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Science Integration in Alternative Learning System: Basis for an Enriched Basic Science Process Skills and Scientific Attitude of Lifelong Learners

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Abstract

This study focused on the effect of science integration approaches in enhancing the basic science process skills and scientific attitudes of junior high school lifelong learners in the Alternative Learning System. A pretest-posttest experimental design was employed to collect the data from 60 junior high school learners using researcher-made science process skills tests and a scientific attitudinal survey. Findings revealed that there is a significant difference in the pre-test and post-test scores of respondents exposed to science intradisciplinary integration and that of those exposed to the science interdisciplinary integration approach. Furthermore, both groups of respondents have the same level of scientific skills before being exposed to science integration approaches. The post-test results of the two groups were significantly different, indicating that the interdisciplinary integration approach better enhanced the basic science process skills of the students. In addition, it was found that learners have the same level of scientific attitude even after being exposed to science integration approaches. In the profile of respondents, the findings also revealed that there is a significant difference in the students' science process skills in terms of observing and communicating when grouped according to age. Moreover, it was confirmed in the study that there is no significant difference in the level of science process skills except for communicating and the level of scientific attitude except for open-mindedness when grouped according to marital status. It was also confirmed that sex and employment status are not significant factors in the enhancement of scientific skills and attitudes of ALS learners. Science integration approaches are crucial in enhancing the basic science process skills and scientific attitudes of learners. Thus, the implementation of intradisciplinary and interdisciplinary approaches in teaching science could be recommended.

Keywords: Basic Science Process Skills, Intradisciplinary, Interdisciplinary, Scientific Attitude, Science Integration.

Introduction

Knowledge, skills, and attitudes are acquired through education. Science is an important aspect of students' foundation for education. In the Philippines, the science curriculum was implemented to nurture scientifically literate individuals who are rational decision-makers and can utilize scientific knowledge as active participants in society (Dela Cruz, 2022). Primarily, the science curriculum is developed to enhance the students' three learning domains. These are recognizing and implementing scientific knowledge,

achieving scientific processes and skills, and developing students' scientific attitudes (Montebon, 2014). Moreover, it is also important that students realize that what they are learning in science is essential for their future. To make sure that students are capable of taking on the challenges of tomorrow, investing in precise and focused science education is important (Loney, 2014).

Furthermore, as stated in the Ministry of Education, as cited by Fraser (2013), one of the leading principles of the curriculum is consistency, by which students are offered *"a broad education that makes links within and across learning areas".* The pervasive goal of science education is to develop basic skills and appropriate scientific attitudes in students. Accordingly, as mentioned by Winarti et al. (2019), science process skills are unique skills resulting from learning science concepts. For better mastery, students must be given a chance to train these skills in various content areas and contexts. According to Rahardini et al. (2017), the key to successful science learning is to improve students' process skills. On the other hand, to be scientific means that one has such attitudes as curiosity, rationality, open-mindedness, objectivity, and other behaviors that promote scientific acts or thoughts (Pitafi and Farooq, 2012).

The Alternative Learning System Act or Republic Act No. 11510 of 2020 declared that the policy of the State shall promote the right of all citizens to quality education at all levels and take the appropriate steps to make education accessible to all. The act aims to promote lifelong learning opportunities for out-of-school children and youth (in special cases) and adults to enhance knowledge, skills, and values. It also aims to develop, integrate, and utilize different approaches in the implementation of ALS programs, including educational outcomes and competencies assessment through flexible learning programs and contents using responsive learning modalities appropriate for the learners.

The Bureau of Curriculum Development launched the ALS K-12 Basic Education Curriculum to ensure that ALS Curriculum is aligned with the K-12 Program. Although the framework is organized into learning strands, the intention is that instruction should be created around topics that should provide opportunities for skills integration. An integrated curriculum combines and connects content areas to create relevant learning opportunities for students. It is defined as one that connects many areas of study by cutting across subject lines and emphasizing significant ideas and integrated concepts. Likewise, McPhail (2018) mentioned that curriculum integration can enhance the learning outcomes of the students through disciplinary learning that can also be deepened through application in an interdisciplinary context. Constructing relevant and integrated learning opportunities makes science learning more process-oriented and learner-centered. Teaching science with this approach can lead to a rich and rigorous learning experience and meaningful science learning.

