INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY: APPLIED BUSINESS AND EDUCATION RESEARCH
2024, Vol. 5, No. 3, 816 – 828
http://dx.doi.org/10.11594/ijmaber.05.03.07

Research Article

Effectiveness of Independent Science Project Plan (ISPP) In Enhancing Scientific Inquiry Skills of Grade 7 Filipino Students

Larjay Hipolito Deliguin*

Schools Division of Zambales, Department of Education, 2208, Philippines

Article history:
Submission February 2024
Revised March 2024
Accepted March 2024

**Corresponding author:*
E-mail:
larjay.deliguin@deped.gov.ph

ABSTRACT

The Independent Science Project Plan (ISPP) was used to improve the science inquiry skills of 100 Science 7 students from 4 secondary public schools in Castillejos District, Division of Zambales, Philippines. A quasi-experimental research design was used, and it required a 50-item pre-test and post-test that were validated, and pilot tested by the researcher. Mean analysis, correlated and independent samples tests, and rate of improvement (ROI) are the statistical tools utilized for analysis. Findings revealed there is a significant difference in the level of scientific inquiry skills of the participants before and after the implementation of the strategy. There is a significant difference in the MPS scores between the control and experimental group during the post-test involving all the scientific inquiry skills. When compared to the control group, the experimental group had a much better degree of proficiency in asking questions about the world, in designing and conducting the investigation, in employing different strategies to obtain information, and in communicating results, compared to the control group. Also, the teachers agreed in their being well-quipped with knowledge and skills in delivering distance learning classes through integrating technology into the curriculum, teacher's preparation, and on the available facilities in conducting distance learning for science teaching. The end outcome is a clear indication that the method worked as intended.

Keywords: *Grade 7 students, Independent science project plan, Scientific Inquiry skills*

Introduction

Education is becoming one of the world's top priorities. Education gives us a sense of security in our lives, as well as a better understanding of the world around us. The Department of Education (DepEd) adopted Republic Act No. 10533 (RA No. 10533), popularly known as the K to 12 Program, which intends to provide Filipino students with skills and competencies to meet the needs of the 21st century.

How to cite:
Deliguin, L. H. (2024). Effectiveness of Independent Science Project Plan (ISPP) In Enhancing Scientific Inquiry Skills of Grade 7 Filipino Students. *International Journal of Multidisciplinary: Applied Business and Education Research*. *5*(3), 816 – 828. doi: 10.11594/ijmaber.05.03.07

However, according to the latest results of the Organization for Economic Cooperation and Development's (OECD) Programme for International Student Assessment (PISA) released on December 3, 2019, Filipinos ranked last among 79 countries in terms of reading literacy and second in terms of mathematical and scientific literacy (Reysio-Cruz, 2019). Not only that, but the COVID-19 pandemic has had a significant impact on the world, causing schools, colleges, and universities to temporarily close. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), school closures have affected nearly 87 percent of the world's student population or 1.5 billion students. UNESCO has advocated the adoption of distance learning programs and open educational applications and platforms that schools and teachers can use to reach learners remotely and reduce interruption in education in the Philippines to ensure the welfare of more than 27 million learners in basic education. Teachers must now figure out how to effectively use remote learning while keeping students engaged in curriculum assignments, conducting assessments in a variety of ways, and assisting parents in becoming their children's learning facilitators at home.

The researcher devised an Independent Science Project Plan (ISPP), an intervention strategy to meet the new normal's growing worries by conducting various science learning activities allotted to them, this strategy serves all students by providing them with equal opportunities as self-directed and autonomous learners. The teacher's job is to make the learning process easier and to bring all of the concepts together in all of the activities. On this new normal, the researcher believes that science is vital to everyone and that discoveries will begin at home.

This study was designed to test the effectiveness Independent Science Project Plan (ISPP) in enhancing the Scientific Inquiry Skills of Grade 7 students in Castillejos District. In quest of this intent, the following problems were answered:

1. What is the level of Scientific Inquiry Skills of Grade 7 students in Castillejos District before the use of ISPP in terms of:
   1.1 asking questions about the world;
   1.2 designing and conducting investigations;
   1.3 employing different strategies to obtain information; and
   1.4 communicating results?
2. What resources are available in school for science teaching in terms of:
   2.1 teacher's preparation; and
   2.2 facilities?
3. How is the ISPP used in enhancing the scientific inquiry skills of Grade 7 students in Castillejos?
4. What is the level of scientific inquiry skills of the Grade 7 students in Castillejos District after the application of ISPP?
5. Is there a significant difference in the pretest and post-test scores of the control and experimental groups of students?
6. Which of the scientific skills has improved the most?

