Using data from one geographical location may not generalize to educators in more highly populated, urban areas of other states and countries. The data will be collected over a short period of time. Data collection is limited to one semester. In addition, participants may self-select if they wish to complete the survey.

Methods of Approach

Participants will include approximately 50-100 K-12 educators and school professionals from Wisconsin, in addition to approximately 50 current teacher education students. The participants will include the educators participating in a three-year STEM institute at the

University of Wisconsin-Platteville, as well as pre-service educators completing the teacher education program at the university. Participants will be notified prior to the study that they will have the opportunity to participate. Interested educators will receive an email containing a survey administered through Survey Monkey, an online survey tool. The survey will assess feelings of competency among pre-service and in-service educators in the area of STEM.

CHAPTER 2

REVIEW OF LITERATURE

The world around us is ever changing. Career paths are shifting. The 21st century is focused largely on the fields of science, technology, engineering, and mathematics, collectively known as STEM (Hutchinson-Anderson, Johnson, & Craig, 2015). President Obama recognizes the importance of STEM and has brought it to the head of the conversation in the field of education. (Nadelson, et al., 2012). The importance of STEM is not limited to current and future students. While students will benefit from real life, hands on experiences that will increase their problem solving skills and prepare them for their lives outside of the K-12 school setting, Americans as a whole will see growth from the STEM initiative. Here in the United States, we are ill prepared to take on STEM related career paths (Nadelson, et al., 2012). A lack of expertise in the STEM fields will negatively affect the growth of our country and economy, and as a result, changes must be made. A starting point is preparing in-service and pre-service educators to effectively teach STEM topics with competence. Educators must become competent in the area of STEM to provide students with applicable STEM investigations that will provide knowledge and drive to allow them to actively participate in today's technology rich environment.

What is STEM?

STEM is defined by a combination of academic foci: science, technology, engineering and mathematics (Moomaw & Davis, 2010). The goal of STEM is to integrate activities focused on science, technology, engineering, and mathematics into other areas of the curriculum in the K-12 classroom setting. Through successful integration of STEM, students will become familiar with

topics and skills required to be successful in the 21st century. In addition, STEM lessons ultimately increase problem solving skills, critical thinking, and perseverance (Lott, Wallin, Roghaar, & Price, 2013).

STEM activities are currently being implemented in classrooms across the country (Lott, et al., 2013). However, rather than being successfully integrated into current curriculum, educators are simply placing each portion of STEM as separate components into the daily schedule. While students generally find these science-focused activities exciting, they hold little merit when not integrated into other curricular areas. The goal of STEM is for students to carry over their STEM experience to that of an experience in the real world (Lott, et al., 2013). Thus, it is important that educators begin to use STEM lessons to actively engage students across their curriculum.

Student Learning and STEM

Today's students are very different than those a decade ago. Gone are the days of playing outside and exploring. Rather, students are inside playing computer games and watching television (Lachapelle, Sargianis & Cunningham, 2013). Technology has become a way of life, not an assistive tool. Students are typically dependent on technology, rather than using it to problem solve and create. STEM investigations can help students address the use of technology differently. This is where the Next Generation Science Standards, the driving force behind implementing science experiences and a focus on STEM becomes a critical tool. STEM activities hold many benefits for today's students that are not limited to preparation for a career in STEM (Lachapell, et al., 2013). Students participating in thoroughly integrated STEM lessons may carry over problem solving skills into other areas in their lives, not just school activities (Lott, et al., 2013). Students will find success in solving problems in their every day lives with the help of STEM investigations. Research using age appropriate mathematics activities suggests that

lessons that are integrated and hands-on are critical to student growth (Presser-Lewis, Clements, Ginsburg, & Ertle, 2015).

