RESEARCH CAPABILITIES OF SENIOR HIGH SCHOOL STUDENTS

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Abstract - The purpose of the study was to describe the level of research capabilities of students in the senior high school department of a local university. Differences in the capabilities of students when grouped according to gender were also investigated. In addition, in-depth understanding of their perceived research capability levels was explored. A sequential explanatory mixed-method approach was employed, with 46 Grade 12 students being chosen as respondents through convenience sampling. The study started from a quantitative exploration of the students' conceptual understanding of the four components of research (the nature of inquiry, understanding of literature and studies, research method, and interpreting results). The Research Achievement Test (RAT) developed prior to this study was used to quantitatively describe the students' research competencies. Observations on their test performances were used to develop the interview component of the test. Results showed that overall, the students' research capabilities were only at the average level. Male and female students were comparable in the ability to conduct research. Opportunities for quantitative instruction were lacking in the context of the participants. The implications for research instruction are discussed in the paper.

Keywords: research capabilities, research literacy, K12, senior high school

INTRODUCTION

K12 in the Philippines

The promulgation of Republic Act No. 10533, otherwise known as the Enhanced Basic Education Act of 2013, increased the number of years for basic education in the Philippines. The previous duration of 10 years of basic education was expanded to 13 years to accommodate Kindergarten and Grades 11 and 12. The expanded period has been popularly referred to in the country as K12.The shift to this new educational system necessarily led to the design of a curriculum relevant to the ever fast-paced modern world (K12 Philippines, 2015a). K12 was fully implemented beginning school year 2016-2017.

Students of Grades 11 and 12, which together form what is more aptly called senior high school (SHS), go through a core curriculum under a track of their choice. Four career tracks are offered:
1. Academic
    a. ABM (Accountancy, Business, and Management)
    b. STEM (Science, Technology, Engineering, and Mathematics)
    c. HUMMS (Humanities and Social Science)
    d. General Academic
2. Arts and Design
3. Sports
4. Technical-Vocational-Livelihood

The core curriculum is complemented afterwards with applied and specialized subjects specific to the chosen track (K12 Philippines, 2015b).

Practical Research is one of the new subjects in the enhanced basic education curriculum. It is an applied track subject that is twofold, covering quantitative and qualitative research consecutively. In this subject, students are expected to learn about qualitative and quantitative research designs and their application in the actual conduct of a research. SHS students carry out a research capstone project as a culminating requirement for their respective tracks. Practical Research aims to develop research literacy among SHS students, while recognizing that there may be other possible intervening factors in the delivery of the subject (teacher competency, availability of learning resources, etc.).

THEORETICAL FRAMEWORK

The significance of undertaking research and being involved in the research process cannot be underestimated especially in this global era. Powell (2016) defined "research literacy" as "*the capacity to obtain, process and understand basic information needed to make informed decisions about research participation*" (p. 3, italics in the original). Very few will contest the relevance of promoting research literacy in educational institutions since it helps individuals understand this complex and ever-changing world.

Research literacy is higher and research participation is more evident among undergraduate and graduate students. This situation can be mainly attributed to the undertaking of research projects at the bachelor's and master's levels as a major academic requirement and as proof of one's scholarship. Nevertheless, students in basic education are also being given learning exposure to research. McKee (2003) pointed out three reasons for conducting research: it (1) increases knowledge and understanding, (2) provides evidence for decision- and policy-making, (3) advances professional practice and generates new ideas that can lead to service innovation and improvement.

It is for this reason that teaching students how to conduct research is part of the curriculum in the basic education program. Students need research skills as outlined by the Common Core State Standards (CCSS) in the case of United States. These research skills will prepare students for college, workforce training, and life in technological society. As students undertake research projects, they improve their ability to gather, understand, evaluate, synthesize, and summarize information. More importantly, students can conduct original research to answer questions, analyze related literature, and solve problems (CCSS, 2013).

Research Capabilities of SHS Students in the Philippines

The Philippine educational system recognizes the importance of acquiring research knowledge and skills in the precollege years. A clear proof of this recognition may be seen in the inclusion of Practical Research as a subject in the new K12 curriculum.

Our study involved SHS students in a private, not-for-profit higher education institution (which we will disguise and refer to in this paper as ABC University or ABCU) in Metro Manila. In 2016, the DepEd granted ABCU the permit to operate a SHS. ABCU thus joined the ranks of many universities in the country delivering research courses to their SHS students.

In ABCU's case, however, the SHS courses form part of an academic program that integrates the SHS years into a plan of studies that has strong liberal education roots and that seamlessly leads to undergraduate and graduate degrees. This innovative linkage between SHS and university-level education made the research course offered by ABCU to its Grade 12 students a very interesting case to look into.

