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Research Article

Science Process Skills and Research Competence of Grade 12 Learners in the Province of Iloilo

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ABSTRACT

The descriptive-correlational study determined the relationship between science process skills and research competence among Grade 12 learners. This was conducted in the Province of Iloilo for School Year 2019-2020. The respondents are 359 Grade 12 learners chosen through systematic cluster random sampling covering the five (5) districts of the province. The results disclose that as an entire group, the Grade 12 learners possess "developing/ moderate" science process skills when classified as to district. The research competence of Grade 12 learners as an entire group is "competent" and when classified as to district range from "not competent" to "competent". Significant differences existed in the science process skills taken as a whole when classified as to district. No significant difference in the experimenting skills of the learners classified as to district. The research competence of the learners significantly differed when grouped as to district. Finally, a low and significant relationship existed between the science process skills and research competence of Grade 12 learners.

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INTRODUCTION

The implementation of the K to 12 curriculum among Department of Education schools had brought big changes in the educational system of the Philippines. The graduates can be globally competitive with those of other countries in terms of training provided, skills learned, and competencies developed. Despite these changes in the curriculum, Education Commission (EDCOM, 2015) still reported low achievement of learners in the different disciplines more specifically in English, Science, and Mathematics. This entails a kind of focus on how this pressing problem will be addressed. Students need to reach different types of information to fill in the gap in student achievement.

Science process skills could help students to get this information (Dela Fuente, 2019; Burke, 2014; Aydoğdu, 2014). These process skills are important elements that may influence students' performance. According to Johnston (2009) supported by Dela Fuente (2021), science process skills are significant in improving students' cognitive development and facilitating students' active participation during the teaching and learning process. Furthermore, science process skills are the basis for scientific thinking and research (Mutlu & Temiz, 2013). Besides, these are the thinking skills that were used to get information, and tools that acquire information about the world and the order of this information (Ostlund, 1992). The process of getting information, problem-solving, and many others as defined in science process skills has something to do with research competence, since the scientific research process can be described as identifying a problem, gathering data, analyzing the data, and interpreting the gathered results (Fraenkel & Wallen, 2011).

On the other hand, research is widely recognized as an important tool for solving man's various problems and in making life more colorful and convenient (Ciocon, 2018). Moreover, the purpose of research is to serve man and its goal is good. Hence, due to research man becomes progressive because man is utilizing the products of research. The Department of Education as an agency of the government implemented the K to 12 curriculum which aims to provide sufficient time for the mastery of concepts and skills, develop lifelong learners, and prepare graduates for tertiary education, middle-level skills development, employment, and entrepreneurship. One of the salient features of this curriculum is it is learner-centered, inclusive, and research-based.

In this curriculum, all senior high school students, regardless of their track, need to undergo quantitative research writing. This is the result of the mandate which states that the curriculum shall be relevant, responsive, and research-based (Department of Education, 2013). Writing a research output, as observed, is difficult for the students. The formulation of each component in every chapter of the research output becomes a burden on the part of the students (Ciocon, 2018). A national study was conducted in a state-funded university in the Philippines on AY 2011-2012 involving 963 graduating college students. The results of the study showed that students performed poorly in identifying and arranging steps involved in a research process. Less than half of the students are at least proficient in research. Basic research skills had already been introduced in secondary education, yet results seemed to reveal that students who will soon join the labor market are not fully equipped with these skills (Dela Fuente & Biñas, 2020; Arellano et al., 2012).

This study was anchored on the Constructivism Theory of Jerome Bruner (1966) which points out that learning is an active process in which learners construct new ideas or concepts based on their current/past knowledge. The learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so (Dela Fuente, 2021). According to the constructivist theory of learning, effective teaching must offer experiences that encourage students to become active, self-directed learners (Smith, 2007). Students learn best when they gain knowledge through exploration and active learning and teachers develop their higher-order thinking (Dela Fuente, 2021). The different theories used as bases of this study recognize the importance of the learners' active participation, and individual differences and that their new ideas or concepts are based upon their current/past knowledge.

This study was also anchored in the law of readiness. Thorndike's Law of Readiness refers to a preparatory set on the part of the organism to learn. It points out that one learns only when he is

physically and mentally ready for it. In other words, the preparatory set on the part of the organism is an important condition for learning. When the organism is prepared to do some work, the act of doing is satisfying, and not doing it is annoying. Conversely, when he does not want to work, forcing him to work is dissatisfying. If students are not willing to learn, forcing them to learn will cause dissatisfaction and annoyance. Many students soon get disinterested in learning because they are forced to learn when they are not physically and mentally ready (Thorndike, 1898). The readiness of the students to learn how to conduct research is not enough. Strengthening the research process skills of the students in junior high school could help them to be ready in conducting research work in senior high school. It is on this premise that a study on science process skills and research competence was advanced.

Objectives

This study determined the relationship between science process skills and research competence among the Grade 12 learners in the Province of Iloilo for the School Year 2019-2020.

Specifically, the study sought to answer the following questions:

1. What is the level of science process skills of Grade 12 learners when taken as an entire group and when classified according to the district?
2. What is the research competence of Grade 12 learners when taken as an entire group and when classified according to the district?
3. Is there a significant difference in the science process skills of Grade 12 learners when classified according to the district?
4. Is there a significant difference in the research competence of Grade 12 learners when classified according to the district?
5. Is there a significant relationship between science process skills and the research competence of Grade 12 learners?

