IJAMS
INTERNATIONAL JOURNAL OF ADVANCED MULTIDISCIPLINARY STUDIES
Volume III, Issue 10 October 2023, eISSN: 2799-0664

Fostering Critical Thinking Skills and Enjoyment in Science 8 Class Using Interactive Science Notebook (ISN)

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Abstract — In science teaching, the ability to think critically and to reason out have been regarded as the central outcomes of students' learning. A simple yet powerful instructional tool that caters this need is the Interactive Science Notebook (ISN). The conducted study attempted to provide solution to the low scientific proficiency of Grade 8 students of Valencia National High School, Division of Valencia City through the utilization of ISN. Descriptive research was employed involving pre-test and posttest design measuring the achieved critical thinking skills of the students using ISN. Likewise, the student's attitude towards learning science was compared before and after utilization of ISN, this was supported by the employment of interview schedule.

Results of the study revealed that during the last three grading periods where ISN was used, the students achieved a higher critical thinking skills mean scores when compared to their pre-test mean scores resulting to improved science learning outcomes. Data shows that it allows students to take control of their learning while processing information and engaging in self-reflection, further providing them a varied set of strategies to create a personal, organized, and documented learning record. Additionally, a remarkable change was observed on the attitude of the students in terms of enjoyment in learning science as most of the students' experienced meaningful learning when they are actively engaged in their learning process.

Given these results, it is possible that longer implementation of the ISN might yield larger effects. Thus, the ISN could potentially affect students' scientific proficiency. As educators are held accountable for increasing student achievement through the use of research proven methods, Interactive Science Notebook (ISN) can be promising variables in teaching and learning which could justify observable behavior to increase students' academic achievement.

Keywords — Critical Thinking Skills, Enjoyment, Interactive, Notebook, Science

I. Introduction

Closing achievement gaps and improving science learning outcomes for all students are educational priorities. It is assumed that every student has the potential for learning things beyond what they already know with the assistance and stimulations from the teachers. The extent of the students' learning is being assessed by the National Achievement Test (NAT), an examination given annually by the Department of Education (DepEd) in March to find out the level of mastery of both public and private school students.

For several years, the NAT results of the Grade 10 students of Valencia National High School, Valencia City in the subject area of science show a relative increasing and decreasing trend up to 3 to 8%. This indicates a steady improvement in academic performance of the school. However, the recent NAT results in science pegged only at the average of 43% shows a very wide gap between students' mastery level and the 75% national passing standards. This is amidst the efforts and interventions made during the three (3) formative years of the students when they were in Grade 7 to 9. This reality poses a challenge to teachers to improve the teaching-learning process.

In-depth study and efforts towards the improvement of students' academic ability and performance should be made to attain the desired outcome, equip students with valuable and fundamental skills in science, transport ideas and procedures in preparing them for higher scientific concepts. Likewise, the teacher who wishes students to learn at the maximum level should do his/her best to discover and integrate innovative ways of teaching. Hence, teacher must take a quantum leap in teaching approaches, methods and be mindful of the fast changes in the educational system.

In the light of this observation, the researcher endeavored to find out basis for an action plan to better improve science achievement among the students of Valencia National High School and hopes to achieve the desired outcome coupled with a positive attitude towards learning science.

II. Methodology

The Research Design

In order to find out the potential of Interactive Science Notebook (ISN) in fostering critical thinking skills and enjoyment in science, the study employed descriptive research using quantitative and qualitative methods.

The Research Locale and the Pilot Students/Class

Two (2) intact sections of Grade 8 students in Science- Biotechnology of Valencia National High School, Valencia City under the Special Science Program served as the subjects of study. The students utilized Interactive Science Notebooks (ISN) in their learning process.

The Interactive Science Notebook (ISN)

A medium size composition notebook was used as the ISN. Papers, such as instructions, notes, labs, etc. were periodically glued into the notebook. However, students should not add or rip out any other pages. They organized their ISN in the following guide: the right side of the ISN is for input and the left is for output. Input includes, lecture notes, handouts, notes from a Powerpoint presentations, video lessons, etc. The left output side included items such as drawings, reflections, chapter test exercises, diagrams, concepts maps, theme charts or completed the KWL table, etc. The pilot teacher gave direct instructions and examples for the various types of output

products that could best represent students thinking. Furthermore, students were instructed to always date and number their pages consecutively throughout their ISN. Guiding prompts for student's reflections were placed in front inside cover as a reference tool for the student.

The teacher took the advantage of using the students' entries in the left side for formative assessment. Feedbacks were also provided to students by writing comments on their ISN made by the pilot teacher at the same time, the parents could write their comments to the lessons undertaken by their children. Moreover, students' interactive notebook was periodically assessed and graded with the use of a rubric.

Instrumentation

The instruments of the study were the academic and non-academic assessment.

A. Academic Assessment.

Several items in testing the acquired critical thinking skills of the students in science class were constructed by the teacher-researcher. The trend of the achieved grade scores of the students under these skills were compared each grading period. The students output and scores were reflected in their ISN.

