

Improving Undergraduate Research Competence through a Directed and Collaborative Research Proposal Development- A Case Study

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Abstract: A pretest- posttest quasi-experimental design study was carried out to determine if a one-semester collaborative research proposal development by eleven (11) Fourth Year BSSED Biology students of Iloilo State College of Fisheries (ISCOF) Main Campus can improve their research competence in terms of their a. Basic Educational Research Knowledge, b. Ability to Synthesize and Evaluate Journal Articles in Biology Education, and 3. Understanding of their Proposed Research Topics. Wilcoxon Signed Rank Test for Related Samples showed a significant increase in basic educational research knowledge ($p= 0.018$, $\alpha=0.05$) and proposed topics understanding ($p= 0.007$, $\alpha=0.05$). Their ability to synthesize and evaluate educational researches remained the same ($p= 0.068$, $\alpha=0.05$). These results showed that the intervention was somehow successful in delivering improvement to the student-researchers' competence; however, further examination of raw post-test data for the 3 criteria with an overall competence mean of about 11 out of 20 reveal that it is only to the minimum accepted level. This study did accomplished two important tasks- first is preparing the student to have an in-depth grasp of his completed research proposal before presenting it to his/her chosen adviser and panel evaluators; and second, it provided grounded data on the value of collaborative activities in an undergraduate research proposal development. Continued monitoring and synthesis of additional findings up to the eventual completion of these students' researches can back up the creation of a Student Research Support Program in ISCOF.

Keywords: educational research, case study, collaborative learning.

I. RATIONALE

Students always face difficulties when it comes to conducting research as a requirement for graduation. In the case of BSSED Biology students of Iloilo State College of Fisheries-Main Campus, it seems like passing their research-related subjects cannot guarantee them the required competence and confidence to go through the intricacies of the research process. These students are typically trained to become educated consumers of research- meaning not only to be able to do research but also to evaluate research (Katzer, Cook, and Crouch 1998). The ability to do and evaluate research is already a good measure of competence. Consequently, becoming a proficient student researcher is more often part of the hidden curriculum of science education programs. For example, by learning how to do research, students learn something about how to evaluate them. By writing term papers, students learn how to locate, read, and understand research reports. In the preparation of laboratory reports, students become used to inquiry-based cognitive processes. Thus, what students learn about conducting and evaluating research is learned independently, as a prerequisite or by-product of other learning. But

despite all these expectations, students look as if they are totally clueless of what is going on in their research, how to do it, and how to defend it from critics, skeptics and most importantly against panel evaluators.

This study proposes ways in which a teacher can directly help his/her students to become competent research consumers by providing them with a manageable amount of support in the development of their research proposals. The role of the teacher/ mentor is simply to provide literature resources, facilitate improved decision making, review previous learning, promote peer collaboration, and conduct assessments that can stimulate reflective practice. The possible effects of this teacher involvement coupled with enhanced student peer collaborations must be clear. Whether the results are positive or negative in terms of improving undergraduate student competence, this study will ensure that all participants have finished their research proposals on time with better chances of conducting it to completion without added confusion and setbacks. It is on this light that this study was conducted.

II. THE PROBLEM

The Main Problem:

Fourth Year BSED Biology students of Iloilo State College of Fisheries-Main have difficulty developing their research proposals. They seem to be lacking the required competencies to undergo undergraduate research.

The Sub-Problems:

The following specific research questions were given attention for intervention:

1. Do Fourth Year BSED Biology students possess sufficient amount of knowledge on basic Educational Research?
2. Can Fourth Year BSED Biology students read, comprehend and evaluate educational research articles?
3. How knowledgeable and ready are these students on their proposed research topics?

III. INTEGRATED THEORETICAL FRAMEWORK, PARADIGM AND RELATED STUDIES

When students are enrolled in a traditional research course, they have trouble seeing the application and relevance of what they are learning. This inability to find relevance is perhaps the single greatest barrier that students face when learning about research methodology. Such profession bound that students see their research course as something to be endured, with little or no practical value to their future careers. For such students, a course focused on the evaluation of research, learning how to become better consumers of research, is a meaningful and logical application of a research course. This "consumer" focus creates relevance, which facilitates learning (Gagne 1985). In their future careers, these students will probably never conduct or supervise the type of research project that originates from a research institution. However, these future professionals will need to continue evaluating research in an effort to keep their programs and practices current and research based. Hence, the ability to evaluate research is arguably more important than the ability to conduct research (Rodriguez and Toews, 2005).