METHODS

This study used a descriptive-correlational research design. Descriptive research is a given state of affairs as fully and of individuals or groups carefully as possible (Fraenkel & Wallen, 2011). In this study, the correlation between the two dependent variables which were the science process skills and research performance of Grade 12 students was ascertained.

Framework

The schematic diagram shows the relatedness of the variables of the study. The dependent variables were the science process skills and research competence while the independent variable of this study was the district where the schools of the respondents are located. The researcher believed that the science process skills and research competence of Grade 12 learners differed when classified according to the district. Furthermore, it is believed that science process skills and research competence are related to each other.

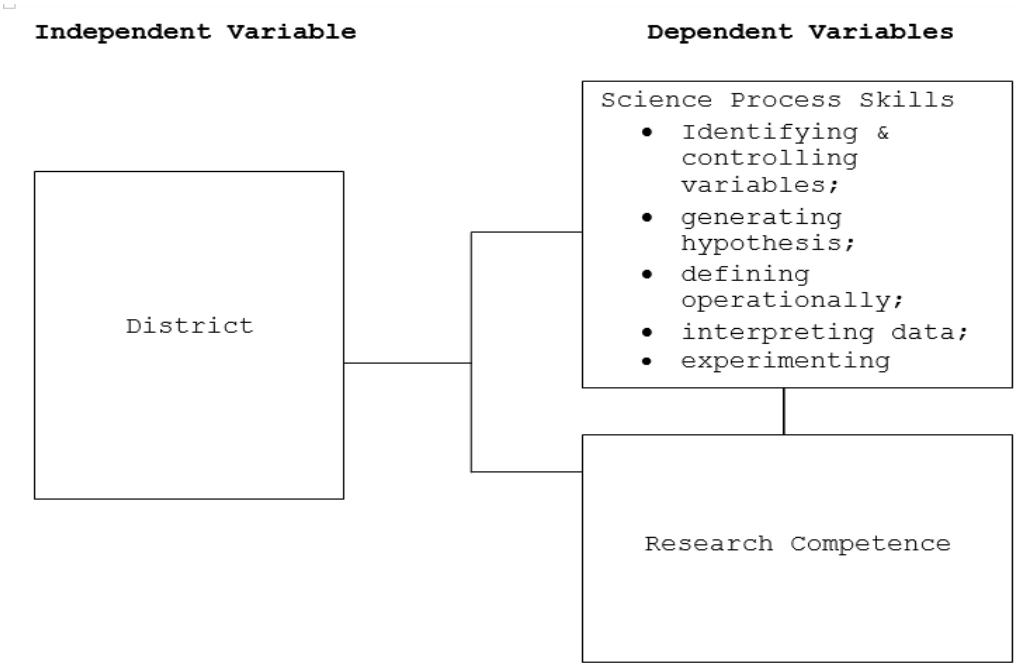

Figure 1. *Schematic diagram showing the relationship between the independent and dependent variables*

Respondents

The study was conducted in the Province of Iloilo involving five districts. The respondents of the study were 359 randomly selected Grade 12 learners out of the 3,422 from the randomly selected schools in the Province of Iloilo. Grade 12 learners' sample size was determined by using cluster, systematic, and random sampling. When the respondents were categorized as to District, 77 or 21% were from District 1, 57 or 16% were from District 2, 97 or 27% were from District 3, 65, or 18% were from District 4, and 63 or 18% were from District 5. The sampling technique used in the study was cluster, systematic, and random sampling. The respondents were grouped by cluster composed of five districts. In each district, the towns wherein the sample schools were chosen were determined through systematic sampling. Systematic sampling was applied also in determining the sample schools. In each sample school, random sampling was used in determining the respondents of the study.

Instrument

Integrated Science Process Skills (ISPS) Test. The instrument used in determining the Integrated Science Process Skills was adopted from Oakley et al., (Belga, 2016). In gathering the needed data, a standardized instrument in science process skills, the Test for Integrated Process Skills II (TIPS II) was adopted by Oakley et al., (Belga 2016). A research instrument in the Test Integrated Process Skills II (TIPS II) was composed of 36 items. To determine the research competence, an adopted research competence questionnaire from Ciocon (2018) was used. The research instrument was composed of three parts. Part I reflected the Personal Information, and Part II centered on the Test Integrated Process Skills II (TIPS II). Part III was a Research Competence Questionnaire.

The result of the research competence was categorized into:

Mean Score Range	Verbal interpretation
3.26–4.00	Highly competent
2.51–3.25	Competent
1.76–2.50	Not competent
1.00–1.75	Highly not competent

Data Collection

At the start, the researcher asked permission from the Schools Division Superintendent to conduct the study. After approval of the request, the researcher sent a letter of permission to the principals to allow their grade 12 learners to participate in the research. The researcher administered the research instrument personally to the identified respondents and checked the accomplished instrument as to its completeness. The data collected were tabulated, classified, encoded, statistically processed, analyzed, and interpreted.