B. Non-academic Assessment.

A pre-test-posttest attitudinal surveys were conducted using a questionnaire consisted of sixteen (16) items on students' attitude with regards to enjoyment in science. This was adapted with modification from Beng Cha Wa (1990) and Pabualan (2013). This was administered to all the respondents in the study to determine their entering attitudes and assess the affective learning outcomes of students when ISN was implemented.

This five (5) point Likert rating scale was used to analyze the affective attitudes of the students toward science. The following were embedded in the scale during the interpretation of data.

Scale	Range	Descriptive Interpretation
5	4.51- 5.0	Strongly Agree
4	3.51- 4.5	Agree
3	2.51- 3.5	Undecided
2	1.51- 2.5	Disagree
1	1.00- 1.5	Strongly Disagree

The negative statements were given reverse weights. Thus, a high score indicates positive attitude towards science and low scores indicating negative attitudes.

Interview schedule was conducted by the researcher to find out the features and effectiveness in the implementation of ISN. Fifteen (15) respondents were randomly selected in the study. The interview consisted of three (3) open-ended question requiring students to answer questions at length.

Statistical Treatment

Statistical procedure was used to answer each research questions. Descriptive statistics such as the mean, standard deviation and percentages were employed to establish the parameters of the study. Likewise, one sample t-test was established to find out any significant improvement on the study.

III. Results and Discussion

There were fifty-seven (57) students involved in the study. Of these, fifteen (15) are represented by male and forty-two (42) are represented by the female. These students were all Grade 8 and enrolled at Valencia National High School, Valencia City under the Special Program for Science and Technology-Engineering and Science Education Program (SPST-ESEP) for the school year SY 2013-2014. The distribution of the samples is shown in Table 1.

Table 1. Distribution sample of the respondents.

Gender	**No. of Student**
Male	15
Female	42
Total	57

Student' Critical Thinking Skills

Table 2 presents the comparative means scores between the students' critical thinking skills achieved before the utilization of the Interactive Science Notebook and on the time of implementation for the whole three (3) grading period.

Table 2. Comparative mean scores of students' critical thinking skills before and after the implementation of the ISN in science class.

Grading Period	Mean Score on Critical Thinking Skills	Std. Deviation
Pretest (Male)	84.94	3.85
Pretest (Female)	83.07	3.44
Second Grading Period (Male)	86.33	3.64
Second Grading Period (Female)	83.86	3.79
Third Grading Period (Male)	86.41	3.72
Third Grading Period (Female)	85.15	3.54
Fourth Grading Period (Male)	91.14	6.57
Fourth Grading Period (Female)	91.06	4.15

The summary of the critical thinking skills mean scores of both male and female are shown in Table 3.

Table 3. Summary of students' critical thinking skills mean scores.

Period	Mean Score on Critical Thinking Skills	Std. Deviation	Std. Error Mean
Pretest	83.5235	3.61708	.47909
Second Grading Period	84.5088	3.87816	.51367
Third Grading Period	85.4860	3.60131	.47701
Fourth Grading Period	91.0821	4.83786	.64079

The results of the one sample t-test data analysis on students' critical thinking skills with the utilization of ISN are presented in table 4.

Table 4. Analysis on students' critical thinking skills mean scores on the utilization of ISN.

	One-Sample Test				
	t-value	df	Sig. (2-tailed)	95% Confidence Interval of the Difference	
				Lower	Upper
Second Grading	164.421	56	.000*	84.45877	83.4298
Third Grading	179.109	56	.000*	85.43596	84.4804
Fourth Grading	142.062	56	.000*	91.03211	89.7484

* Significant at 0.05 level

Enjoyment in Science Class

The enjoyment in learning science was administered to all students at the beginning of the ISN implementation as pretest to determine their entering attitudes. The same instrument was also administered as posttest at the conclusion to assess the affective learning outcomes of students when ISN was implemented.

Table 5. Comparisons on students mean scores for enjoyment in learning science before and after the study.

Attitude Indicators	Pre-Test Mean	Descriptive Interpretation (DI)	Post Test Mean	Descriptive Interpretation (DI)
1. I am interested and willing to increase my knowledge in science.	4.79	Strongly Agree	4.68	Strongly Agree
2. I am interested to use science concepts outside the school.	4.16	Agree	4.39	Agree
3. * Science is not interesting because it gives me no freedom to express my personal opinion.	3.47	Undecided	4.00	Agree
4. *Learning science makes me feel uneasy and confused.	2.39	Disagree	3.70	Agree
5. Science laboratory is enjoyable and exciting.	4.65	Strongly Agree	4.76	Strongly Agree
6. I enjoy doing more than the assigned work of science.	3.39	Undecided	3.53	Agree
7.*I never liked science and it is the subject I most afraid of.	4.00	Agree	4.05	Agree
8. Science is very interesting and I always enjoyed my science class.	3.95	Agree	4.25	Agree
9. I enjoy studying my lesson in science.	3.74	Agree	3.96	Agree
10. *I do not feel like learning and thinking in science class.	4.06	Agree	4.96	Strongly Agree

11. I am interested to learn more science topics.	4.09	Agree	4.46	Agree
12. I feel confident science class.	3.46	Undecided	3.72	Agree
13. If there is science class "lesson" today, I will feel "very interesting".	3.05	Agree	3.89	Agree
14. Science class is "very interesting".	4.07	Agree	4.21	Agree
15.*I don't like to study science and other science subject.	4.09	Agree	4.63	Strongly Agree
16.*Doing science activity is not on interesting way of spending time.	4.02	Agree	4.50	Agree
GRAND MEAN	3.85	Agree	4.18	Agree

The following is an excerpt from interviews on students' perceptions on the implementation of the ISN in learning science:

Question 1: How do you feel about using the Interactive Science Notebook (ISN) in learning science?