Methods

Research Design

Quasi-Experimental Research Method with a Nonequivalent Control Group Design was used in the study. A quasi-experimental design is a type of study design that seeks to establish a link between two things. It entails changing an independent variable without assigning individuals to conditions or randomly ordering conditions. The researcher will identify a group of people who share some characteristics with the quasi-independent variable group.

Group A is the experimental group that receives a pretest, a treatment, and a posttest. Furthermore, Group B is the control group that is given a pretest, no treatment, and then a posttest. Modular Distance Learning is used as a learning modality by both of these groups. The ISPP was the treatment given to the experimental group.

A Nonequivalent Control Group is a type of comparison group in which participants are matched based on pre-existing characteristics that are similar to those observed in a treatment group rather than being chosen at random. The most fundamental of the quasi-experimental designs is the design of nonequivalent comparison groups (Rubin and Babbie, 2017).

In the new research of Thomas (2020), the researcher chooses groups that appear to be

identical in appearance, but only one of them receives therapy in a non-equivalent group design. The groupings are not chosen at random, and they may have varying characteristics. To have control over the treatment, the researcher will create it and choose which subjects will receive it. This form of hybrid design, according to Chiang, Jhangiani, and Price (2020), is generally superior because it combines features of both.

Respondents

Castillejos is one of thirteen (13) municipalities that make up the province of Zambales. Castillejos National High School (CNHS), Jesus F. Magsaysay Technical Vocational High School (JFMTVHS), Castillejos Resettlement High School (CRHS), and Hanjin Integrated School (HIS) were the four public high schools in Castillejos, Zambales, where the study was carried out.

Sampling Technique

The respondents were chosen using a non-random sampling technique, namely the Purposive Sampling Technique. This involved the deliberate selection of people deemed to be the most appropriate source of data following the study's objectives. According to Bernard (2002), purposive sampling, also known as judgment sampling, refers to the deliberate selection of a participant based on their characteristics. It is a non-random method that does not necessitate any underlying ideas or a certain number of participants. Each public secondary school class, on the other hand, had already been assigned to a group before the study. As a result, these groups were used as responders by the researcher.

Instrument

To achieve the study's goal of valid and reliable results, a diagnostic test/achievement test was used to assess the effectiveness of the ISPP among Grade 7 Science students. Furthermore, students were evaluated based on their performance tasks. They were given a competency-based 50-item multiple-choice achievement test with topics based on the lessons presented in DepEd's MELC for the First Quarter. An item analysis was used to the 50-item test to measure knowledge, comprehension, application and higher-order thinking skills (HOTS) of the students. The test developed was based on the prescribed Table of Specifications (TOS) and aligned with learning competencies formulated under the Restructured Basic Education Curriculum (RBEC) of the Department of Education (DepEd). The test was validated, and pilot tested to assess the level of scientific inquiry skills of the learner-participants.

Result and Discussion

Learners' Level of Scientific Inquiry Skills Before the Use of ISPP

In recent years, many countries have developed and implemented inquiry-based learning curricula (chemistry, physics, biology, earth science, life science, and so on) in their science curricula. Although one of the most significant goals of the science curriculum is to develop and apply inquiry skills, each student's talents do not progress at the same rate, Feyzioğlu (2019). Inquiry-based learning is a method of connecting prior knowledge with scientific representations of the natural world that can be used in the classroom. Students must incorporate some of the most important aspects of inquiry-based learning, such as assimilation of new knowledge through sensory stimuli and incorporation of their current and prior knowledge. As a result, they will be more engaged and will express their opinions about the learning environment. They must also reflect on their knowledge and experiences as they continue to construct and reconstruct their understanding. The scientific inquiry skills of learners involved four skills: asking questions about the world (Skill 1); designing and conducting an investigation (Skill 2); employing different strategies to obtain information (Skill 3); and, communicating skills (Skill 4). Table 1 presents the level of scientific inquiry skills of Grade 7 learners in the control and experimental group during the pre-test. Lower values of the standard deviation (SD) indicate a more homogenous group.