Data Analysis

The data gathered were analyzed employing descriptive and inferential statistical tests. In the descriptive statistical tests, frequency, mean, and standard deviation were utilized. Frequency was applied in determining the number of respondents per level based on the mean scale. Mean. The mean was used as a basis for the interpretation of data gathered for describing the science process skills and research performance. Standard Deviation was used to determine the dispersion in the science process skills and research performance. As to the inferential statistical test, One-way Analysis of Variance (One-way ANOVA), Kruskal-Wallis, and Spearman rho were utilized. One-way Analysis of Variance (One-way ANOVA). One-way ANOVA was used to determine the significant differences in the science process skills of the respondents among districts in the Province of Iloilo. Kruskal Wallis was utilized in determining the significant differences in the research competence of the respondents among districts in the province of Iloilo. Spearman rho was used in determining the relatedness between science process skills and research competence.

RESULTS

As can be gleaned in Table 1, the data divulge that the science process skills of the Grade 12 learners as an entire group are “developing/moderate” (M=13.22, SD=4.98). It is noted that the Grade 12 learners from district A science process skills are “developing/moderate” (M=15.82, SD=5.19), from district B “developing/moderate” (M=11.65, SD=3.92), and also from district C “developing/moderate” (M=13.99, SD=4.96). The Grade 12 learners have “developing/moderate” (M=12.11, SD=4.31) SPS from district D and also those from district E “developing/ moderate” (M=12.57, SD=4.50). The results show that all the Grade 12 learners in the five districts have the same level of SPS which is “developing/moderate”.

The results may imply that most of the Grade 12 learners involved in the study possess a “developing/moderate” level of science process skills. This result further means that the learners’ similarities in their SPS may be due to the commonality in their learning environment and teachers’ teaching strategies. The “developing/moderate” Grade 12 learners' SPS level poses a big challenge to the science teachers to improve since learners are Grade 12 and by the following year they will be entering tertiary education wherein it is expected that their science process skills should be higher.

The result of the present study negates that of Batisla-ong (2019) involving Grade 10 Science, Technology, and Engineering (STE) students revealed that the science process skills as an entire group are “accomplished/high”. The need for a higher level of students’ SPS supports the opinion of Kazeni (2005), that science process skills enables also students to gain the skills necessary to solve everyday problems. These skills are not only used during education and training period but they are also used in daily life (Rillero, 1998). Harlen (1999) stresses that science process skills are highly important for science literacy. Similarly, Ewers (2001) reported that when science process skills are not acquired, it will be an obstacle since science literacy is not limited to reading and hearing; instead, it requires efficient use of science process skills.

Table 1. Level of science process skill of grade 12 learners taken as an entire group and classified as to district

Group	Mean	SD	Description
Entire Group	13.22	4.98	Developing/Moderate
District			
A	15.82	5.19	Developing/Moderate
B	11.65	3.92	Developing/Moderate
C	13.99	4.96	Developing/Moderate
D	12.11	4.31	Developing/Moderate
E	12.57	4.50	Developing/Moderate

Legend: 0.00 - 9.00 Beginning/Low; 9.01 - 18.00 Developing/Moderate; 18.01 - 27.00 Accomplished/High; 27.01 - 36.00 Exemplary/Very High

Table 2 presents the science process skills of Grade 12 learners per skill grouped as to district.

District A. The Grade 12 learners from district A Science Process Skills(SPS)level in identifying and controlling variables, generating hypotheses, and defining operationally are all "developing/moderate" with means of (M=5.34, SD=1.95), (M=3.61, SD=1.80) and (M=2.21, SD=1.28) respectively. On the other hand, they have "accomplished/ high" SPS levels in interpreting data (M=3.09, SD=1.50) and experimenting (M=1.57, SD=0.85). The result reveals that the Grade 12 learners' SPS level trend is increasing. These results may imply that learners are more challenged when they interpret data and conduct experiments thus enhancing their science process skills thereby their SPS in the mentioned areas are higher.

District B. In District B, the Grade 12 learners' SPS in five areas ranges from "beginning/low" to "developing/ moderate". The learners have a "beginning/low" level in defining operationally (M=1.49, SD=1.12) while "developing /moderate" in identifying and controlling variables (M=4.04, SD=1.80), generating hypothesis, (M=2.47, SD=1.24), interpreting data (M=2.19, SD=1.47), and experimenting (M=1.46, SD=0.80). The lower SPS level is on "defining operationally". The result shows that Grade 12 learners' SPS levels vary despite that they are from the same location. These results may imply that the Grade 12 learners' skill to define operationally is not fully developed compared to the rest of the skills.

District C. The Grade 12 learners from district C SPS in five areas are all at the level of "developing/moderate" in identifying and controlling variables (M=5.02, SD=1.91), generating hypothesis(M=3.01, SD=1.66), defining operationally (M=1.97, SD=1.32), interpreting data (M=2.59, SD=1.57,) and experimenting (M=1.38, SD=0.95). The result shows that most of the Grade 12 learners are on the "developing/moderate" SPS level. This result where the SPS level of Grade 12 learners is similar may imply that their science teachers have exposed them to the same learning environment.