Moreover, the researcher chose the mentioned research to help figure out the effectiveness of science integration approaches in enhancing the scientific skills and attitudes of lifelong learners. A learning continuum comprising core skills, knowledge, and attitudes is included in the ALS curricular framework and is designed for non-formal education. As a transitory provision of DepEd Order no. 19 s. 2019 (Enhanced ALS 2.0), to learn new skills in the ALS K-12 Basic Education Curriculum, learners under the previous curriculum must engage in supplementary learning. For this, the researcher believes that science integration would be a great help to achieve the goal of the Alternative Learning System. All of these are crucial attributes for students in their years beyond K-12 education.

Objectives of the Study

The purpose of the study was to determine the effect of using intradisciplinary and interdisciplinary approaches in enhancing the basic science process skills (Observing, Communicating, Classifying, Measuring, Inferring, and Predicting) and scientific attitude (Curiosity, Rationality, Open-mindedness,

Objectivity, and Aversion to Superstition) of the lifelong learners enrolled in the Alternative Learning System in Del Remedio District during the school year 2021-2022.

Methodology

This study utilized a pretest-posttest experimental design. This research design is intended to determine the difference between the level of basic science process skills and scientific attitudes between Intradisciplinary and Interdisciplinary groups of respondents. 60 junior high school learners participated in the study. The respondents were selected using a purposive sampling technique. The learners were selected from the different Community Learning Centers in Del Remedio District and enrolled during the school year 2021-2022. Those who are 16 years of age or older and who are not enrolled in school are eligible to attend ALS junior high school. That is why the learners from both groups have ages ranging from 16-65 years old. Both groups were composed of 30 students with 10 male and 20 female respondents in each group. The respondents were heterogeneously grouped with different ages, marital status, and employment status. The primary instruments of the study were the Science Integrated Lesson Exemplars for both Intradisciplinary and Interdisciplinary approaches, researcher-made basic science process skills pretest and posttest, and an attitudinal survey to determine the level of scientific attitude of the learners.

The study covered three phases namely: pre-implementation, implementation, and post-implementation. Included in the initial phase were the preparation and validation of the instruments and the grouping of respondents. The teacher prepared the science-integrated lesson exemplars for both intradisciplinary and interdisciplinary integration approaches. The contents and activities used in the exemplars were based on the ALS modules and other resources from the DepEd Learning Resource portal. The lesson exemplars, basic science process skills tests, and the scientific attitude survey used were submitted to the experts for comments and suggestions. Upon validation and approval to conduct the study, the researcher assigned two groups: intradisciplinary and interdisciplinary, based on the integration approaches used in the study.

The implementation phase started by conducting a basic science process skills pre-test for the two groups of respondents. Both groups covered the same science competencies and the same sets of questions. ALS programs are delivered in various modes such as face-to-face and independent learning. Since most of the ALS learners are working adults and parents, considering as well the restrictions on face-to-face class sessions because of the COVID-19 pandemic, the modality used in the study is modular distance learning. Depending on the learner's situation, learning materials were delivered in either print or digital/electronic format. For this, students were given a day to answer and finish the pretest. Upon retrieval of the pretest, integrated lessons were given to the experimental groups. The intradisciplinary group was provided with science lesson exemplars that utilized an intradisciplinary integration approach. While the interdisciplinary group was exposed to an interdisciplinary integration approach wherein lessons were integrated within subject areas. The students in this group were provided with competency-based mathematics lectures and activities, video lessons with guide questions, and science vocabulary words with definitions to ensure the utilization interdisciplinary integration approach. During this phase, the teacher took the obligation of monitoring the academic development of both groups of learners. The teacher also made sure to answer all the queries of the students regarding the lessons.