A growing body of research documents the positive outcomes of research experiences for undergraduates (Bauer and Bennett 2003; Hathaway et al. 2002; Hunter et al. 2007; Kardash 2000; Kremer and Bringle 1990; Lopatto 2004; Rauckhorst et al. 2001; Russell et al. 2007; Seymour et al. 2004). Undergraduates have reported personal gains such as increased confidence in their ability to do science, professional gains such as establishing working relationships with peers and mentors, intellectual gains such as learning to "think and work like a scientist," improved skills in performing techniques or communicating scientific findings, and increased career clarification and preparation (Hunter et al. 2007; Seymour et al. 2004). These gains have been corroborated by faculty mentors, who have noted that involvement in research helps undergraduates "become scientists" through their cognitive and personal growth and development of their professional identity (Hunter et al. 2007).

Undergraduate students can participate in research at several intensities. A common strategy is to teach about how research is conducted. Under this practice-oriented model students clarify career goals, develop relationships with mentors, and acquire some basic research skills but have few opportunities to apply them (Kremer and Bringle 1990). The technician model allows students to collect data, learn research techniques, and work as a team. Working as a technician is advantageous because students clarify their career path, develop relationships with mentors, see how coursework is connected with research, and often learn topics in great depth. Student technicians also often work alone and

independently, thus developing their problem-solving skills. The student colleague model involves the greatest level of participation and views the student as a research colleague (Kremer and Bringle 1990, Malachowski, 1996). Under this model, students make significant contributions to many portions of a research project. Students work collaboratively with mentors to develop hypotheses, design the study, analyze the data, and present their findings. As a result, students better understand the entire research process, learn the scientific literature and how to build on previous ideas, and understand the ethical implications of research (Kremer and Bringle 1990).

IV. SPECIFIC ACTIONS OR INTERVENTIONS

Intervention:

Pre-Evaluation:

Before the interventions were conducted, an initial evaluation of 1. Basic Educational Research Knowledge Test, 2. Research Article Comprehension, and 3. Understanding of Proposed Research Topic was made in the form of a pre-test. The students were also required to give their tentative research titles.

Intervention Proper:

- a. A Lecture Review covering the basics of educational research was done by the researcher. The content of the PowerPoint presentation was taken primarily from How to Design and Evaluate Research in Education, 7th Edition book by Fraenkel and Wallen (2009).
- b. The initial titles given by students were deliberated critically and alternative educational research topics were presented. Students were able to choose whether to stay with their topics or adapt a new topic from the given list of alternatives.
- c. When topics were finalized, formal research proposal development followed. Each student can choose to work with his/her adviser or work independently with appropriate guidance from the researcher. Each of the sections of the first 3 chapters of the research proposal was developed one after the other and discussed together with the other participants. A student is not only aware of his/her work but also with that of his/her peers. In this manner, a give and take of ideas can occur. An average of 5 hours/ week in one month time was utilized for this purpose.
- d. Students were also required to read 3 research articles related to their chosen topics and share it with the rest of the participants. This provided the researcher with data to rate their comprehension of journal articles.

Post Evaluation:

The same instruments used during the pre-evaluation were used to be able to measure whether the intervention has an impact on the research competence of BSED Biology students.

Participants:

Eleven (11) Fourth Year BSED Biology Students of Iloilo State College of Fisheries-Main, Tiwi, Barotac Nuevo, Iloilo, Philippines were purposively requested to participate in this study. Other BSED majors cannot participate because the researcher involved in the intervention is a Biology teacher and can only provide authentic support to students in his own discipline.

Research Instruments:

The following three (3) researcher-made instruments were used in this study:

- A. Basic Educational Research Knowledge Test- a 100-item Questionnaire that measures the educational research knowledge of student participants
- B. Educational Research Article Comprehension Rating Rubric- measures the ability of participants to comprehend, and evaluate a given journal article based on delivery of 1. Problem/Topic Interest, 2. Methodology/Approach, 3. Literature and 4. Findings/Implications- each of these 4 criteria is scored up to 25 points maximum for a total of 100 points.
- C. Proposed Research Topic Understanding Questionnaire- a 20-item Questionnaire that measures the level of understanding each participants have on the current research topic they are studying. Data was later transformed by multiplying by 5 to make it 100 points to fit the scale of the previous instruments.