A great example of an age appropriate STEM activity is shared through a kindergarten lesson entitled: [Engineering Encounters: Catch Me If You Can!](#) This article provides a wonderful look into a STEM lesson that was successfully integrated into curriculum. The educator uses a topic already addressed in the classroom as a springboard for a STEM lesson. The topic of the lesson is gingerbread men. Hands-on learning is applied as students successfully create gingerbread men traps to place throughout the school. Through curriculum integration, students were able to use an inquiry-based approach to solve a problem and catch the gingerbread men. The educator integrated the topic into all areas of the curriculum, including, language arts, science, mathematics, engineering, and technology to actively engage students in the experience. Since the lesson was applicable to multiple curriculum areas, it is likely that students will recall and use their problem solving skills to solve additional problems in both the academic and real world setting (Lott, et al., 2013).

Benefits of the STEM Initiative

The STEM initiative is full of beneficial outcomes that should fuel educators to work toward successful integration of STEM into curriculum. To begin, STEM lessons are often student-led with a hands-on approach using curiosity and excitement to fuel lessons. This new, integrated approach to science, technology, engineering and mathematics will give new meaning to science study for both students and educators. Students will use skills from STEM lessons to solve real world problems. The perseverance gained from completing inquiry-based activities is a positive life skill for any child. STEM lessons also provide students with the opportunity to become familiar with science, technology, engineering, and mathematics topics in an age

appropriate manner. Many students reach higher education and do not feel knowledgeable in the areas of science and math because of lack of experience. Students are quick to label themselves in the STEM areas with which they struggle (Epstein & Miller, 2011). The integration of STEM lessons throughout the K-12 classroom setting will build student confidence and interest in the science and math fields.

Educator Preparedness in STEM

Looking forward, educators' goals now must include becoming familiar with STEM to be able to successfully implement STEM activities within their classrooms. Familiarity and preparedness are crucial for educators to implement these activities and prepare students for the real world. Educators must be ready to prepare STEM lessons, engage in higher-level thinking, questioning, and investigations (Nadelson, et al., 2013). Feelings of competency are critical in educator preparedness. Until recently, pre-service educators likely completed a course in each curriculum area and moved on to complete his/her degree. Unfortunately, this means not all educators are ready to tackle the implementation of STEM lessons (Nadelson, et al., 2013).

Fortunately, STEM is becoming an increasingly popular addition to educator undergraduate programs. In the United States, universities are becoming aware that educators are lacking the competency to successfully implement STEM based investigations and ultimately, are failing our students who are expected to be prepared for the 21st century upon graduation (Murphy, &Manini-Samuelson, 2012). University education programs are developing STEM certificates to better prepare their graduates for the classroom. State education programs currently implementing this program are seeing a change in teacher competency and confidence upon completion of their programs (Murphy, Mancini-Samuelson, 2012).

While STEM certificates at the undergraduate level are a building block for the future, current educators may find they are lacking the skills to approach STEM integration. Educators actively participating in the field of education may choose to seek out professional development opportunities to increase their STEM knowledge. Educators must work to build on their perceived competency in the area of STEM through educational opportunities and networking so K-12 students are better prepared for the real world. Competent educators will create valuable, hands-on, and project-based learning opportunities that have relevance to real world challenges. Ultimately, this will prepare students to consider a career path that may be in a STEM field. By making changes now, we will not only help future educators, but most importantly, future students.

The Current Study

The current study will assess the educators participating in the University of Wisconsin-Platteville STEM institute and current pre-service educators completing the teacher education program at the University of Wisconsin-Platteville. Through self-report surveys, the researcher will assess educators' feelings of competency in integrating STEM topics in the K-12 classroom setting. I expect to find that pre-service educators currently completing a teacher education program will feel more competent in the area of STEM than in-service educators due to their familiarity with technology and their current study of the field of education.

CHAPTER 3

METHOD

Participants

The sample of participants will consist of approximately 50-100 pre-service and in-service educators. All participants will be age 18 years old and older and will provide assumed consent by completing and submitting the survey. Participants will be invited to respond through an email which will contain an overview of the study and a link to the survey on the Survey Monkey webpage. All participants will be treated according to the Code of Ethics from the American Educational Research Association.