Table 1. Learners' Level of Scientific Inquiry Skills Before the Use of Independent Science Project Plan

Skills	Control Group			Experimental Group		
	MPS	SD	Qualitative Description	MPS	SD	Qualitative Description
Asking Questions About the World	33.08	4.67	Low Mastery	35.69	4.69	Low Mastery
Designing and Conducting Investigations	35.00	1.78	Low Mastery	40.00	2.25	Average Mastery
Employing Different Strategies to Obtain Information	31.75	1.77	Low Mastery	33.75	1.91	Low Mastery
Communicating Results	48.00	2.34	Average Mastery	51.25	2.20	Average Mastery
Pretest Overall Score	**35.56**	**8.54**	**Low Mastery**	**38.56**	**9.41**	**Average Mastery**

As learners grow, they are expected to develop skills to design and conduct investigations about the facts around them. It can be seen in Table 1 that the learners in the control group (MPS=33.08, SD=4.676) and the experimental group (MPS=35.49, SD=4.69) are at a Low Mastery level in terms of asking questions about the real world. Chin and Osborne (2006) stated that student's questions play an important role in meaningful learning and scientific inquiry. They are a potential resource for both teaching and learning science. In designing and conducting investigations, the learners in the control group showed to have a low mastery (MPS=35.0, SD=1.78) while those in the experimental group garnered an MPS=40 (SD=2.25) are at an Average Mastery level. This includes their ability to gather evidence to support explanations of the causes and phenomena or find solutions to a particular need.

Additionally, both the control group (MPS=31.75, SD=1.77) and the experimental group (MPS=33.75, SD=1.91) attained a Low Mastery level in *employing different strategies to obtain information.* This is indicative of their lack of ability to find resources that could give them sufficient relevant information for their scientific problems. Moreover, both the control (MPS=48.0, SD=2.34) and experimental (MPS=.51.25, SD=2.20) attained the highest MPS among the four scientific inquiry skills at an Average Mastery level in *communicating results.* This involves their skills to systematically collect and organize data and communicate investigations, culminating in abilities to formulate explanations or models based on the results of their investigations.

Resources in Science Teaching

Based on the study of Omorogbe and Ewansiha (2013), the effectiveness of teachers is critical to achieving the goals of science education. As a result, high-quality teacher education is essential. A regular schedule of in-service training, conferences, seminars, and workshops to assist instructors in improving their practices and competencies should be provided to keep them up to date on the latest scientific discoveries and to enhance their topic knowledge. For the effective implementation of inquiry-based science education, it is necessary to identify and effectively apply good practices. Students need a variety of science materials to engage in inquiry-centered science learning. Science must be adequately taught at a lower level to provide a solid foundation for science at a higher level.

When learners have access to appropriate resources, the quality of their learning is considerably improved. Things are made easier by computers and conceptual tools, which allow students to do tasks that they would not be able to perform otherwise. To teach science, however, teachers were limited to modules and online technologies. Table 2 presents the agreement of the science teachers in terms of availability of resources in science teaching.

Table 2. Resources in Science Teaching

Teacher's Preparation	Weighted Mean	Qualitative Description
I am well-equipped with the knowledge and skills required in delivering distance learning education classes.	3.50	Strongly Agree
I am familiar with the ways of integrating technology into the curriculum.	3.25	Agree
I am enthusiastic about the introduction of mandatory distance teaching for an indefinite (probably quite long) time.	3.50	Strongly Agree
I support the interaction among students and collaborative activity as a means of teaching and learning.	3.75	Strongly Agree
I am able to manage my time well in the conduct of classes, monitoring of responses, availability of students, and other issues.	3.00	Agree
Composite	**3.40**	**Agree**
Facilities	**Weighted Mean**	**Qualitative Description**
I have available printed modules that I can use as a tool for teaching.	3.25	Agree
I can use online modules as supplementary materials that are available on the internet such as DepEd TV, DepEd Commons, etc.	3.50	Strongly Agree
I can use technology (PC, laptop, mobile phone, etc.) to support my teaching methods.	3.75	Strongly Agree
I have stable internet access that I can use for distance teaching.	2.75	Agree
I can use social media, e-mails, and other platforms of distance learning education.	3.50	Strongly Agree
Composite	**3.35**	**Agree**

It can be seen in Table 2 that the teachers garnered the highest mean (3.75, Strongly Agree) in terms of supporting the interaction among students and collaborative activity as a means of teaching and learning. The lowest mean dropping at 3.00 indicates that the teachers Agree that they manage their time well in the conduct of classes, monitoring of responses, availability of students and other teaching-learning-related issues. The composite value of 3.40 indicates that the teachers Agree in their being well-quipped with knowledge and skills in delivering distance learning classes through integrating technology into the curriculum.