We considered it worthwhile to see if the students' are developing research skills that can prepare them for the university-level components of the integrated plan of studies. We also sought to gather the perceptions of the SHS students and their school dean regarding the students' research experiences. Figure 1 shows the conceptual framework that guided our study.
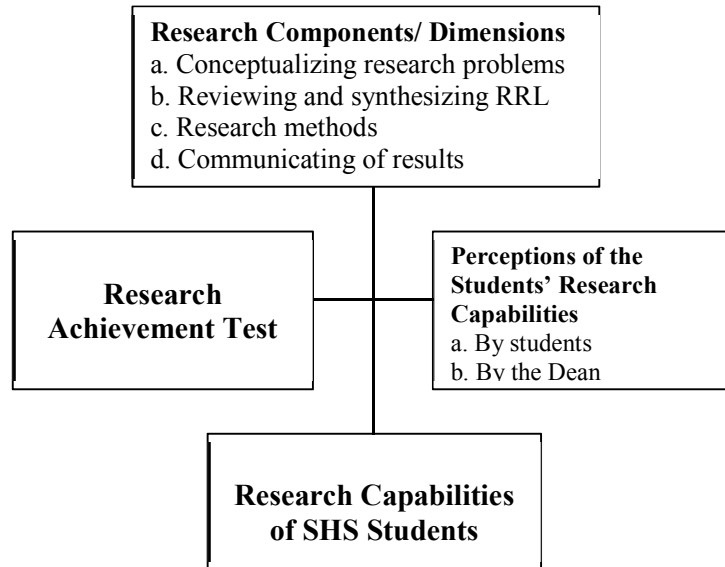
METHOD

Research Design

The study used mixed-method research. The design is sequential, which is indicated by the procedural notation "Quan -->Qual. "Quantitative data were first collected, followed by the gathering of qualitative data. The results of the quantitative method were intended to inform the modifications, if there would be any, in the predetermined qualitative method.

Participants

There are three sections of Grade 12 students in ABC University. We (the researchers) were given permission to administer the Research Achievement Test (RAT) to two sections. A total of46 students (31 females and 15 males), equivalent to 51% of the total population of Grade 12 students enrolled in the research writing course, participated in the study. The participants were all the Grade 12 students who were present in class at the time the RAT was administered. They were all under the

Humanities and Social Science (HUMMS) track. Whenwe conducted the study, the students had already learned the steps in doing research and were about to begin writing their final paper requirement. The same batch of SHS students completed the course Statistics and Probability in school year 2016-2017 when they were in Grade 11. The course covered the introduction to inferential statistics and data analysis.

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│ Research Components/ Dimensions      │
│ a. Conceptualizing research problems │
│ b. Reviewing and synthesizing RRL    │
│ c. Research methods                  │
│ d. Communicating of results          │
└─────────────────────────────────────┘

┌──────────────────┐     ┌─────────────────────────┐
│                  │     │ Perceptions of the      │
│    Research      │     │ Students' Research      │
│ Achievement Test │     │ Capabilities            │
│                  │     │ a. By students          │
│                  │     │ b. By the Dean          │
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          │ Research Capabilities │
          │ of SHS Students       │
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Figure 1. Conceptual Framework

The Dean of the college that oversees the SHS also participated in the study by giving insights on the conduct of the research course, the students' performance in the course, and the plans for the improvement of the course.

Measures
Quantitative instrument
A Research Achievement Test (RAT) developed under the K to 12 Research Curriculum was administered to Grade 12 SHS students. The test touches on four factors: the nature of the research problem, review of related literature, research method, and interpreting the results of the study (see Appendix A).

Qualitative instruments
The Research Capability Interview Questionnaire (RCIQ) was used to validate the students' performance on the test (see Appendix B). The questions were anchored on the four dimensions of the RAT. The questionnaire was also used to find out the students' perception of their research capability. Another set of questions was sent to the Dean of the college to gather more insights about the students' research capability.

Data Collection
Three sets of data were gathered in the study. The first was the quantitative data set obtained from the RAT. The second and third sets, consisting of qualitative data, were drawn from the interviews with the SHS students and their Dean.
To collect the data, our research team secured permission from the Dean to administer the RAT among the Grade 12 students and afterwards interview six students and the Dean herself. The administration of the RAT to two sections was arranged directly with the course instructor. After analyzing the results of RAT and preparing the RCIQ, our team requested the course instructor to allow

six students (three boys and three girls) to be excused from class for one-on-one interviews. The RCIQ for the teacher was administered instead to the Dean due to the former's unavailability.