Materials

The self-report survey for in-service educators, (see Appendix B), will be a short questionnaire that asks participating educators to answer questions regarding their sex, age, and grade level taught. For pre-service educators, the questionnaire will ask questions regarding sex, age, and desired level of teaching. In addition, participants will report on feelings of competency in teaching STEM. Participants will share a positive or negative response to the question on a five-point scale.

Procedure

A between subjects design is used. Participants will receive an email. The email will include an informed consent statement for participants to review prior to completion of the survey, (see Appendix A). Participants will be informed that the survey is assessing educators' attitudes and feelings of competency in integrating STEM topics within their classrooms. Educators will complete the survey at their leisure, given a two-week time span. After submitting

the survey, participants will be thanked and provided with a debriefing statement, (see Appendix C). Participants' responses will be compared between pre-service and in-service educators.

CHAPTER 4

RESULTS

Purpose of the Study

The study addressed the topic of teacher competency in the area of STEM, (Science, Technology, Engineering, and Mathematics). Currently, there is a push to create an educational atmosphere where students are college and career ready. However, many of the jobs educators are preparing students for have not yet been created, (Esteves, 2016). The majority of these careers will be in the area of technology, but will also push for students to think critically and problem solve. The successful implementation of STEM at an early age is crucial for student success in college and career readiness. However, while students are embracing the change and becoming STEM literate, there are many educators who are lacking the competency and confidence in the area of STEM to successfully implement lessons that will allow students to flourish.

This study surveyed both pre-service and in-service educators. The study posed this question: Do current pre-service educators feel more competent in teaching STEM than in-service educators? As the researcher, I expected that pre-service educators would feel increased levels of competency in STEM due to active use of technology and hands-on, project based learning. The survey allowed for the comparison of feelings of competency between both groups of educators.

Results

The participants of the study included twenty-five pre-service educators currently enrolled in the education program at the University of Wisconsin-Platteville and thirty-two in-

service educators currently participating in a three year STEM institute. All participants are 18 years old or older. Both groups of educators were contacted via email and asked to complete an anonymous survey via Survey Monkey, an online program. The surveys were created using the same format and comprised of the same, (or similar) questions. The consistency in the surveys between both groups helped to ensure validity when comparing results. The results were collected via Survey Monkey and analyzed by researcher Jenna Govier.

Analysis of Data

The collection of data was completed using Survey Monkey. The online program allowed participants to respond to the survey anonymously. Participants were made aware of this via a debriefing form, (Appendix C). Participants were asked a series of thirty-one questions and were to respond using an assigned scale. The scale asked participants to respond by choosing strongly agree, agree, uncertain, disagree, or strongly disagree. After participants were contacted via email, there was a two-week time span to complete the survey. This was extended due to lack of response from both groups of participants. After one semester, results were collected and compared using Survey Monkey. A total of 57 educators participated, 25 pre-service and 32 in-service.

After results were collected, the assistance of Dr. Barb Barnet was solicited to help understand the best form of statistical analysis for this data. A proportions test was recommended to compare the responses of the two groups of participants. To analyze only the feelings of competency, the data from participants who answered, “strongly agree” or “agree” were the focus. To begin the analysis, surveys were compared and questions were selected that were either the same or similar. Those questions were then pulled from the survey and compared using the proportions test. A comparison of those who responded to the test and those that agreed with the

question for both groups of participants were then used in the test. The analysis was completed using a computer program, *Minitab*, which was provided to the researcher via the University of Wisconsin-Platteville. Below you will find the results from the proportions test for twenty-four of the thirty-one questions asked on the survey.