Moreover, garnering the highest mean in terms of Facilities, the teachers Strongly Agree (3.75) that they use technology such as laptops, personal computers, mobile phones and other electronic gadgets to support their teaching methods. They rated lowest (2.75, Agree) in terms of having stable internet access for their distance teaching tasks. However, they also Strongly Agree (3.50) in using social media and other internet platforms for distance learning education using their mobile phones. The composite value of 3.35 indicates that they Agree on the available facilities in conducting distance learning for science teaching. This includes the provision of both the DepEd sim card, which allows internet access and the National Educators' Academy of the Philippines (NEAP) sim card, which allows teachers to communicate with their students via phone and text.

The Use of Independent Science Project Plan

School opening in the new normal avoided the traditional face-to-face learning in the

classroom. The physical opening depended on the risk severity grading or classification of communities according to guidelines from the Department of Health (DOH), the Inter-Agency Task Force (IATF) for the Management of Emerging Infectious Diseases in the Philippines, and the Office of the President (OP). The learning delivery modalities that schools adopted depended on the COVID-19 restrictions and the context of the learners in the school or locality. One of which is Modular Distance Learning. It involves individualized instruction that allows learners to use self-learning modules (SLMs) in print or digital format/electronic copy, whichever is applicable in the context of the learner, and other learning resources like Learner's Materials, textbooks, activity sheets, study guides and other study materials. Learners access electronic copies of learning materials on a computer, tablet PC, or smartphone. CDs, DVDs, USB storage and computer-based applications can all be used to deliver e-learning materials, including offline E-books. The teacher takes the responsibility of monitoring the progress of the learners. The learners may ask assistance from the teacher via e-mail, telephone, text message/instant messaging, etc. Where possible, the teacher shall do home visits to learners needing remediation or assistance. Any member of the family or other stakeholder in the community needs to serve as a para-teacher (Llego, 2020).

The Independent Science Project Plan adheres to the Activity-Before-Concept (ABC) of Science. As a result, this is not the same as traditional teaching. Before delivering the lesson, students conduct experiments in which they develop concepts that are then reviewed and discussed. Real-world experiences are necessary for students to develop abstract concepts. This is what inquiry-based research provides. This is one of the most important cognitive studies because it equips teachers with effective methods and strategies based on how people learn. Our job is to find out what the students already know about the concept we're teaching, look for any inaccuracies or misunderstandings, and give them the chance to change their minds. To guide students to accomplish the performance task provided in the self-learning modules independently, a Science Project Plan was given to them. It is a document that contains an overview and clear learning targets. It also shows a smooth process flow of activities to take to accomplish the task. This served as a roadmap to the students that show the project phases, key activities, their start and end dates, dependencies between tasks, and project milestones. Moreover, the students were guided by a project plan. Since face-to-face classes are strictly prohibited, ISPP gave students a sense of responsibility in managing their projects alone, managing their own time, and budgeting their work properly. It helped them work individually and decide based on the outputs that they get from the experiments. Also, students were given the freedom to work at their own pace, assume responsibility for learning, find that textbooks are not the only source of learning, know exactly what they must learn, encourage to master the module, and competition for grades is reduced.

The ISPP was used for five (5) weeks starting from the administration of the pre-test. Before the administration of the post-test, the teachers administered four (4) performance tasks, 25 points each that served as a formative assessment on the development of the scientific inquiry skills of the learners. Table 3 shows the results of the performance tasks showing the experimental group to be more homogeneous than the control group as indicated by lower values of the standard deviations (SD).

Table 3. Learners' Performance Task Results During the Use of Independent Science Project Plan

Performance Tasks	Control Group			Experimental Group		
	MPS	SD	Qualitative Description	MPS	SD	Qualitative Description
A Doctor for a Day	46.32	6.76	Average Mastery	86.48	4.75	Moving towards Mastery

Performance Tasks	Control Group			Experimental Group		
	MPS	SD	Qualitative Description	MPS	SD	Qualitative Description
A Young Scientist	48.80	7.45	Average Mastery	82.16	5.09	Moving towards Mastery
A Tourist in Your Own House	41.68	5.64	Average Mastery	90.08	3.92	Moving towards Mastery
A Scientist and His Experiment	51.84	6.91	Average Mastery	90.08	3.66	Moving towards Mastery

Table 3 presents the learners' performance task results during the use of ISPP. The learners in the control group performed on an Average Mastery level in all of the performance tasks given each week. Using the ISPP, the learners in the experimental group attained Moving towards Mastery level in the performances tasks – A doctor for a day (MPS=86.48, SD=4.75), a young scientist (MPS=82.16, SD=5.09), a tourist in your own house (MPS=90.08, SD=3.92) and a scientist and his experiment (MPS=90.08, SD=3.66).

This implies that the experimental group benefited from the implementation of the ISPP in their scientific inquiry skills indicative of their higher level of mastery compared to the control group.