The data collection procedure employed in the study is illustrated in Figure 2.

Data *Analysis*
Checking of assumptions

The results of the RAT and the grades of students in the research course were subjected to outliers, linear relationship, test for normality, and homoscedasticity.
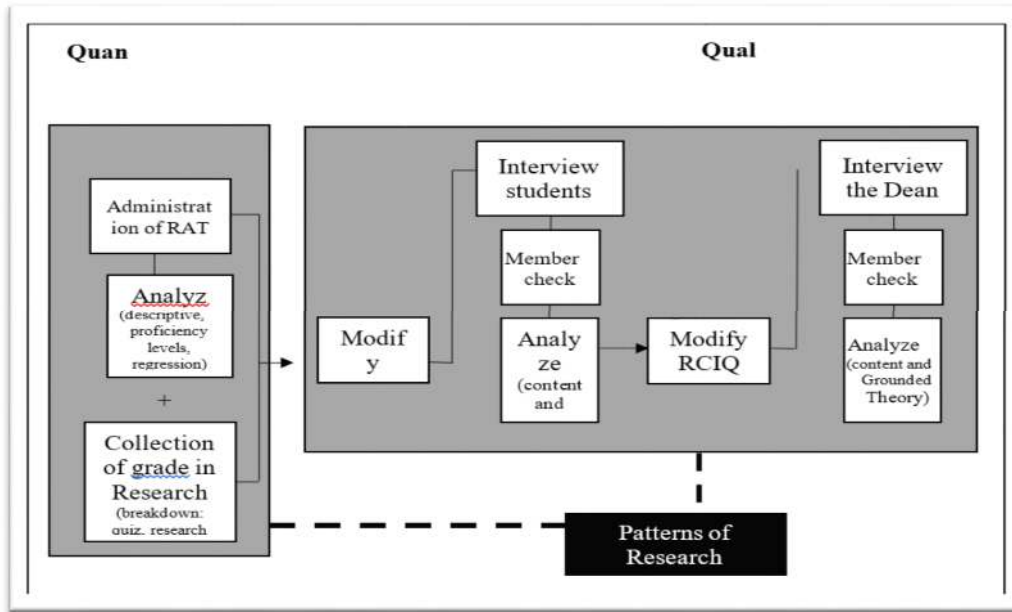
Figure 2. Data Collection Procedure for an Exploratory Sequential Mixed-Method on Research Capabilities of Grade 12 SHS Students

Quantitative data analysis

To analyze the results of RAT, descriptive statistics and proficiency scores according to RAT levels were used.To determinewhether there was a difference in the research capabilities of the students when grouped according to sex, a t-test for independent means was conducted.

Qualitative data analysis

To obtain valid and rich data, athree-stage procedure—capta collection from interviews with students and teachers, member checking, and data analysis—was carried out. For the capta stage, our teaminterviewed six students using the guide questions from the RCIQ. The questions from the RCIQ were already constructed but were later on modified based on the results of the RAT. The responses of students were analyzed. The students' interview responses likewise informed the modifications made in the interview questionnaire for the Dean. The students' responses were recorded and transcribed with their permission.

A synthesis of each of the participant's responses was made and shared with the participantsafter each interview session. This step served as the step of member checking in a qualitative study. Itvalidated the researchers'understanding of the research capabilities of the participants.

The transcribed responses were subjected to content analysis and Grounded Theory. In content analysis, the texts are coded. A code is a unit of analysis that serves as a label for texts being studied. Open coding was first performed. The coding units were then clustered together to form the contextual units. Related contextual units were grouped together to form the themes. The frequency of themes in the transcripts was also identified.

RESULT AND DISCUSSION

Level of Research Capabilities of SHS Students

The performance of the SHS students as a class is shown in Table 1. The positive skewness for the nature of inquiry (0.08) and method (0.82) indicates that the students had difficulty in these components of research. The negative skewness for knowledge of the literature of interest (-0.28) and interpretation of results (-0.50) show that students were capable of handling these components.

Table 1. Descriptive Statistics of the SHS Students' Capabilities in the Four Components of Research (n=46)

Components	Mean	SD	Skew.	Kurtosis	Min	Max
Nature	5.89	1.58	0.08	0.12	3	10
Literature	3.30	1.17	-0.28	-0.52	1	5
Method	8.76	2.98	0.82	3.85	2	20
Interpretation	6.46	2.08	-0.50	-0.66	3	10
Overall	24.80	5.54	-0.43	0.92	9	38

The details of the performance of the students per component and as a whole were classified into five: *superior*(Score + 2SD and above), *above average*(Score + 1SD to Score +2SD), *average*(Score - 1SD to Score +1SD), *below average* (Score - 1SD to Score -2SD), and *low/poor* (Score - 2SD and below).