Proportions Test Results

Test and CI for Two Proportions – Twenty-Four Questions Compared

Q. 6

Sample	X	N	Sample p
1	17	24	0.708333
2	32	32	1.000000

Difference = p (1) - p (2)
 Estimate for difference: -0.291667
 95% CI for difference: (-0.473513, -0.109820)
 Test for difference = 0 (vs. ≠ 0): Z = -3.14 P-Value = 0.002

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.001

Q. 9

Sample	X	N	Sample p
1	16	24	0.666667
2	23	32	0.718750

Difference = p (1) - p (2)
 Estimate for difference: -0.0520833
 95% CI for difference: (-0.296698, 0.192531)
 Test for difference = 0 (vs. ≠ 0): Z = -0.42 P-Value = 0.676

Fisher's exact test: P-Value = 0.772

Q. 10

Sample	X	N	Sample p
1	19	24	0.791667
2	29	32	0.906250

Difference = $p(1) - p(2)$
Estimate for difference: -0.114583
95% CI for difference: (-0.305890, 0.0767230)
Test for difference = 0 (vs. $\neq 0$): $Z = -1.17$ P-Value = 0.240

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.268

Q. 11

Sample	X	N	Sample p
1	8	23	0.347826
2	5	32	0.156250

Difference = $p(1) - p(2)$
Estimate for difference: 0.191576
95% CI for difference: (-0.0401860, 0.423338)
Test for difference = 0 (vs. $\neq 0$): $Z = 1.62$ P-Value = 0.105

Fisher's exact test: P-Value = 0.119

Q. 12

Sample	X	N	Sample p
1	17	23	0.739130
2	24	32	0.750000

Difference = $p(1) - p(2)$
Estimate for difference: -0.0108696
95% CI for difference: (-0.244777, 0.223038)
Test for difference = 0 (vs. $\neq 0$): $Z = -0.09$ P-Value = 0.927

Fisher's exact test: P-Value = 1.000

Q. 13

Sample	X	N	Sample p
1	7	23	0.304348
2	26	32	0.812500

Difference = $p(1) - p(2)$
Estimate for difference: -0.508152
95% CI for difference: (-0.739776, -0.276528)
Test for difference = 0 (vs. $\neq 0$): $Z = -4.30$ P-Value = 0.000

Fisher's exact test: P-Value = 0.000

Q. 14

Sample	X	N	Sample p
1	4	23	0.173913
2	3	32	0.093750

Difference = $p(1) - p(2)$
Estimate for difference: 0.0801630
95% CI for difference: (-0.104754, 0.265081)
Test for difference = 0 (vs. $\neq 0$): $Z = 0.85$ P-Value = 0.396

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.435

Q. 15

Sample	X	N	Sample p
1	7	23	0.304348
2	7	32	0.218750

Difference = $p(1) - p(2)$
Estimate for difference: 0.0855978
95% CI for difference: (-0.150786, 0.321981)
Test for difference = 0 (vs. $\neq 0$): $Z = 0.71$ P-Value = 0.478

Fisher's exact test: P-Value = 0.539

Q. 16

Sample	X	N	Sample p
1	4	23	0.173913
2	2	32	0.062500

Difference = $p(1) - p(2)$
Estimate for difference: 0.111413
95% CI for difference: (-0.0647381, 0.287564)
Test for difference = 0 (vs. $\neq 0$): $Z = 1.24$ P-Value = 0.215

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.223

Q. 17

Sample	X	N	Sample p
1	16	23	0.695652
2	22	32	0.687500

Difference = $p(1) - p(2)$
Estimate for difference: 0.00815217
95% CI for difference: (-0.239138, 0.255443)
Test for difference = 0 (vs. $\neq 0$): $Z = 0.06$ P-Value = 0.948

Fisher's exact test: P-Value = 1.000

Q. 18

Sample	X	N	Sample p
1	12	22	0.545455
2	10	32	0.312500

Difference = $p(1) - p(2)$
Estimate for difference: 0.232955
95% CI for difference: (-0.0298823, 0.495791)
Test for difference = 0 (vs. $\neq 0$): $Z = 1.74$ P-Value = 0.082