Data Collection Procedure:

This study relied on a quasi-experimental design specifically pretest-posttest design, thus, the data collection procedure was primarily done before and after the intervention using the above mentioned instruments. Researcher notes provided qualitative data and were embedded in the discussion of results.

Data Analysis Procedure:

Student scores from the three questionnaires were interpreted as follows respectively:

- 0-20 Poor Knowledge/ Comprehension/ Understanding
- 21-40 Below Average Knowledge/ Comprehension/ Understanding
- 41-60 Average Knowledge/ Comprehension/ Understanding
- 61-80 Above Average Knowledge/ Comprehension/ Understanding
- 81-100 Excellent Knowledge/ Comprehension/ Understanding

Because the assumptions for a Dependent Samples T-test were never met in this study, the non-parametric Wilcoxon Signed Rank Test for Related Samples was used to analyze differences between pretest and posttest scores. Descriptive Statistics was also measured while qualitative data was analyzed and synthesized in the discussion section.

V. RESULTS

The following were the initial research titles by BSED Biology students. Most if not all cannot be categorized as education research while some are not researchable at all.

1. Avifaunal Composition of Mangroves in Brgy. Guintas Barotac, Nuevo, Iloilo
2. Epiphytes at Different Canopy Levels of Mangroves at Brgy. Guintas, Barotac Nuevo
3. Health Benefits and Medicinal Uses of Malunggay
4. Health Profile of Brgy. Bungca, Barotac Nuevo, Iloilo: Basis for Program
5. Solid Waste Management Practices in Town Proper of Barotac Nuevo
6. Waste Disposal Practices of Brgy. Tiwi as Basis for Policy Making
7. Save Me Movement: Actions Towards Planet Earth
8. Youth Involvement in Waste Management in Brgy. Bungca, Barotac Nuevo, Iloilo
9. Urban Gardening Practices of Residents of Poblacion, Barotac Nuevo, Iloilo
10. Application of Compost Tea as a Standalone Nutrient Medium in Hydroponics System
11. Herbal Plants: Substitute for Alternative Medicines

The listings below were the final titles. Seven students decided to change their titles while 4 students (italics) decided to keep their initial titles because they have already finalized it with their advisers.

1. Student Teacher Self Evaluation Using Lecturescribe Software
2. Teaching Styles of BSED Biology Student-Teachers- Is it Discipline Dependent?
3. Availability and Utilization of Iloilo State College of Fisheries Science Laboratories for Biology Education
4. Teaching Self-Efficacy and Demo-Teaching Performance of Iloilo State College of Fisheries BSED Biology Student Teachers
5. Difficult Topics in Biology as Perceived by Students and Biology Teachers
6. Shoreline Protection Strategies of Banate-Barotac Bay Resource Management Council, Inc. vis-a-vis Community Involvement

7. *Solid Waste Disposal Practices of Sitio Kalubihan, Brgy. Tiwi, Barotac Nuevo, Iloilo*
8. *Application of Compost Tea as a Standalone Nutrient Medium in Hydroponics System*
9. Graphical Conceptions of Environmental Issues by 4th Year Highschool Students of ISCOF FMSHS
10. *Avifaunal Composition of Mangroves in Brgy. Guintas Barotac, Nuevo, Iloilo*
11. *Epiphytes at Different Canopy Levels of Mangroves at Brgy. Guintas, Barotac Nuevo, Iloilo*

Descriptive data on Knowledge of Basic Educational Research, Educational Research Article Comprehension, and Proposed Research Topic Understanding are summarized in the tables below:

Table 1. Pretest-Posttest and Scores Crosstabs

		Basic Education Research Knowledge Test			Total		
		below average	average	above average			
Time	Pretest	10	1	0	11		
	Posttest	3	6	2	11		
Total		13	7	2	22		
		Research Article Comprehension Ratings				Total	
		poor	below average	average	above average		excellent
Time	Pretest	1	4	3	2	1	11
	Posttest	0	3	1	2	5	11
Total		1	7	4	4	6	22
		Proposed Research Topic Understanding				Total	
		poor	below average	average	above average		
Time	Pretest	1	9	1	0		11
	Posttest	0	5	1	5		11
Total		1	14	2	5		22