District D. The same result of "developing/moderate" SPS level of Grade 12 learners from district D in five areas such as identifying and controlling variables (M=4.57, SD=1.76), generating hypothesis (M=2.45, SD=1.33), defining operationally (M=1.55, SD=1.23), interpreting data (M=2.28, SD=1.43), and experimenting (M=1.26, SD=0.89) "developing/ moderate". The result discloses that Grade 12 learners from district D have developed the same level of SPS. The results may imply that Grade 12 learners' comparable level of SPS may be accounted to the teaching strategies employed by their science teachers.

District E. As to Grade 12 learners from district E, their SPS in identifying and controlling variables (M=4.62, SD=1.94) is "developing/moderate", generating hypothesis (M=2.62, SD=1.47) "developing/moderate", and defining operationally (M=1.75, SD=1.28) "developing/moderate".

Likewise, "developing/moderate" in interpreting data (M=2.32, SD=1.69) and experimenting (M=1.27, SD=0.95) "developing/moderate." The result shows that the Grade 12 learners from district E have the same level of SPS. This result on the similarity in SPS of Grade 12 learners from the same location may be due to the comparable teaching techniques employed by science teachers.

Of the five districts covered in the study, only Grade 12 learners' science process skills from district B are "beginning/low" level on "defining operationally" and district A Grade 12 learners "interpreting data" and "experimenting" science process skills were "accomplished/high". On the other hand, Grade 12 learners from districts C, D, and E are all on the level of "developing/moderate". The result shows that there is a variation in the "defining operationally", "interpreting data," and "experimenting" SPS among Grade 12 learners in the province of Iloilo. The present finding contradicts that of Batisla-ong (2019) involving Grade 10 Science, Technology, and Engineering (STE) students revealed that the science process skills when classified as to school range from "developing/moderate" to "accomplished/high". Another study that contradicts the recent findings conducted in Turkey shows that students in high school had poor science process skills (Şen & Nakipoğlu, 2012).

Table 2. Level of science process skill of grade 12 learners per skill classified as to district

District	Identifying and Controlling			Generating Hypothesis			Defining operationally			Interpreting Data			Experimenting variables		
	Mean	SD	D	Mean	SD	D	Mean	SD	D	Mean	SD	D	Mean	SD	D
A	5.34	1.95	D/M	3.61	1.80	D/M	2.21	1.28	D/M	3.09	1.50	A/H	1.57	0.85	A/H
B	4.04	1.80	D/M	2.47	1.24	D/M	1.49	1.12	B/L	2.19	1.47	D/M	1.46	O.80	D/M
C	5.02	1.91	D/M	3.01	1.66	D/M	1.97	1.32	D/M	2.59	1.57	D/M	1.38	0.95	D/M
D	4.57	1.76	D/M	2.45	1.33	D/M	1.55	1.23	D/M	2.28	1.43	D/M	1.26	0.89	D/M
E	4.62	1.94	D/M	2.62	1.47	D/M	1.75	1.28	D/M	2.32	1.69	D/M	1.27	0.95	D/M

Legend:

Identifying & Controlling Variables	*Generating Hypothesis*	*Description (D)*
0.00 - 3.00	*0.00 - 2.25*	*Beginning/Low (B/L)*
3.01 - 6.00	*2.26 - 4.50*	*Developing/Moderate (D/M)*
6.01 - 9.00	*4.51 - 6.75*	*Accomplished/High (A/H)*
9.01 - 12.00	*6.76 - 9.00*	*Exemplary/Very High (E/VH)*

Defining Operationally/ Experimenting Interpreting Data		
0.00 - 1.50	*0.00 - 0.75*	*Beginning/Low (B/L)*
1.51 - 3.00	*0.76 - 1.50*	*Developing/Moderate (D/M)*
3.01 - 4.50	*1.51 - 2.25*	*Accomplished/High (A/H)*
4.51 - 6.00	*2.26 - 3.00*	*Exemplary/Very High (E/VH)*

Table 3 presents Grade 12 learners' research competence per area in five districts. *District A*. The Grade 12 learners from district A research competence in seven (7) areas are all "competent". They are "competent" in coming up with creative ways of structuring ideas or "Technical Aspects" (M=2.87, SD=0.37), leading the reader to present study and concerns or "Introduction" (M=2.84, SD=0.45), articulating how to present study attempts to fill the research gaps or "Literature Review" (M=2.75, SD=0.44), and establishing the research instrument's validity and reliability or

"Methodology"(M=2.88, SD=0.48). They are also "competent" in explaining new insights about the problem after taking the findings into consideration or "Results and Discussion" (M=2.71, SD=0.48), indicating what can be conducted from the findings of the study or "Conclusions and Recommendations" (M=2.70, SD=0.45), and writing the abstract of the study using the correct format or "Producing other Parts of Research Paper" (M=2.79, SD=0.52). As a whole, Grade 12 learners are "competent" in research (M=2.81, SD=0.40). This result means that Grade 12 learners involved in the study possess the same level of capability in all aspects of conducting and writing research outputs. The results may imply that Grade 12 learners are exposed to a comparable learning environment where they acquired and developed their research competency.