In the post-implementation, both groups were given a 60-item post-test. The post-test examination is an equivalent instrument to the pretest examination. Both groups were also given a survey form to determine the level of their scientific attitudes after being exposed to the integration approaches. All collected data were collated for analysis. Frequency and percentage were used to describe the profile of

the respondents. To determine the mean performance of each group, the mean and standard deviation were computed. The researcher also utilized a t-test to determine the significant difference between the level of basic science process skills and scientific attitudes of the two groups of respondents.

Results and Discussion

This section presents interprets and discusses the results obtained in this study.

1. Profile of the Respondents

1.1. In terms of Age

The respondents' profile was described in terms of age, sex, marital status, and employment status.

Table 1
Profile of the Respondents as to Age

Age	Intradisciplinary		Interdisciplinary	
	frequency	percentage	frequency	percentage
16 – 24 years old	19	63.34	16	53.34
25 – 35 years old	7	23.33	7	23.33
36 – 44 years old	3	10.00	4	13.33
45 – 65 years old	1	3.33	3	10.00
Total	30	100.00	30	100.00

Table 1 presents the distribution of respondents according to age. The 60 learners have ages ranging from 16-65 years. The youngest respondent is 16 years old and the oldest is 54 years old. Most of the age group is 16-24 years old with 63.34% for Intradisciplinary and 53.34% for Interdisciplinary. While the lowest percentage in both groups is in the age group 45-65 with 3.33% and 10.00%. The table shows that ALS junior high school is serving both out-of-school youth and adults.

1.2. In terms of Sex

Table 2
Profile of the Respondents as to Sex

Sex	Intradisciplinary		Interdisciplinary	
	frequency	percentage	frequency	percentage
Male	10	33.33	10	33.33
Female	20	66.67	20	66.67
Total	30	100.00	30	100.00

Table 2 shows the frequency count and percentage distribution of the respondents as to sex. Sixty (60) learners were equally distributed in both groups. Ten (10) respondents or 33.33% are male 20 respondents or 66.67% are female both in Intradisciplinary and Interdisciplinary groups.

1.3.In terms of Marital Status

Table 3 shows the marital status of the respondents. The highest percentage of the student's marital status for both groups is single with 25 or 83.33% for intradisciplinary and 23 or 76.67% for interdisciplinary. This shows that the majority of the 60 respondents are single.

Table 3
Profile of the Respondents as to Marital Status

Marital Status	Intradisciplinary		Interdisciplinary	
	frequency	percentage	frequency	percentage
Single	25	83.33	23	76.67
Married	4	13.34	6	20.00
Widow/Widower	1	3.33	1	3.33
Separated/Divorced	0	0.00	0	0.00
Total	30	100.00	30	100.00

1.4. In terms of Employment Status

Table 4
Profile of the Respondents as to Employment Status

Employment Status	Intradisciplinary		Interdisciplinary	
	frequency	percentage	frequency	percentage
Unemployed	17	56.67	18	60.00
Part-time	8	26.67	4	13.33
Full-time	5	16.66	8	26.67
Others	0	0.00	0	0.00
Total	30	100.00	30	100.00

Table 4 reveals the employment status of the respondents. Most of the students for both groups are unemployed with 17 or 56.67% for intradisciplinary and 18 or 60.00% for interdisciplinary. Only a few students are working part-time and full-time jobs.

2. Mean Pre-Test and Post-Test Scores in both Intradisciplinary and Interdisciplinary Science Integration Approaches in terms of the Basic Science Process Skills

Table 5
Mean Pre-Test and Post-Test Scores of Respondents Exposed to the Science Integration Approaches

Basic Science Process Skills	Intradisciplinary				Interdisciplinary			
	Pre-test		Post-test		Pre-test		Post-test	
	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
Observing	4.40	1.10	7.03	1.47	4.80	1.63	8.43	1.17
Communicating	3.10	1.69	6.60	1.57	3.70	2.35	7.40	1.54
Classifying	5.27	1.60	7.70	1.53	5.83	1.76	8.60	1.65
Measuring	3.03	1.54	5.67	1.42	4.00	2.38	7.53	1.17
Inferring	3.50	1.85	5.40	1.65	3.97	1.65	6.63	1.25
Predicting	3.47	1.48	5.63	1.56	3.37	1.50	6.53	1.85
Total Score	22.77	5.74	38.03	5.86	25.67	7.02	45.13	5.39

Table 5 presents the mean pre-test and post-test scores performance of both intradisciplinary and interdisciplinary groups of respondents in terms of basic science process skills.