Learners' Level of Scientific Inquiry Skills After the Use of ISPP

After the use of the ISPP, a final test was administered to measure the improvement of the experimental group in the four scientific inquiry skills as compared to the control group. Table 4 presents the result of the post-test.

Table 4. Learners' Level of Scientific Inquiry Skills After the Use of ISPP

Skills	Control Group			Experimental Group		
	MPS	SD	Qualitative Description	MPS	SD	Qualitative Description
Asking Questions About the World	44.92	4.39	Average Mastery	64.15	3.02	Average Mastery
Designing and Conducting Investigations	50.25	1.79	Average Mastery	66.25	1.55	Moving towards Mastery
Employing Different Strategies to Obtain Information	45.00	1.94	Average Mastery	73.00	1.62	Moving towards Mastery
Communicating Results	52.50	1.73	Average Mastery	71.50	1.41	Moving towards Mastery
Posttest Overall Score	**47.00**	**8.32**	**Average Mastery**	**67.08**	**5.77**	**Moving towards Mastery**

It can be seen in Table 4 that the learners in the control group had an average mastery level in all of the scientific inquiry skills during the post-test. The learners in the experimental group aside from *asking questions about the world* (MPS=64.15, Average Mastery) had attained Moving towards Mastery level in *designing and conducting an investigation, in employing different strategies to obtain information and in communicating results.* Their overall scores in the post-test reached an MPS= 67.08 (SD=5.77) which indicates that they had improved to a Moving towards Mastery level after the use of the ISPP. However, this began in their average mastery in asking questions and seeking answers as they explore and try to make sense of their surroundings.

Moreover, the learners in the experimental group had improved in considering what problems they are trying to find possible solutions

and creating a hypothesis, designing their experiments and stating their findings and conclusions.

Differences in the Scientific Inquiry Skills of Learners after the Use of ISPP

Descriptively, the results above showed differences in the scores (MPS) of the learners both in the control and experimental group. Table 5 presents the correlated t-test on learners' level of scientific inquiry skills before and after the use of ISPP.

It can be seen on Table 5 that learners in the control group SIS 1 (t=8.176, p=.000), SIS 2 (t=4.264, p=.000) and SIS 3 (t=4.659, p=.000) and composite (t=18.914, p=.000) had significance values less than the set alpha level (α=.05). These signify a rejection of the null hypothesis; hence, there is a significant difference on skills 1, 2 and 3, and in the overall pretest and posttest MPS of the learners using the traditional teaching-learning method.

In the experimental group, SIS 1 (t=16.315, p=.000), SIS 2 (t=8.056, p=.000), SIS 3 (t=12.951), SIS 4 (t=5.852, p=.000) and composite (t=24.187, p=.000) had significance values that are less than the set alpha level (α=.05) which prompted rejection of the null hypotheses. Hence, there is a significant difference in the level of scientific inquiry skills of the learners from the experimental group before and after the use of the ISPP. This implies the effectiveness of the project plan in improving all of the four scientific inquiry skills of the learners. In comparison to the traditional instructional approach, the use of guided inquiry with analogy, according to Nworgu et al. (2013), not only significantly improved students' acquisition of science process skills, but it also resulted in a significant or substantial reduction of the gap in science process skill acquisition between males and females.

Table 5. Paired t-Test on Learners' Level of Scientific Inquiry Skills Before and After the Use of ISPP

	Scientific Inquiry Skills	Paired Difference			t	df	Sig. (2-tailed)
		Mean	SD	SEM			
CONTROL	1	3.080	2.664	.377	8.176	49	.000**
	2	1.220	2.023	.286	4.264	49	.000**
	3	1.060	1.609	.228	4.659	49	.000**
	4	.360	1.838	.260	1.385	49	.172
	Composite	5.72	2.138	.302	18.914	49	.000**
	Scientific Inquiry Skills	**Paired Difference**			**t**	**df**	**Sig. (2-tailed)**
		Mean	**SD**	**SEM**			
EXPERIMENTAL	1	7.400	3.207	.454	16.315	49	.000**
	2	2.100	1.843	.261	8.056	49	.000**
	3	3.140	1.714	.242	12.951	49	.000**
	4	1.620	1.958	.277	5.852	49	.000**
	Composite	14.260	4.169	.590	24.187	49	.000**

Moreover, Table 6 shows the independent samples t-test result comparing the scientific inquiry skills between the control and experimental group both during the pretest and the posttest.