District B. In terms of Grade 12 learners from district B, as a whole, they are "competent" (M=2.65, SD=0.39) but in terms of interpreting data in tabular forms or "Results and Discussions," they obtained a rating of "not competent" (M=2.48, SD=0.44). The Grade 12 learners from district B are "competent" in coming up with complex ways of structuring ideas or "Technical Aspects" (M=2.75, SD=0.40), also in discussing theories on which the study is anchored or "Introduction" (M=2.72, SD=0.44), then in synthesizing information from relevant studies or "Literature Review" (M=2.65, SD=0.60), and choosing the appropriate data analysis method or "Methodology" (M=2.76, SD=0.60). They are also "competent" in discussing the meaning of the results beyond what they mean statistically or "Conclusions and Recommendations" (M=2.55, SD=0.54) and summarizing the conclusions of the study or "Producing other Parts of Research Paper" (M=2.59, SD=0.46). The result shows that Grade 12 learners have not fully developed their capability in interpreting data and interpreting results from the computer software. The findings may imply that Grade 12 learners' less knowledge of results and discussions may be due to their less exposure to preparing the said component of research output.

District C. The Grade 12 learners' research competence from district C ranged from "not competent" to "competent" where out of the seven areas rated only one area obtained a rating of "competent". They are "competent" in terms of organizing the thoughts and ideas in writing research output or "Technical Aspect". They are "not competent" in setting the appropriate tone for the paper or "Introduction" (M=2.52, SD=0.38), asserting the relevance of the surveyed claim to one's research or "Literature Review" (M=2.39, SD=0.43), and explaining the research type or "Methodology" (M=2.48, SD=0.39). Moreover, Grade 12 learners are "not competent" in analyzing research findings or "Results and Discussion" (M=2.36, SD=0.43), explaining what the research findings mean concerning the problem or "Conclusions and Recommendations" (M=2.44, SD=0.42, as well as writing the outline of the results and discussion of the study or "Producing other parts of Research Paper" (M=2.49, SD=0.46). As a whole, Grade 12 learners from district C are "not competent" with a mean of 2.45 (SD=0.34). The result reveals that Grade 12 learners have not mastered the major aspects of research. The results may imply that they are not exposed to the actual research process as well as in writing the manuscript.

District D. In terms of Grade 12 learners from district D there is one area where they got a rating of "not competent" in comparing the results with earlier findings and explaining the contradictory results if any or "Results and Discussions" (M=2.47, SD=0.44). The Grade 12 learners' ratings are all "competent' in coming up with sophisticated ways of structuring ideas or "Technical Aspects"(M=2.69, SD=0.47), defining relevant terms operationally or conceptually or "Introduction" (M=2.67, SD=0.49), articulating how the present study attempts to fill the research gaps or "Literature Review"(M=2.58, SD=0.51), and describing procedures for analyzing data or "Methodology" M=(2.75, SD=0.53). Furthermore, Grade 12 learners are "competent" in discussing the findings together and explaining the interrelationships or "Conclusions and Recommendations" (M=2.58, SD=0.50) and summarizing the recommendations of the study or "Producing other Parts of the Research Paper" (M=2.77, SD=0.70). The Grade 12 learners' research competence as a whole is "competent." This result shows that Grade 12 learners manifest competency in most parts of the research. The findings may imply that Grade 12 learners are exposed to actual research and writing of outputs but they are only fully short on how to package the results.

District E. For Grade 12 learners from district E, only one area obtained a "competent" rating in writing with correct grammar usage or "Technical Aspects" (M=2.55, SD=0.44). They obtained a "not competent" rating in coming up with creative ways of structuring ideas or "Introduction" (M=2.48, SD=0.44), asserting the relevance of the surveyed claim to one's research or "Literature Review" (M=2.35, SD=0.48), and justifying methods of measuring variables or "Methodology' (M=2.43, SD=0.42). Likewise, the "not competent" rating in generating new data or "Results and Discussion" (M=2.30, SD=0.39), also in explaining what the research findings mean concerning the problem or "Conclusions and Recommendations" (M=2.39, SD=0.45), and writing the abstract of the study using the correct format or "Producing other Parts of Research Paper" (M=2.42, SD=O.46). As a whole, Grade 12 learners from district E possess 'not competent" research capability (M=2.42, SD=0.38). The result means that Grade 12 learners have not developed their competency in most aspects of research. The results may imply that Grade 12 learners should conduct actual research and be trained in data processing and interpretation. The finding of the present investigation where Grade 12 learners' research competence range from "not competent" to "competent" supports the national study of Arellano et al., (2012) in a state-funded university in the Philippines involving 963 graduating college students. The results of the study showed that students performed poorly in identifying and arranging steps involved in a research process. Less than half of the students are at least proficient in research.

Table 3. Research competence of grade 12 learners per area classified according to district

Grouping	Mean	SD	Interpretation
District A			
Technical Aspects	2.87	0.37	Competent
Major Parts of Research Paper			
Introduction	2.84	0.45	Competent
Literature Review	2.75	0.44	Competent
Methodology	2.88	0.48	Competent
Results and Discussion	2.71	0.48	Competent
Conclusions and Recommendations	2.70	0.45	Competent
Producing other Parts of Research Paper	2.79	0.52	Competent
As a whole	2.81	0.40	Competent
District B			
Technical Aspects	2.75	0.40	Competent
Major Parts of Research Paper			
Introduction	2.72	0.44	Competent
Literature Review	2.65	0.60	Competent
Methodology	2.76	0.60	Competent
Results and Discussion	2.48	0.44	Not Competent
Conclusions and Recommendations	2.55	0.54	Competent
Producing other Parts of Research Paper	2.59	0.46	Competent
As a whole	2.65	0.39	Competent
District C			
Technical Aspects	2.53	0.38	Competent
Major Parts of Research Paper			
Introduction	2.52	0.38	Competent
Literature Review	2.39	0.43	Not Competent
Methodology	2.48	0.39	Not Competent