Based on the pre-test result, the intradisciplinary group has a mean score of 22.77 and (SD=5.74) in the basic science process skill test. The highest mean value is classifying (m=5.27) and the least mean

is measuring (m=3.03). The post-test result revealed that the average score of the students increased after being exposed to the intradisciplinary integration approach with (m=38.03 and SD= 5.86). The highest mean value in the post-test is classifying (m=7.70) and the least mean is inferring (m=5.40).

The interdisciplinary group has an overall mean of 25.67 with (SD=7.02) in the pretest. The highest mean value is classifying (m=5.83) and the least mean is predicting (m=3.37). The post-test result revealed that the average score of the students increased after being exposed to the interdisciplinary integration approach (m=45.13 and SD= 5.39). The highest mean value is classifying (m=8.60) and the least mean is predicting (m=6.53). The data showed that in both groups of respondents classifying skills has the highest post-test mean in their basic science process skills test. According to Puspita (2016), as cited by Maison et al. (2019) classifying is part of the basic science process skills, a second indicator that must be strengthened by the student after observing skills in studying Physics. Furthermore, the result revealed that the average score of the students exposed to the interdisciplinary science integration approach is higher compared to that of those exposed to the intradisciplinary approach.

3. Level of Scientific Attitudes of the Respondents from the two Groups Exposed to Science Integration Strategies

Table 6
Level of Scientific Attitudes

Classification	Intradisciplinary			Interdisciplinary		
	mean	s.d.	interpretation	mean	s.d.	interpretation
1. Curiosity	3.36	0.07	To a high level	3.57	0.61	To a very high level
2. Rationality	3.45	0.67	To a high level	3.52	0.64	To a very high level
3. Open-mindedness	3.47	0.67	To a high level	3.61	0.61	To a very high level
4. Objectivity	3.25	0.79	To a high level	3.41	0.72	To a high level
5. Aversion to Superstition	3.23	0.70	To a high level	3.35	0.68	To a high level

Table 6 shows the result of the scientific attitudinal survey on the two groups exposed to science integration approaches. The scientific attitude is classified into five: curiosity, rationality, open-mindedness, objectivity, and aversion to superstition. Each classification comprises five indicators where students indicate their level of scientific attitude.

As presented in the result, the Intradisciplinary group has *"a high level"* of curiosity, rationality, open-mindedness, objectivity, and aversion to superstition. On the other hand, the Interdisciplinary group has *"a very high level"* of curiosity, rationality, open-mindedness, and *"a high level"* of objectivity, and aversion to superstition. The highest mean value for both groups is open-mindedness with 3.47 for Intradisciplinary and 3.61 for Interdisciplinary. This implies that students are willing to acquire new knowledge and are willing to reanalyze one's perspectives based on strong evidence.

4. Test of Difference in the Pre-Test and Post-Test Scores of Respondents Exposed to Science Intradisciplinary Integration and those Exposed to Science Interdisciplinary Integration Approach

Table 7 shows that there is a significant difference between the pretest and post-test scores of the Intradisciplinary group (.003 ≤ .05) and the Interdisciplinary group (.000 ≤ 05). This implies that the science integration approaches used may improve students' basic science process skills since the p-value is greater than the critical value of 0.05.

Table 7
Test of difference in the pre-test and post-test scores of respondents exposed to science intradisciplinary and interdisciplinary integration approaches

Variables	Pretest		Posttest		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Intradisciplinary	3.79	1.73	6.34	1.73	2.653	58	.003
Interdisciplinary	3.37	1.50	7.52	1.65	9.278	58	.000

Likewise, as mentioned by Derilo (2019) mastering science process skills may lead to improved science performance.