Table 2. Mean Scores of the 11 BSEd Biology Students in 3 Tests

Test	Pre-test Mean (n=11) Score	Post-test Mean (n=11) Score	p-value ($\alpha=0.05$)	Findings
1. Basic Education Research Knowledge (BERKT)	35	50	0.018	significant
2. Research Article Comprehension Ratings (RACR)	46	62	0.068	not significant
4. Proposed Research Topic Understanding (PTUT)	34	55	0.007	significant

Wilcoxon Signed Rank test showed that there is a significant difference ($p=0.018$) between the Basic Education Research Knowledge (BERKT) pretest (35) and post-test (50) scores. In terms of their Research Article Comprehension Ratings (RACR) however; there is no significant difference ($p=0.068$) between the pretest (46) and post-test (62) scores. Finally, there is a significant difference ($p=0.007$) between the Proposed Research Topic Understanding (PTUT) pretest (34) and post-test (55) scores.

VI. DISCUSSION OF SIGNIFICANT FINDINGS

Despite the significant increase in the post-test scores in terms of Basic Educational Research Knowledge, the mean value of 50 out of 100 is still a mediocre value. The mean pre-test score of 35 is a clear indication that students have little retention of basic concepts and terminologies in their Educational Research subject. Nevertheless, the intervention has somehow increased that below average knowledge value to an average one. Perhaps if they have already completed the entire study/ manuscript, we can expect an additional increase on this aspect of research competence. Students need to understand the components of a research report: the title, abstract, introduction, literature review, methods including the sample, procedures, and instruments, results, and discussion sections. Students need to understand the sequencing of these

sections, the importance of each section, and the type of information included in each section. Students should consider issues such as misleading titles, unclear methodology, and incongruence among the sections.

Comparisons on their ability to comprehend and evaluate related journal articles on the other hand showed no significant difference. The students have already reached a stage wherein they have already established a stable cognitive framework to process scholarly works. This stability applies both to their competence and incompetence as well. If we look at raw data, 5 out of 6 students became excellent consumers of literature since it started with only 1 after the pre-test. It was due to inconsistencies that made results not significantly different because some students who were already in a higher level of research article comprehension after the pre-test, went down to a lower level after the post-test. A common misconception of undergraduate graduate students is that journal articles are relatively flawless. They are not aware of the relatively imperfect nature of research reports that when questioned in a critical manner, they become confused and thus provide inconsistent transfer of information. Moreover, the researcher still considers the basic educational foundation of students as the culprit. Their lack of ability to report properly what they have read and synthesized to the researcher is due primarily to their inadequacy with the English Language. If they are allowed to express in the vernacular and that the teacher mentor explains difficult terms and concepts in the article, these students perform relatively way better.

Student understanding of their initial topics before the intervention is very weak with a mean of 34 out of 100. It increased significantly to 55 after the post-test. This result is expected because after the intervention, students were able to get a better grasp of their research topics after being able to write down the background, significance, limitations, related studies, and methodologies. If the researcher is explaining a technical format or criticize a particular student, the other student participants also learn by modelling the experience or process. Collaborative discussions also fostered exchange of ideas that increased the awareness of each participant of the strengths and limits of his/her study. Before they were able to finalize their research titles, student participants are complaining about the lack of support from their advisers in terms of making them understand what they are going to study. They also admitted that the titles are not theirs- they were simply suggested by their chosen advisers and some members of the faculty. When asked about why they should conduct the study or what will be the research design and instruments to be used, they are so clueless. It is alarming that students construct titles then chose their advisers immediately without yet finishing the entire proposal. The students become bound to a certain title and the chosen adviser who will eventually prove inappropriate as the research proposal development progresses. This is the reason why some students decided to remain with their initial titles because they feel that they will betray their advisers and the topics they suggested to them.

VII. RECOMMENDATIONS

A unified school program that provides grounded support to undergraduate students' research proposal development must be made. This must however be backed up by additional action researches and must consider students and mentors in other fields of specialization.

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