Results and Discussion	2.36	0.43	Not Competent
Conclusions and Recommendations	2.44	0.42	Not Competent
Producing other Parts of Research Paper	2.49	0.46	Not Competent
As a whole	2.45	0.34	Not Competent
District D			
Technical Aspects	2.69	0.47	Competent
Major Parts of Research Paper			
Introduction	2.67	0.49	Competent
Literature Review	2.58	0.51	Competent
Methodology	2.75	0.53	Competent
Results and Discussion	2.47	0.44	Not Competent
Conclusions and Recommendations	2.58	0.50	Competent
Producing other Parts of Research Pap er	2.77	0.70	Competent
As a whole	2.64	0.45	Competent
District E			
Technical Aspects	2.55	0.44	Competent
Major Parts of Research Paper			
Introduction	2.48	0.44	Not Competent
Literature Review	2.35	0.48	Not Competent
Methodology	2.43	0.42	Not Competent
Results and Discussion	2.30	0.39	Not Competent
Conclusions and Recommendations	2.39	0.45	Not Competent
Producing other Parts of Research Paper	2.42	0.46	Not Competent
As a whole	2.42	0.38	Not Competent

Legend: 3.26–4.00; Highly Competent; 2.51–3.25 Competent; 1.76–2.50 Not Competent
1.00–1.75 Highly Not Competent

Table 4 shows the difference in Grade 12 learners' science process skills as a whole. As a whole. The total score in SPS gathered when subjected to the Analysis of Variance revealed a significant difference (F=9.296, p=0.000<.05), thus rejecting the null hypothesis which states that there is no significant difference in the science process skills of Grade 12 learners taken as a whole when classified as to district. The result means that the district influenced students' SPS. The result when further analyzed by applying Scheffe test to identify where the differences existed disclosed that Grade 12 learners SPS from district A differed significantly from those in district B (F=9.296, p=0.000<.05), district D (F=9.296,p=0.000<.05), and district E (F=9.296,p=0.003<.05). The result shows that district A Grade 12 learners have significantly higher SPS than those from districts B, D, and E. The rest of the Grade 12 learners SPS from other districts not mentioned above existed no significant differences.

The result implies that Grade 12 learners from district A are more exposed to the learning environment that favors the development of their science process skills. Identifying and controlling variables. In identifying and controlling variables skill (Skill 1), a significant difference existed in the SPS of the respondents when analyzed applying the Analysis of Variance (F=4.645, p=0.001<.05), thereby not accepting the null hypothesis which states that there is no significant difference in Skill 1 science process skills of Grade 12 learners classified as to district. The Scheffe test revealed that a significant difference occurred between Grade 12 learners from Districts A and B (F=4.645, p=0.004<.05) and between district B and C (F=4.645, p=0.045<.05). The result means that the identifying and controlling variables skill of Grade 12 learners from district A varied from those in district B while Grade 12 learners from district B differed from those in district C.

The result implies that in terms of identifying and controlling variables skill, only the respondents from the three districts mentioned varied among themselves while in the rest of the districts, no significant differences existed. Generating hypothesis. In terms of generating hypothesis skill (Skill 2), the data when analyzed employing the Analysis of Variance resulted in a significant difference ($F=7.178$, $p=0.000<.05$). The null hypothesis which states that there is no significant difference in generating hypothesis skill science process skills of Grade 12 learners classified as to district is rejected. The significant result, when subjected to Scheffe test, disclosed that significant differences in Skill 2 SPS existed between Grade 12 learners from districts A and B ($F=7.178$, $p=0.002<.05$), district D ($F=7.178$, $p=0.001<.05$), and district E ($F=7.178$, $p=0.007<.05$).

This result shows that the generating hypothesis skills from district A Grade 12 learners are different from those of Grade 12 learners from districts B, D, and E. This result implies that the Skill 2 variation of Grade 12 learners from district A compared to the mentioned districts could be due to the training they have in research that involved generating of hypothesis. As to the aspect of defining operational skill (Skill 3), a significant difference existed as divulged by the result of the Analysis of Variance ($F=3.922$, $p=0.004<.05$), hence rejecting the null hypothesis which states that there is no significant difference in defining operationally science process skills of Grade 12 learners classified as to district. The Scheffe test revealed that a significant difference occurred between Grade 12 learners from district A and B ($F=3.922$, $p=0.033<.05$). The result means that the defining operational skill of Grade 12 learners from district A varied from those in district B only, while the rest of Grade 12 learners from other districts Skill 3 are similar. The result implies that district is a factor in Grade 12 learners' variation of Skill 3.