Table 2 shows the distribution of performance classifications in the test. More than half of the students were at the above average level for the nature of inquiry (f = 24, 52%). Close to half were at the average level for the literature part (f = 22, 48%). For the research method component, 30% were at the above average level (f = 14, 30%) and another 30% at the average level (f = 14, 30%). Close to half were at the superior level for the interpretation of results part (f = 21, 46%). Overall, the research capability of the students wasat the average level (f=26, 57%).

Table 2. Distribution of Level of Research Capabilities of SHS Students (n=46)

Components	Superior		Above Average		Average		Below Average		Low/Poor		
				%	f	%	f	%	F	%	Total
Nature		3	4	52	7	15	9	20	0	0	100%
Literature		7	2	26	22	48	4	9	8	17	100%
Method	0	2	4	30	14	30	4	9	4	9	100%
Interpretation	1	6		20	8	17	3	7	5	11	100%
Overall			2	26	26	57	6	13	1	2	100%

Additional observations of the performance of students in each component were done. Focusing on items with low *p* indexes, the following qualitative judgments were made: For the nature of inquiry, the students could not identify the appropriate scope and delimitation of a study. For the knowledge of literature, the students had difficulty selecting the required hypotheses, as well as giving credits to primary sources. Among the four components of research capabilities, the students had the lowest performance on items addressing quantitative research methods. Specifically, they had difficulty with the research procedure, identifying a population and selecting a sample, detecting sampling bias, doing statistical analysis, and interpreting the data in a form of a chart. These difficulties were used to formulate questions for further investigation. The results are discussed in a later section.

Gender-Related Differences in the Research Capabilities of the Students

Table 3 shows that there were no significant differences between the male and female students in all the four research components, as well as in the overall research capability as measured by the RAT.

Table 3. Independent t-test on Research Capabilities of Male and Female SHS Students
(Male=15, Female = 31)

Research Aspects	Group	Mean	SD	t-test	Sig. (2-tailed)
Nature of Inquiry	Male	5.33	1.77	1.01	.32
	Female	6.06	1.48		
Knowledge of Literature	Male	3.27	1.23	0.15	.88
	Female	3.22	1.17		
Research Method	Male	8.86	3.91	0.14	.89
	Female	8.71	2.48		
Interpreting results	Male	6.33	2.35	1.09	.29
	Female	7.09	1.92		

The Students' Perception of Their Research Capability

The students' interview responses validated the results of theRAT. Table 4 shows the comparison between the quantitative (RAT) and qualitative (interview responses) data gathered, categorized according to the four major research components.

Table 4. Summary of Quantitative and Qualitative Data Gathered

Quantitative (RAT Results)	Qualitative (One-on-One Interviews)
Nature of Research	
Cannot identify the scope and delimitation	Basis for Scope and Delimitation are the following: Personal Resources and Availability, Context, and Design of Research
Review of Related Literature	
▪ Difficulty in formulating hypothesis ▪ Difficulty in giving credits to primary sources	▪ No clear idea of how to formulate hypothesis ▪ Acknowledgment, Citation Styles, Time-consuming (if done manually)
Research Methods	
▪ Low in qualitative research skills specifically on the following: Procedure, Data analysis, and Data presentation ▪ No mastery in quantitative research design ▪ Not familiar with the difference between sample and population ▪ Cannot detect bias in sampling	▪ Research Methods is based on personal constraints ▪ Knowledge of Doing Market Research only ▪ Confident in doing research (Chapters 1 to 5 as steps in Doing Qualitative Research) ▪ Generally low knowledge of Sampling Designs
Research Results	
Cannot interpret frequency distribution	▪ Data Representation (Charts and Graphs) ▪ Personal Insights ▪ Creating Patterns ▪ Reference to Research (RRL)

For the nature of research, review of related literature, and research results, the six students who were interviewed claimed that they did not have difficulties in these areas. However, their inaccurate responses to the questions posed during the interviews showed that the students were not adept in these areas as supported by the results of RAT. For the question "What are the considerations in identifying the scope and delimitation of a study?" the participants 'answers referred to their personal limitations and capabilities (i.e., time, resources), rather than to the study or research itself. With regard to citing sources, all six students said that they did not have difficulty in this task, giving the reason that online resources that check citations are available. However, the RAT results show otherwise. Three out of the six interviewees said that they did not know how to formulate hypotheses. The other three just described the characteristics of a hypothesis but not the actual steps in formulating it. Hence, the interview results showed that they did not have a clear idea of how to formulate hypotheses. Sampling was another topic in which the students had difficulty, as indicated by the RAT results. This was validated during the interviews when the students found it difficult to answer the question "How do you avoid biases in sampling?" The interviews corroborated the results of the RAT.