Fisher's exact test: P-Value = 0.101

Q. 19

Sample	X	N	Sample p
1	12	22	0.545455
2	12	32	0.375000

Difference = $p(1) - p(2)$
Estimate for difference: 0.170455
95% CI for difference: (-0.0968054, 0.437714)
Test for difference = 0 (vs. $\neq 0$): $Z = 1.25$ P-Value = 0.211

Fisher's exact test: P-Value = 0.270

Q. 20

Sample	X	N	Sample p
1	10	22	0.454545
2	29	31	0.935484

Difference = $p(1) - p(2)$
Estimate for difference: -0.480938
95% CI for difference: (-0.706263, -0.255614)
Test for difference = 0 (vs. $\neq 0$): $Z = -4.18$ P-Value = 0.000

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.000

Q. 21

Sample	X	N	Sample p
1	6	22	0.272727
2	3	32	0.093750

Difference = $p(1) - p(2)$
Estimate for difference: 0.178977
95% CI for difference: (-0.0327606, 0.390715)
Test for difference = 0 (vs. $\neq 0$): $Z = 1.66$ P-Value = 0.098

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.136

Q. 22

Sample	X	N	Sample p
1	11	22	0.500000
2	13	32	0.406250

Difference = $p(1) - p(2)$
Estimate for difference: 0.09375
95% CI for difference: (-0.175711, 0.363211)
Test for difference = 0 (vs. $\neq 0$): $Z = 0.68$ P-Value = 0.495

Fisher's exact test: P-Value = 0.582

Q. 23

Sample	X	N	Sample p
1	11	22	0.500000
2	16	32	0.500000

Difference = $p(1) - p(2)$
Estimate for difference: 0
95% CI for difference: (-0.271412, 0.271412)
Test for difference = 0 (vs. $\neq 0$): $Z = 0.00$ P-Value = 1.000

Fisher's exact test: P-Value = 1.000

Q. 24

Sample	X	N	Sample p
1	8	22	0.363636
2	11	32	0.343750

Difference = $p(1) - p(2)$
Estimate for difference: 0.0198864
95% CI for difference: (-0.239896, 0.279668)
Test for difference = 0 (vs. $\neq 0$): $Z = 0.15$ P-Value = 0.881

Fisher's exact test: P-Value = 1.000

Q. 25

Sample	X	N	Sample p
1	5	23	0.217391
2	1	32	0.031250

Difference = p (1) - p (2)
Estimate for difference: 0.186141
95% CI for difference: (0.00711705, 0.365166)
Test for difference = 0 (vs. \neq 0): Z = 2.04 P-Value = 0.042

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.072

Q. 26

Sample	X	N	Sample p
1	13	23	0.565217
2	29	32	0.906250

Difference = p (1) - p (2)
Estimate for difference: -0.341033
95% CI for difference: (-0.567404, -0.114662)
Test for difference = 0 (vs. \neq 0): Z = -2.95 P-Value = 0.003

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.008

Q. 27

Sample	X	N	Sample p
1	12	23	0.521739
2	5	32	0.156250

Difference = p (1) - p (2)
Estimate for difference: 0.365489
95% CI for difference: (0.125693, 0.605286)
Test for difference = 0 (vs. \neq 0): Z = 2.99 P-Value = 0.003
Fisher's exact test: P-Value = 0.007

Q. 28

Sample	X	N	Sample p
1	4	23	0.173913
2	1	32	0.031250

Difference = $p(1) - p(2)$
Estimate for difference: 0.142663
95% CI for difference: (-0.0235582, 0.308884)
Test for difference = 0 (vs. $\neq 0$): $Z = 1.68$ P-Value = 0.093

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.149

Q. 29

Sample	X	N	Sample p
1	4	22	0.181818
2	0	32	0.000000

Difference = $p(1) - p(2)$
Estimate for difference: 0.181818
95% CI for difference: (0.0206496, 0.342987)
Test for difference = 0 (vs. $\neq 0$): $Z = 2.21$ P-Value = 0.027