It can be seen in Table 6 that, during the pretest, all skills including the composite value showed p-values (Sig. 2-tailed) were greater than the set alpha level (α=.05) which signify acceptance of the null hypotheses, hence no sig-

nificant difference in the MPS of learners between the control and experimental group. However, during the post-test, Skill 1 (t=6.568, p=.000), Skill 2 (t=3.776, p=.000) Skill 3 (t=6.210, p=.000), Skill 4 (t=4.758, p=.000) and composite (t=6.942, p=.000) have significance values less than the set alpha level (α=.05).

Table 6. Independent Samples t-Test between the Experimental and Control Group Before and After the Use of ISPP

Pretest	**Difference**		**t**	**df**	**Sig. (2-tailed)**	**Interpretation**
	Mean	St. Error				
Skill 1	.680	.945	.720	98	.474	Not Significant
Skill 2	.400	.410	.975	98	.332	Not Significant
Skill 3	.160	.372	.430	98	.668	Not Significant
Skill 4	.260	.459	.566	98	.573	Not Significant
Composite	1.500	1.816	.826	98	.411	Not Significant
Posttest	**Difference**		**t**	**df**	**Sig. (2-tailed)**	**Interpretation**
	Mean	St. Error				
Skill 1	5.000	.761	6.568	98	.000	Significant
Skill 2	1.280	.339	3.776	98	.000	Significant
Skill 3	2.240	.361	6.210	98	.000	Significant
Skill 4	1.520	.319	4.758	98	.000	Significant
Composite	10.040	1.446	6.942	98	.000	Significant

This prompted rejection of the null hypotheses; hence there is a significant difference in the MPS scores between the control and experimental group during the posttest involving all the scientific inquiry skills. This indicates that the experimental group significantly had a higher mastery level in asking questions about the world, in designing and conducting an investigation, in employing different strategies to obtain information and in communicating results, compared to the control group.

As a result of the study, the implementation of the Independent Science Project Plan improved the learners' scientific inquiry skills. Although some studies, such as Jeková1 et al. (2018), Kirschner et al. (2006), and Klahr and Nigam (2004), show that inquiry approaches are less effective than traditional approaches, the findings of this study are consistent with the findings of Cetin (2021), Lubiano and Magpantay (2021), Tekin and Erylmaz Muştu (2021), B. Panjaitan and Siagian (2020), Sahintepe et al. (2019), Duran and Dökme (2016), and Lord and Orkwiszewski (2006) have all demonstrated that inquiry approaches were effective in enriching science inquiry skills of learners than that of the traditional ones.

In this regard, the inquiry-based learning (IBL) approach is more effective in raising students' critical thinking levels. As a result, it can be argued that science and technology classes taught using the IBL approach have a greater positive effect on students' critical thinking levels (Duran and Dökme, 2016), an increase in science process skills and scientific creativity (Panjaitan and Siagian, 2020) and it showed that the views of students on scientific inquiry improved in all aspects after the implementation (Cetin, 2021).

Most Improved Scientific Inquiry Skills After the Use of ISPP

The results above revealed that the usage of ISPP is useful in enhancing the learners' scientific inquiry skills. One of the most important goals of education today, according to Yumusak (2015), is to teach students how to think scientifically and how to do science. Aside from comparison skills, data gathering, data interpretation, and the ability to hypothesize, science process skills include abilities that require more complex experiences, such as the ability to observe, which we develop and use naturally even as children. According to the study of Gormally et al. (2009), inquiry students increased self-

confidence in scientific abilities, while conventional students gained more, implying that the traditional curriculum produced overconfidence.

Furthermore, the researcher aimed to determine which of these skills is most improved by using the ISPP. Table 7 displays the rate of improvement (ROI) in scientific inquiry skills of learners from both the control and experimental groups.

Table 7. Learners' Rate of Improvement (ROI) on Scientific Inquiry Skills After the Use of ISPP

Scientific Inquiry Skills	Rate of Improvement (ROI) per Week	
	Control	Experimental
Asking Questions About the World	2.368	5.692
Designing and Conducting Investigations	3.050	5.250
Employing Different Strategies to Obtain Information	2.650	7.850
Communicating Results	0.900	4.050

Using the traditional method of science teaching, the learners from the control group had the highest ROI of 3.050 in terms of designing and conducting investigations. Noticeably, the experimental group had a higher ROI in all four scientific inquiry skills. Moreover, using the ISPP, the experimental group had the highest ROI of 7.850 per week in terms of their skills in employing different strategies to obtain information. This implies that the learner benefited the most improvement in applying their techniques in obtaining data or information for their experiment activities. Hairida (2016) found that employing inquiry-based modules in conjunction with genuine assessment to teach science to seventh-grade students is an excellent way to help students build their critical thinking and inquiry skills.