5. Test of Difference between the Pre-test and Post-test of the two Groups of Respondents after being Exposed to the Science Integration Approaches

Table 8
Test of difference between the pre-test and post-test of the two groups of respondents

Variables	Intradisciplinary		Interdisciplinary		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Pre-test	3.79	1.73	3.37	1.50	0.013	58	.062
Post-test	6.34	1.73	7.52	1.65	3.831	58	.031

Table 8 shows that there is no significant difference between the pretest scores of the two groups of respondents on the basic science process skills assessments ($p > 0.05$). This implies that both groups have the same level of skills before their exposure to the integration approaches. While the post-test result shows that there is a significant difference between the two groups after being exposed to science integration approaches ($p<0.05$). The data revealed that the interdisciplinary group has a higher mean posttest value compared to the intradisciplinary group. This implies that the students from the interdisciplinary group scored better than the others. Furthermore, integration between subject areas may increase students' basic science process skills as manifested in the post-test result. Similarly, the data is paralleled in the study of Alghamdi (2017), that an integrated curriculum has an advantageous effect on the academic development of the students. Teachers should motivate learners to look for opportunities to get involved with interdisciplinary learning and assessment as it provides the students ownership over their learning. Interdisciplinary approaches can help students to have a better understanding of science (Yarker and Park, 2012).

6. Test of Difference in the Level of Scientific Attitudes Exist Between the two Groups of Respondents Exposed to the Science Integration Approaches

Table 9 shows that there is no significant difference between the level of scientific attitude between the two groups of respondents exposed to Intradisciplinary and Interdisciplinary integration approaches as to curiosity (p-value= 0.052), rationality (p-value= 0.102), open-mindedness (p-value= 0.064), objectivity (p-value= 0.068), and aversion to superstition (p-value 0.093) since the $p>0.05$. This implies that both groups of learners exposed to the science integration approaches have the same level of improvement in terms of scientific attitude.

Table 9
Test of difference in the level of scientific attitudes of the two groups of respondents

Scientific Attitudes	Intradisciplinary Integration		Interdisciplinary Integration		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Curiosity	3.36	0.70	3.57	0.45	0.005	58	0.052
Rationality	3.45	0.67	3.52	0.64	0.299	58	0.102
Open-mindedness	3.47	0.67	3.61	0.61	0.057	58	0.064
Objectivity	3.25	0.79	3.41	0.72	0.063	58	0.068
Aversion to Superstition	3.23	0.70	3.35	0.68	0.137	58	0.093

7. Test of Difference in the Level of Basic Science Process Skills and Scientific Attitudes when Grouped According to the Profile of Respondents

Table 10
Test of difference in the level of basic science process skills and scientific attitudes when grouped according to age

Basic Science Process Skills	Sig.	Scientific Attitudes	Sig.
observing	0.000	curiosity	0.053
communicating	0.013	rationality	0.051
classifying	0.062	open-mindedness	0.055
measuring	0.052	objectivity	0.055
inferring	0.059	aversion to superstition	0.052
predicting	0.055		

Table 10 presents the level of basic science process skills and scientific attitudes of the two groups of respondents when grouped according to age.

Based on the given table, there is a significant difference between the level of basic science process skills when grouped according to age as to observing (p-value= 0.000), and communicating (p-value= 0.013) since $p<0.05$. However, there is no significant difference between the level of basic science process skills as to classifying, measuring, inferring, and predicting since $p>0.05$. This implies that the level of observation and communication skills of the learners is different with specific age groups. During the conduct of the study, it was observed that students, especially the younger ones are more detailed and accurate with their written or drawn descriptions. In their work samples, they provide detailed interpretations of their answers based on their understanding and observations. Students communicate regularly with the teacher and share their ideas through talking and listening with their classmates who are usually their family members/friends/ neighbors.

Table 11
Test of difference in the level of basic science process skills and scientific attitudes when grouped according to sex:

Basic Science Process Skills	Sig.	Scientific Attitudes	Sig.
observing	0.062	curiosity	0.058
communicating	0.081	rationality	0.072
classifying	0.057	open-mindedness	0.064
measuring	0.071	objectivity	0.077
inferring	0.082	aversion to superstition	0.073
predicting	0.080		

Table 11 presents the level of basic science process skills and scientific attitudes of the two groups of respondents when grouped according to sex.