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.023

Q. 30

Sample	X	N	Sample p
1	19	22	0.863636
2	31	32	0.968750

Difference = $p(1) - p(2)$
Estimate for difference: -0.105114
95% CI for difference: (-0.260671, 0.0504433)
Test for difference = 0 (vs. $\neq 0$): $Z = -1.32$ P-Value = 0.185

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.293

Q. 31

Sample	X	N	Sample p
1	8	23	0.347826
2	0	32	0.000000

Difference = p (1) - p (2)

Estimate for difference: 0.347826

95% CI for difference: (0.153179, 0.542473)

Test for difference = 0 (vs. \neq 0): Z = 3.50 P-Value = 0.000

* NOTE * The normal approximation may be inaccurate for small samples.

Fisher's exact test: P-Value = 0.000

Upon completion of the data analysis of the common questions among the surveys of both participants using *Minitab*, I then used the P-Value from each test to decipher if the group reached the null hypothesis and agreed on feelings of competency or rejected the null hypothesis and did not agree. With each proportions test a P-Value was provided. If the P-Value was less than or equal to 0.05 it rejected the null hypothesis and the two groups did not agree. If the P-Value was greater than 0.05 the data showed a null hypothesis and the two groups agreed.

The data from the proportions tests shows that on 14 of the 26 questions, or 66.7% of the P-Values stated there was a null hypothesis and the two groups agreed on their feelings of competency. There were only 8 questions, or 33.4% of the questions, where the null hypothesis was rejected and the P-Value indicated the two groups did not agree. The data shows that neither group of participants had a greater feeling of competency in the area of STEM, ultimately proving the researcher's hypothesis incorrect.

CHAPTER 5

DISCUSSION

Limitations

Unfortunately, there were a plethora of limitations regarding this research and data analysis. To begin, the pool of participants was small, from the same small rural community and attending the same university in some capacity. This small pool of participants' results may not generalize to all educators, especially those in highly populated, urban areas. The data collection was completed over a short period of time. In addition, participants could self-select if they wished to participate, ultimately leading to an even smaller pool of responses than originally planned. If the research were to be conducted again, the limitations of this research would be addressed to allow for increased validity of responses in relation to the hypothesis.

Future Research

While there are currently no plans to further this research, the results do lead me to believe that further research could be completed to provide a clear picture of teachers' feelings of competency in the area of STEM. As a participant of a STEM institute, I hear educators speak frequently of their feelings and lack of competency and overall confidence in implementing STEM lessons effectively and providing hands on learning opportunities for their students. The results of this study prove those feelings wrong. The P-Values from the proportions test suggest that both pre-service and in-service educators have feelings of competency.

If research were to continue, an increased number of educators would be surveyed, including in-service educators who are not currently seeking professional development in the area of STEM. In addition, survey questions may be modified to include short answer responses and not just a form of, "agree" or "disagree." This would allow the researcher to address feelings

of competency specifically and may push educators to answer honestly and with description. Also, by surveying a larger group of educators there would not be such a small pool of data to analyze.

Conclusion

Upon completion of the data analysis, the researcher's hypothesis was proved to be incorrect. It was hypothesized that the pre-service educators would have a greater feeling of competency in STEM due to use of technology and hands-on, project based learning. The data collected from the proportions tests of common survey questions from both groups prove that the majority of the questions were answered with feelings of competency from both pre-service and in-service educators. While this commonality should strike as a feeling of relief for the future of education and the future of our students who are taught by these STEM literate educators, as the researcher and current educator, I fear the results could be skewed. A self-select survey by two small groups could easily provide a clouded view of the true feelings of teacher competency in the area of STEM.

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APPENDIX A

CONSENT FORM FOR PARTICIPATION OF HUMAN PARTICIPANTS IN RESEARCH - UNIVERSITY OF WISCONSIN – PLATTEVILLE

PLEASE DO NOT PUT YOUR NAME ANYWHERE ON THIS SURVEY. There is no need to identify yourself.