Moreover, Lord and Orkwiszewski (2006) recommend that all science professors consider teaching through inquiry challenges. Their students not only understand the material better than memorizers, but they also retain the information for a longer period. Students who are taught through inquiry are better able to apply what they learn in new situations and are more likely to develop a personal interest in the science around them than students who are taught traditionally.

Conclusion

From the findings of the study, the researcher draws the following conclusions:

First, before the use of the ISPP, the learners in the control group had a low mastery level of asking questions about the world, designing and conducting investigations, and employing different strategies to obtain information but had an average level of skill in communicating results. On the other hand, the learners in the experimental group had a low mastery level of asking questions about the world and in employing different strategies to obtain information and had an average mastery level of scientific inquiry skills in terms of designing and conducting investigations and communicating results.

Second, in terms of preparation, the teachers are well equipped with the knowledge and skills required in delivering distance education classes which includes their time management and supportive interaction and collaboration with the students using the integration of technology in the curriculum. In terms of facilities and materials, they have available printed modules provided by the schools and have stable internet connectivity used for distance teaching and remote interaction with the students through social media and other web-based interactions with the students.

Third, during the inclusive weeks of using the ISPP, the learner from the control group performed on an average mastery level while the learners from the experimental group performed on moving towards mastery level on the performance tasks given each week.

Fourth, after the use of the ISPP, the learners in the control group attained an average mastery level while the learners in the experimental group had improved and attained

moving towards mastery level of scientific inquiry skills.

Fifth, on average, learners from both the control and experimental group showed a significant difference in their level of scientific inquiry skills before and after the use of ISPP. However, after the use of ISPP the learners from the experimental group had significantly differed from the control group in their level of scientific inquiry skills.

Sixth, the use of the ISPP greatly improved the skills of the learners in employing different strategies to obtain information.

Acknowledgement

The researcher would like to express his greatest appreciation to the following individuals.

To the Parents, Mama Rose and Papa Larry, sisters Gleds and Ghie, brothers Rowell, Rjay, and Joncen, and nephews Keenu and Keeon for their constant support to him financially, emotionally, and psychologically, for the never-ending support, guidance, and considerations for the fulfillment of this paper. For their ceaseless love and their unending words of encouragement.

To God the Creator. From the beginning of this study to the completion of this paper, thank you for blessing the researcher with knowledge, love, and guidance to complete this study, for healing him in times of fatigue and exhaustion as he worked to complete what was required, and for always being there for him.

To PRMSU Graduate School Director, Dr. Marie Fe D. De Guzman, for her leadership in ensuring that this academic accomplishment was achieved.;

To Dr. Jo A. Espiritu, the former Assistant Director of the Graduate School, and Dr. Ivy H. Casupanan, the new Coordinator of PRMSU Graduate School - Castillejos Extension, for their guidance and assistance.

To Dr. Rosario D. Dacuno, the enthusiastic and passionate thesis adviser, who deserves special recognition for never failing to motivate the researcher when he feels like giving up, and for being positive and energetic, which motivates him to continue the journey that began.

To the Research Panel headed by Dr. Ferdinand V. Tamoria, and his members Dr. Ivy H. Casupanan and Ma'am Corazon A. Peralta for their thoughtful consideration, patience, and unwavering support in bringing this study to a successful conclusion. The advice and recommendations are greatly appreciated.

To the Graduate School Family for their energy and enthusiasm, which inspires the researcher despite the challenges that he has faced in performing and completing this research.

Finally, he would like to express his most ardent gratitude to everyone who assisted the researcher in achieving his goals and touched his life.

References

Bernard, H. R. (2002). Research methods in anthropology: Qualitative and quantitative approaches (3rd ed.). Walnut Creek, CA: Alta Mira Press.

Cetin, P. (2021). Effectiveness of Inquiry-Based Laboratory Instruction on Developing Secondary Students' Views on Scientific Inquiry. Journal of Chemical Education, 98(3), 756-762. doi: 10.1021/acs.jchemed.0c01364

Chiang, I., Jhangiani, R., & Price, P. (2020). Quasi-Experimental Research. Retrieved 5 September 2020, from https://opentextbc.ca/researchmethods/chapter/quasi-experimental-research/#:~:text=Quasi%2Dexperimental%20research%20involves%20the,and%20interrupted%20time%2Dseries%20designs.