Interpreting data. On interpreting data skills (Skill 4), the Analysis of Variance disclosed a significant difference ($F=4.029$, $p=0.003<.05$). The null hypothesis states that there is no significant difference in science process skills of Grade 12 learners in terms of interpreting data classified as to district is not accepted. The result means that the district influenced Grade 12 learners' Skill 4 SPS. The result when further analyzed by applying the Scheffe test revealed that Grade 12 learners Skill 4 SPS from district A differed significantly from those from district B ($F=4.029$, $p=0.026<.05$) and district D ($F=4.029$, $p=0.044<.05$). The result shows that district A Grade 12 learners have significantly higher Skill 4 SPS than those from districts B, and D while comparable to those from other districts. The result implies that Grade 12 learners from district A have highly developed their interpreting data skill may be due to the teaching strategies of their science teachers and exposure to the learning environment that favor the development of their Skill 4 science process skills. The significant results on the four skills affirm the study of Batisla-ong (2019) involving Grade 10 Science, Technology, and Engineering (STE) students revealed that the science process skills differed significantly when classified as to school.

Another study that supports the present finding is the study of Mohd Fedzil, H. and Mohd Saat, R., (2011) in Malaysia revealed that students' lack of exposure to "hands-on" activities at primary school leads to insufficient manipulative skills and they may carry this problem with them to secondary school. Although most pupils can adapt to their new learning environment, some find the transition difficult and problematic. Experimenting skill. On the part of experimenting skill (Skill 5), no significant difference existed in the "experimenting skill" of Grade 12 learners in the whole province of Iloilo as disclosed by the Analysis of Variance, ($F=1.482$, $p=0.207>.05$) hence accepting the null hypothesis which states that there is no significant difference in experimenting skill science process skills of Grade 12 learners classified as to district. This result shows that regardless of district, Grade 12 learners in Skill 5 are comparable. The results may imply that Grade 12 learners from districts A, B, C, D, and E development of their experimenting skills may be due to the same exposure to science activities.

The present finding affirms the observations that students will be learning the skills of science as well as science content. The students will be actively engaged with the science they are learning and thus reach a deeper understanding of the content. In this experimenting skill, the students are actively

engaged when experimenting thus their skill 5 levels are the same. The study of Harlen (1999) supports the present study that the acquisition of science process skills at the desired level is very important for students, and those students, who could not sufficiently acquire these skills, cannot comprehend the world and cannot establish necessary connections. For that reason, especially teachers should develop their students' science process skills, content knowledge, and questioning skills which are major factors for efficient science teaching in primary and secondary schools (K-12 grades Miles, 2010). The acquisition of the skills should be uniformly sufficient to establish the necessary connections.

Table 4. Differences on the science process skills of grade 12 learners classified as to district

Variable	DF		F-Value	p(2-tailed)
As a Whole	4	9.296*	0.000	
A & B*				0.000
A & C^{ns}				0.162
A & D*				0.000
A & E*				0.003
B & 3^{ns}				0.063
B & 4^{ns}				0.990
B & 5^{ns}				0.883
C & 4^{ns}				0.179
C & 5^{ns}				0.475
D & 5^{ns}				0.989
Identifying and Controlling Variables	4	4.645*	0.001	
A & B*				0.004
A & C^{ns}				0.875
A & D^{ns}				0.210
A & E^{ns}				0.283
B & C*				0.045
B & D^{ns}				0.654
B & E^{ns}				0.578
C & D^{ns}				0.691
C & E^{ns}				0.783
D & E^{ns}				1.000
Generating hypothesis	4	7.178*	0.000	
A & B*				0.002
A & C^{ns}				0.170
A & D*				0.001
A & E*				0.007
B & C^{ns}				0.366
B & D^{ns}				1.000
B & E^{ns}			0.992	
C & D^{ns}				0.272
C & E^{ns}				0.650
D & E^{ns}				0.682
Defining operationally	4	3.922*	0.004	
A & B*				0.033

A & C^{ns}				0.818
A & D^{ns}				0.051
A & E^{ns}				0.325
B & C^{ns}				0.271
B & D^{ns}				0.999
B & E^{ns}				0.873
C & D^{ns}				0.376
C & E^{ns}				0.878
D & E^{ns}				0.945
Interpreting Data	4	4.029*	0.003	
A & B*				0.026
A & C^{ns}				0.332
A & D*				0.044
A & E^{ns}				0.069
B & C^{ns}				0.668
B & D^{ns}				0.999
B & E^{ns}				0.995
C & D^{ns}				0.810
C & E^{ns}				0.881
D & E^{ns}				1.000
Experimenting	4	1.482^{ns}	0.207	

*p** ≤ .05
p^{ns} >.05 *Legend: A – District A; B – District B, C – District C ; D – District D; E – District E*

Table 5 reflects the research competence of Grade 12 learners as a whole classified as to district. The data on the research competence when analyzed employing Kruskall Wallis resulted in a significant difference (X2=46.934, p=0.000<.05). The null hypothesis which states that there is no significant difference in the research competence of Grade 12 learners taken as a whole classified as to district is rejected. The significant result when further subjected to Mann Whitney test disclosed that significant differences occurred in the research competence between district A Grade 12 learners and B (U=1758.000, p=0.050<.05), C (U=1853.000, p=0.000<.05), D (U=1976.500, p=0.031<.05), and E (U=1723.500, p=0.000<.05). Significant differences also existed between district B Grade 12 learners and district C (U=1823.500, p=0.000<.05) and E (U=1139.000, p=0.001<.05). Moreover, district C Grade 12 learners differed significantly from district D (U=2232.000, p=0.002<.05) as well as district D from district E (U=1422.500, p=0.003<.05). The result shows that the research competence of Grade 12 learners from district A varied from those from districts B, C, D, and E; district B varied from districts C and, E; then district C and D, and district D and E. The present results where district influenced the research competence of Grade 12 learners imply that students from different districts differed in their research exposures. The present findings affirm the study of Arellano et al., (2012) that more than half of the students can identify the research problem, formulate a conclusion from research findings, apply sampling techniques, correctly choose data gathering instruments, and identify variables while fewer than half can state hypothesis, choose an appropriate scale, for qualitative variables, identify appropriate statistical test, identify research design, and state elements of the introduction.