The data revealed that there is no significant difference between the level of basic science process skills when grouped according to sex since p>0.05. This implies that sex is not a significant factor in acquiring basic science process skills. The result agrees with the findings of Jack (2013) who found that sex does not affect or influence the acquisition of science process skills of the student.

On the other hand, there is no significant difference in the students' scientific attitudes when grouped according to sex. This indicates that being male or female does not influence the level of scientific attitudes of students in learning science. The findings also corroborate the result of a study conducted by Orji et al. (2020) which revealed that gender has no notable influence on the student's scientific attitudes.

Table 12
Test of difference in the level of basic science process skills and scientific attitudes when grouped according to marital status

Basic Science Process Skills	Sig.	Scientific Attitudes	Sig.
observing	0.068	curiosity	0.053
communicating	0.001	rationality	0.058
classifying	0.061	open-mindedness	0.008
measuring	0.051	objectivity	0.053
inferring	0.058	aversion to superstition	0.074
predicting	0.072		

The result shows that there is a significant difference in the level of basic science process skills in terms of communicating (p-value= 0.001) and scientific attitude in terms of open-mindedness (p-value= 0.008 ≤ 0.05). However, the level of basic science process skills including observing, classifying, measuring, inferring, and predicting, and the level of students' scientific attitudes including curiosity, rationality, objectivity, and aversion to superstition showed no significant difference.

Table 13
Test of difference in the level of basic science process skills and scientific attitudes when grouped according to employment status

Basic Science Process Skills	Sig.	Scientific Attitudes	Sig.
observing	0.062	curiosity	0.103
communicating	0.057	rationality	0.092
classifying	0.061	open-mindedness	0.090
measuring	0.055	objectivity	0.089
inferring	0.059	aversion to superstition	0.078
predicting	0.053		

Table 13 presents the level of basic science process skills and scientific attitudes when grouped according to employment status.

When grouped according to employment status, the data revealed that there is no significant difference between the level of basic science process skills and students' scientific attitudes. The results confirmed that both groups of respondents have the same level of scientific skills and attitudes whether the respondents are unemployed, part-time, or full-time.

Conclusions

The findings gathered in the study led to the formulation of the following conclusions:

1. There is a significant difference in the pre-test and post-test scores of respondents exposed to science intradisciplinary integration and that of those exposed to the science interdisciplinary integration approach. Thus, the hypothesis posited is not sustained.

2. There is no significant difference in the pre-test scores of the two groups of respondents. Moreover, there is a significant difference between the post-test scores of the respondents after being exposed to the science integration approaches.

3. There is no significant difference in the level of scientific attitudes that exist between the Intradisciplinary and Interdisciplinary groups exposed to the science integration approaches. This means that the hypothesis posited is supported.

4. There is a significant difference in the basic science process skills in terms of observing and communicating when grouped according to age.

There is no significant difference between the level of basic science process skills and students' scientific attitudes when grouped according to sex and employment status.

There is no significant difference in the level of basic science process skills except for communication skill and the level of scientific attitude except for open-mindedness when grouped according to marital status.

Recommendations

Since the study revealed the effectiveness of using intradisciplinary and interdisciplinary approaches in enhancing the basic science process skills and scientific attitude of the learners, it is suggested that teachers in Alternative Learning Systems may implement the integration approaches in teaching Science. The teachers may also consider the findings of the study in deciding the necessary integration approach that is suitable to the learning needs and profile of the learners. Considering that the level of students' scientific skills and attitudes were enhanced, the school administrators may support the implementation of curriculum integration approaches in teaching and learning science. Teachers must be provided with training- workshops on developing effective science-integrated lessons that will concentrate and give emphasis on improving the skills and attitudes of the learners. It is also highly suggested that future researchers would conduct a more in-depth study about curriculum integration with more variables to consider.

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