Duran, M., & Dökme, İ. (2016). The effect of the inquiry-based learning approach on student's Critical Thinking Skills. *EURASIA Journal of Mathematics, Science and Technology Education*, *12*(12), 2887–2908. https://doi.org/10.12973/eurasia.2016.02311a

Feyzioğlu, B. (2019) The role of inquiry-based self-efficacy, achievement goal orientation, and learning strategies on secondary-school students' inquiry skills, Research in Science & Technological Education, 37:3, 366-392, DOI: 10.1080/02635143.2019.1579187

Gormally, C., Brickman, P., Hallar, B., & Armstrong, N. (2009). Effects of inquiry-based learning on students' science literacy skills and confidence. International Journal for the Scholarship of Teaching and Learning, 3(2). https://doi.org/10.20429/ijsotl.2009.030216

Hairida, H. (2016). The effectiveness using inquiry based natural science module with authentic assessment to improve the critical thinking and inquiry skills of junior high school students. Jurnal Pendidikan IPA Indonesia, 5(2), 209-215.

Ješková1, Z., Balogová1, B., & Kireš1, M. (2018, September 1). IOPscience. Journal of Physics: Conference Series. Retrieved January 22, 2022, from https://iopscience.iop.org/article/10.1088/1742-6596/1076/1/012022

Kirschner, P., Sweller, J., & Clark, R. (2006). Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching. Educational Psychologist, 41(2), 75-86. https://doi.org/10.1207/s15326985ep4102_1

Klahr, D.; Nigam, M. (2004). The Equivalence of Learning Paths in Early Science Instruction: Effects of Direct Instruction and Discovery Learning. Psychological Science, 15(10), 661–667. doi:10.1111/j.0956-7976.2004.00737.x

Llego, M. (2020). DepEd Self-Learning Modules (SLM) for School Year 2020-2021 - TeacherPH. Retrieved 6 September 2020, from https://www.teacherph.com/deped-learning-delivery-modalities

Lord, T. & Orkwiszewski, T. (2006). Moving from didactic to inquiry-based instruction in a science laboratory. The American Biology Teacher, 68, 342- 345. https://doi.org/10.2307/4452009

Lubiano, M. L., & Magpantay, M. S. (2021). Enhanced 7E instructional model towards enriching science inquiry skills. International Journal of Research in Education and Science, 630–658. https://doi.org/10.46328/ijres.1963

Nworgu, L. N., & Otum, V. V. (2013). Effect of guided inquiry with analogy instructional strategy on students acquisition of science process skills. Journal Education and Practice 4,(27) 35, 40.

Omorogbe, E., & Ewansiha, C. J. (2013). The Challenge of Effective Science Teaching in Nigerian Secondary Schools. *Academic Journal of Interdisciplinary Studies*, *2*(7), 187–188. https://doi.org/Doi:10.5901/ajis.2013.v2n7p181

Panjaitan, M. B., & Siagian, A. (2020). The Effectiveness of Inquiry-Based Learning Model to Improve Science Process Skills and Scientific Creativity of Junior High School Students. Journal of Education and E-Learning Research, 7(4), 380–386. https://doi.org/10.20448/journal.509.2020.74.380.386

PISA 2018 National Report of the Philippines. (2019). Retrieved 29 August 2020, from https://www.deped.gov.ph/wp-content/uploads/2019/12/PISA-2018-Philippine-National-Report.pdf

Reysio-Cruz, M. (2019). Worst PH ranking in math, science, reading prompts DepEd review. Retrieved 29 August 2020, from https://newsinfo.inquirer.net/1198208/worst-ph-ranking-in-math-science-reading-prompts-deped-review

Rubin, C. & Babbie, S. (2017). Research methods for social work (9th edition). Boston, MA: Cengage.

Sahintepe, S., Erkol, M., & Aydogdu, B. (2019, November 30). *The impact of Inquiry-Based Learning Approach on secondary school students' science process skills.* Open Journal for Educational Research. Retrieved January 22, 2022, from https://eric.ed.gov/?id=EJ1285099

Tekin, G., & Eryılmaz Muştu, Ö. (2021). The effect of research-inquiry-based activities on the academic achievement, attitudes, and scientific process skills of students in the seventh year science course. *The European Educational Researcher*, *4*(1), 109–131. https://doi.org/10.31757/euer.416

Thomas, L. (2020, August 3). An introduction to quasi-experimental designs. Scribbr. https://www.scribbr.com/methodology/quasi-experimental-design/

Yumusak, G. K. (2015, November 30). ERIC - EJ1109214 - Science Process Skills in Science Curricula Applied in Turkey, Journal of Education and Practice, 2016. Https://Eric.Ed.Gov/?Q=science+process+skills&id=EJ1109214.