You are being asked to complete this survey to help researchers better understand some of the behaviors and attitudes associated with teacher education students and current educators in the Midwest. Many of the questions will focus on your feelings of competency in the area of STEM education. Please be as honest with your responses as possible and answer all questions to the best of your knowledge. You should be able to complete the questionnaire in approximately twenty minutes.

Your participation in this survey is completely VOLUNTARY. By completing this survey you are giving your consent to be involved in the research. If at any point you decide that you do not want to complete the questionnaire, please respond to the email and inform the administrator. Your course grade or evaluation will not be affected if you decide not to participate, nor will your current teaching position. Once completed, the results of the study will be made available through the Education Department.

Your participation should present you with no risks, other than the time and effort involved in completing the materials. Further, you may benefit from your participation by learning about the research methods employed in the social sciences.

Please feel free to ask any questions you may have of the person who is giving you this survey, especially if you there is a word or phrase you do not understand.

Thank you for your cooperation and the time you have put into this research project.

If you should have concerns about your treatment as a participant of this research, please call or write:

Barb Barnet, Chair, UW-Platteville IRB
(608) 342-1942
barnetb@uwplatt.edu

Again, **PLEASE DO NOT PUT YOUR NAME ANYWHERE ON THIS SURVEY.**

Thank You,
Jenna Govier, Researcher
Dr. Karen Stinson, Faculty Sponsor
Department of Education
University of Wisconsin-Platteville
govierje@uwplatt.edu

APPENDIX B

Survey for Pre-Service Educators

STEM is the integration of science, technology, engineering, and math.

Demographics

1. Sex
2. Age
3. Do you have a minor in one of the STEM topics (science, technology, engineering, or math)?
4. What is the certification level that best fits you?

Attitudes

5. What is the main reason you do not have a minor in one of the STEM topics (science, technology, engineering, or math)?

Please indicate the degree to which you agree or disagree with each statement below by selecting your answer based on the following:

SA STRONGLY AGREE
A AGREE
UN UNCERTAIN
D DISAGREE
SD STRONGLY DISAGREE

6. I feel competent in integrating STEM in my future classroom.

Experiences

7. My student teaching experience provided me with opportunities to integrate STEM into my lessons.
8. During student teaching, my cooperating teacher integrated STEM into his/her teaching.

Pre-service STEM Teaching Efficacy Belief Instrument

9. When a student does better than usual in STEM topics, it is often because the teacher exerted a little extra effort.
10. I will continually find better ways to teach STEM topics.
11. Even if I try very hard, I will not teach STEM topics as well as I will most subjects.
12. When the grades of students in STEM topics improve, it is often due to their teacher having found a more effective teaching approach.
13. I know the steps necessary to teach STEM concepts effectively.
14. I will not be very effective in monitoring STEM activities.
15. If students are underachieving in STEM topics, it is most likely due to ineffective teaching.
16. I will generally teach STEM topics ineffectively.
17. The inadequacy of a student's background knowledge in STEM topics can be overcome by good teaching.
18. The low achievement of some students in STEM topics cannot generally be blamed on their teachers.
19. When a low-achieving child progresses in STEM, it is usually due to extra attention given by the teacher.
20. I understand STEM concepts well enough to be effective in teaching.
21. Increased effort in STEM teaching produces little change in some students' achievement.
22. The teacher is generally responsible for the achievement of students in STEM topics.
23. Students' achievement in STEM topics is directly related to their teacher's effectiveness in teaching.

24. If parents comment that their child is showing more interest in STEM topics at school, it is probably due to the performance of the child's teacher.
25. I will find it difficult to explain the meaning of STEM concepts to my students.
26. I will typically be able to answer students' questions regarding STEM concepts.
27. I wonder if I will have the necessary skills to teach STEM topics.
28. Given a choice, I will not invite the principal to evaluate a STEM activity in my classroom.
29. When a student has difficulty understanding a STEM concept, I will usually be at a loss as to how to help the student understand it better.
30. When teaching STEM topics, I will usually welcome student questions.
31. I do not know what to do to turn students on to STEM topics.