Table 5. Differences on the research competence of grade 12 learners taken as a whole classified as to district

Variable	DF	X^2/U	p(2-tailed)
As a Whole	4	46.934*	0.000
A & B*	1758.000		0.050
A & C*	1853.000		0.000
A & D*	1976.500		0.031
A & E*	1173.500		0.000

B & C*	1823.580	0.000
B & D^{ns}	1804.000	0.803
B & E*	1139.000	0.001
C & D*	2232.000	0.002
C & E^{ns}	2906.500	0.603
D & E*	1422.500	0.003

*p** ≤ .05
p^{ns} >.05
Legend: A – District A; B – District B, C – District C; D – District D; E – District

Table 6 shows the extent of the relationship between Grade 12 learners' science process skills and research competence. The data gathered on science process skills and research competence when subjected to Spearman rho divulged a low and significant relationship (rs0.322, p=0.000<.05), thus the null Hypothesis which states that there is no significant relationship existed between Grade 12 science process skills and research competence is rejected. The result means that the science process skills influenced the research competence of the learners. The result implies that the higher the science process skills the higher the research competence of Grade 12 learners. The result that a low and significant relationship existed between science process skills and research competence of Grade 12 learners affirms the opinion of Fraenkel and Wallen (2011), that the process of getting information, problem-solving, and many others as defined in science process skills has something to do with their research competence since scientific research process can be described as identifying a problem, gathering data, analyzing the data, and interpreting the gathered results. Therefore, scientific research develops students' higher-level thinking skills, such as asking questions, doing research, solving problems, and communicating effectively (Cuevas, Lee, Hart, & Deaktor, 2005). Another study was that of Mutlu and Temiz (2013) that science process skills are the basis for scientific thinking and research. Science process skills are the thinking skills that we used to get information. Finally, science process skills form the core of inquiry-based learning. To learn to do science is to master the science process skills and apply them in the scientific investigation (Ngoh, 2009; Batisla-ong, 2019).

Table 6. Relationship between science process skills and research competence of grade 12 learners

Comparison	r_s	p(2-tailed)
Science Process Skills Vs Research Skills	0.322	0.000

p* ≤ .05
p^{ns} > 05 Legend: +.00 to ±0.20 negligible correlation
±0.21 to ±0.40 low correlation
±0.41 to ±0.70 substantial or marked
+0.71 to ±1.00 high to very high

CONCLUSION

From the findings of the study, the following conclusions arrived: Grade 12 learners possess the same level of science process skills, and district accounts for the variances in research competence. The differences in the location of the school connote that the science process skills of Grade 12 learners would vary in identifying and controlling variables, generating hypotheses, defining operationally, and interpreting data except in experimenting. The district is a factor in the research competence of Grade 12 learners. Lastly, the higher the level of science process skills the more competent the learners are in conducting and writing research outputs. The results of the study have important implications in theory and practice. For theory, the results of the study reveal that there are significant differences in the science process skills and research competence of the learners classified as to district. As to practice, the present findings revealed that significant difference in science process skills and research competence supports that of Harlen (1999), the acquisition of science process skills at the desired level is very important for students, and those students, who could not sufficiently acquire these skills, cannot comprehend the world and cannot establish necessary connections.

RECOMMENDATION

Based on the findings and conclusions derived from the study, the researcher recommends the following;

1. The Department of Education (DepEd) administration shall revisit the curriculum and if necessary realign the content with more emphasis on science process skills and the development of research competence that would prepare the learners for tertiary education.
2. The school administrator shall disseminate to the science coordinator during the curriculum planning activities the present findings and plan for strategies on how to improve the science process skills of the learners thereby enhancing also their research competence.
3. The school administrator shall assess also the status of the science learning resources and acquire those that are direly needed.
4. Science teachers shall reassess their teaching strategies, and match them with the expected competencies and availability of facilities and learning materials.
5. Science teachers shall employ recent trends in teaching science and research to encourage learners' engagement in the activities and develop their higher-order thinking skills.
6. The results of the study where science process skills and research competence significantly differed as to district, science teachers during seminars could share their experiences in teaching the subjects and ask the opinions of fellow science and research teachers to further enhance the performance of the learners.
7. Since operationally defining skills obtained a "beginning/low" rating and "negligible" extent of relationship to research competence, the science teachers shall employ varied strategies to further develop the operationally defining skills of Grade 12 learners thereby making them more competent in research.
8. With the significant relationship between science process skills and research competence, the teachers handling the subjects shall review their strategies whether it conforms to the standard steps in both subjects.

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