At the same time, the students interviewed admitted that they lacked the knowledge and skills in conducting quantitative research. Only two out of the six interviewees demonstrated some knowledge about quantitative research designs. Moreover, the two attributed their knowledge to their having studied in science high schools and not to their learning about it in their SHS research course. The other interviewees explicitly said that they were not familiar with conducting quantitative studies. The students described themselves as more confident in and more capable of conducting qualitative than quantitative research. This description validated the results of the RAT and the interviews, which indicated that the students' lack of knowledge and skills in quantitative research made them prefer doing qualitative studies.

The Dean's Perception of the Students' Research Capability

The RAT results were shown to the college Dean to find out the possible reasons for the students 'low scores in some areas and topics. The Dean cited these reasons cited :

1. The areas or topics where the students scored low were not covered in the current research course (i.e., qualitative research designs, sampling methods, collection and analysis of qualitative data).
2. The main objective of the research course that the Grade 12 students were taking (at the time of the study) is the development of basic research skills only (i.e., choosing a research topic, planning and managing a research project, finding and evaluating sources, and using the MLA and APA styles of citation and documentation).
3. The college prioritizes quality over quantity—i.e., cover a few topics but with mastery, rather than cover a lot of content without learning.
4. A more specialized research course will be offered when the students take their college courses. It would be best if the students would stay in the program after completing SHS because the curriculum, together with the schedule of courses, had been designed as formative.
5. The assumption that guided the college in the design of the research course syllabus was that the students did not have any background on research. Hence, the course started with the basics of doing research. Since the RAT was based on the research course syllabus prescribed by the Department of Education, the test items did not correspond to what was discussed in the research course.

To complete the research knowledge and skills that the college hopes to develop among the Grade 12 students, a course titled Applied Integrated Studies (AIS) will be the next research subject that the students will take. According to the Dean, the course will teach the students how to do action research in the schools adopted by ABC University. Hence, AIS will serve two purposes: academic learning and, at the same time, social outreach for the students.

As regards the qualifications of the research course instructor, it was observed that the college prefers to hire instructors who hold master's degrees. There is no prescription for either the area of specialization or the number of years of teaching experience. The priority given to hiring master's degree holders is based on the CHED policy that instructors who teach at higher education institutions should have at least a master's degree. Since the SHS is lodged in a University program, it has become a practice that even those who handle subjects in Grades 11 and 12 should at least be master's degree holders. In the case of the classes where the RAT was administered, the course instructor is a master's degree holder in Humanities, with a year of teaching experience.

CONCLUSION

Our study looked into the SHS students' research capabilities, as well as the perceptions of both the SHS students and the college Dean regarding the students' research experiences. Given the unique features of theSHS program of ABC University, it was worthwhile to examine if the research course that the University delivers prepare its SHS students for the next phases of the integrated program.

Our findingsindicate that overall, the SHS students had average capability in the conduct of research. We found no significant difference between the male and female students in relation to their capability to deal with the four aspects of research (nature of research, review of related literature, research methods, and research results). Furthermore, the students see themselves as being more capable of undertaking qualitative, rather than, quantitative research. The college Dean emphasized that the research subjects that the students take in SHS do not cover some of the areas and topics that comprise the RAT. The focus of the SHS research subjects is to teach the basics of research, based on the assumption that the students have zero research knowledge and skills (which is why they are taught basic research). Based on the findings, the following are recommended:

1. A balance of quantitative and qualitative instruction in the research program is suggested to enable the students to acquire skills in these two types of research.
2. Benchmarking the school's research curricula with those of other SHSs is recommended to ensure that the basic concepts and skills are on a parwith those of students in other schools.

Limitations of the Study

In conducting our study, our research team acknowledges the shortcomings, influences, and conditions that we were not able to control and that might have had an impact on the research processes that we followed and the results that we obtained.

The first limitation of our study was the fact that only one track was sampled to describe the research capabilities of the students. The results would have been more representative and rigorous if all the tracks were sampled. We also acknowledge the issue of sample inadequacy that might have had an impact on the generalizability of the results. Moreover, the study would have been more defensible if the participants included students from both public and private schools.

We likewise acknowledge another omission: our not having gathered the teachers' perceptions of the research capabilities of the students. These perceptions could have helped us draw a fuller description of the research capabilities of the SHS students who participated in our study.

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