Survey for In-Service Educators

STEM is the integration of science, technology, engineering, and math.

Demographics

1. Sex
2. Age
3. Number of Years Teaching
4. What is the grade level that best fits you?

Attitudes

5. What is the main reason you chose NOT to participate in the STEM cohort?

Please indicate the degree to which you agree or disagree with each statement below by selecting your answer based on the following:

SA STRONGLY AGREE
A AGREE
UN UNCERTAIN
D DISAGREE
SD STRONGLY DISAGREE

6. My competence level in integrating STEM is high.

Experiences

7. I have opportunities for professional development in STEM topics.
8. I am integrating STEM in my classroom.

STEM Teaching Efficacy Belief Instrument

9. When a student does better than usual in STEM topics, it is often because the teacher exerted a little extra effort.
10. I am continually finding better ways to teach STEM topics.
11. Even when I try very hard, I don't teach STEM topics as well as I do most subjects.

12. When the grades of students in STEM topics improve, it is most often due to their teacher having found a more effective teaching approach.
13. I know the steps necessary to teach STEM concepts effectively.
14. I am not very effective in monitoring STEM activities.
15. If students are underachieving in STEM topics, it is most likely due to ineffective teaching.
16. I generally teach STEM topics ineffectively.
17. The inadequacy of a student's background knowledge in STEM topics can be overcome by good teaching.
18. The low achievement of some students in STEM topics cannot generally be blamed on their teachers.
19. When a low-achieving child progresses in STEM, it is usually due to extra attention given by the teacher.
20. I understand STEM concepts well enough to be effective in teaching.
21. Increased effort in STEM teaching produces little change in some students' achievement.
22. The teacher is generally responsible for the achievement of students in STEM topics.
23. Students' achievement in STEM topics is directly related to their teacher's effectiveness in teaching.
24. If parents comment that their child is showing more interest in STEM topics at school, it is probably due to the performance of the child's teacher.
25. I find it difficult to explain the meaning of STEM concepts to my students.
26. I am typically able to answer students' questions regarding STEM concepts.
27. I wonder if I have the necessary skills to teach STEM topics.

28. Given a choice, I would not invite the principal to evaluate a STEM activity in my classroom.
29. When a student has difficulty understanding a STEM concept, I am usually at a loss as to
how to help the student understand it better.
30. When teaching STEM topics, I usually welcome student questions.
31. I do not know what to do to turn students on to STEM topics.

APPENDIX C

DEBRIEFING FORM FOR THE STUDY ENTITLED: COMPETENCE IN THE AREA OF STEM WITH PRE-SERVICE AND IN-SERVICE EDUCATORS

Dear Participant,

Thank you for your participation in this study. The general purpose of this research is to research current and pre-service educators' feelings of competency in the area of STEM.

I invited pre-service educators completing the teacher education program at the University of Wisconsin-Platteville and current educators participating in a STEM Institute at the University of Wisconsin-Platteville to participate in this study. As your name was not on the questionnaire, the experimenter does not know individual results. The questionnaires that you completed gave the researcher information on your overall feeling of competency in the area of STEM.

It is hypothesized that individuals currently completing the pre-service teacher education program will have higher feelings of competency in the area of STEM. The results from this study will hopefully provide further information for researchers studying educator competency in the area of STEM education.

If you have any concerns or questions regarding your participation in this study please contact:

Barb Barnet
Chair of the University of Wisconsin-Platteville IRB
(608) 342-1942
barnetb@uwplatt.edu

Once completed, results of this study are available upon request. Please see contact information below to obtain a copy of the results.

Thank you again for your participation in this study.

Sincerely,
Jenna Govier
Department of Education, University of Wisconsin-Platteville
govierje@uwplatt.edu

Dr. Karen Stinson
Director of School of Education
(608) 342-1131
stinsonk@uwplatt.edu