Answers: Ninety percent (70%) claimed that "We feel thankful and great, because with ISN, we could review the topics easily based on our notes, encourages us to listen and do well in class. And we could always look back on my previous activities and see how much we have improved specially on the level of our creativity and it was not difficult for our part to study during exams because we wrote the important details and felt that our skill in arts thus, it's improving the way we study." Two (2) students negatively said that "we find this ISN very tedious and too detailed, because I need to decorate the pages of the notebook and I'm not really fond of doing artistic things that's why it' quite a challenge for me." One (1) student replied that "ISN is a bit of old school that we are in the modern times now-we should learn to use computers".

Question2: Do you enjoy science lessons using Interactive Science Notebook (ISN)? Why?

Answers: Ninety percent (90%) of the students replied "Yes, because we will be able to keep track of the lessons on notes that we have made. It allows us also to enhance and express our creativity. Further, we enjoy reading the notes since it was well arranged which helps us understand the lesson well. And with ISN, we can make some reflections on a particular lesson. However, one (1) student replied "that ISN should be changed every quarter because if not, it will have a lot of entries and makes it bulky and inconvenient for me to carry everyday".

Question 3: What would make the Interactive Science Notebook more useful to you?

Answer: All replied (100%) that "ISN helps us to keep track of our activities in the science class, see how our progress in learning is going along, and helps us realized to do our best in the

class since all our works such as quizzes, tests and notes were seen in the ISN thus it is very useful in studying; helping us to understand easily the lessons taken."

DISCUSSION

Student' Critical Thinking Skills

The current educational climate reflects the importance of learning not only of content information, but also developing skills for thinking critically (Pithers and Soden, 2000). In this study, Interactive Science Notebook was utilized in learning science which is hoped to hone the critical thinking skills of the students.

As shown on the pretest results, the males have a critical thinking skill mean scores of 84.94 with a standard deviation of 3.85 and 83.07; 3.44 for the females. The results are relatively lower when compared to the three (3) preceding grading period when the ISN were utilized in science class. This clearly indicates that there is a positive impact on the students learning process when the ISN were implemented in the class.

As observed, the 4th grading period had the highest critical thinking mean scores of 91.15 (males) and 91.06 (females). This was followed by the 3rd grading period with a mean score of 86.41 (males) and 85.15 (females.) Least were obtained during the 2nd grading period with a mean value of 86.33 (males) and 83.86 (females). The trend shows a decreasing and increasing result specifically among the females that may be attributed to the extent of difficulty of the lesson undertaken affecting the way the learner grasps the lesson critically.

Furthermore, as reflected on the table 4, the students' critical thinking mean scores in three (3) grading periods revealed a significant difference between them with a t-value of 164.421, 179.109 and 142.062 respectively. All of which were found significant at 0.05 level. The result indicates that the students highly mastered the concepts on the activities performed in Biotechnology using the ISN.

Enjoyment in Science Class

Interest is in itself important for the development of cognitive skills, it is revealed in the emotional response in the classroom (Isoda, 2010). The best way for knowing the value of an activity and learning how to learn is to experience it and know its significance through reflection on the activity. As reflected in table 5, there were remarkable changes in the attitude of the students as to their enjoyment in learning science. Overall mean score in posttest was 4.18 indicating "agree". This finding is higher compared to the over-all pre-test mean scores of 3.85 indicating "agree". It indicates that the students had fun in learning science with the utilization of ISN and that students appeared to increase a thorough understanding of concepts and they seemed to enjoy science.

On the whole, as educators are held accountable for increasing student achievement through the use of research proven methods, Interactive Science Notebook (ISN) can be promising variables in teaching and learning which could justify observable behavior to increase students' academic achievement. It allows students to take control of their learning while processing information and engaging in self-reflection, further providing them a varied set of strategies to create a personal, organized, and documented learning record. More importantly, this tool empowers students for science achievement.

Moreover, the impact of the ISN on science learning in this study demonstrated an increased in the critical thinking skills mean scores between three (3) grading periods. Given these results, it is possible that longer implementation of the ISN might yield larger effects. Thus, the ISN could potentially affect students' scientific proficiency.

As such, roll out of ISN in school should be conducted and workshops for teachers on using the interactive notebook should be made. Teachers and educators therefore should examine the implications and consider finding ways in applying ISN as tool in enhancing critical thinking instruction in the classroom.

Likewise, stakeholders such as students, parents, teachers, and school administrators, should be well informed of its use, cost, and applications.

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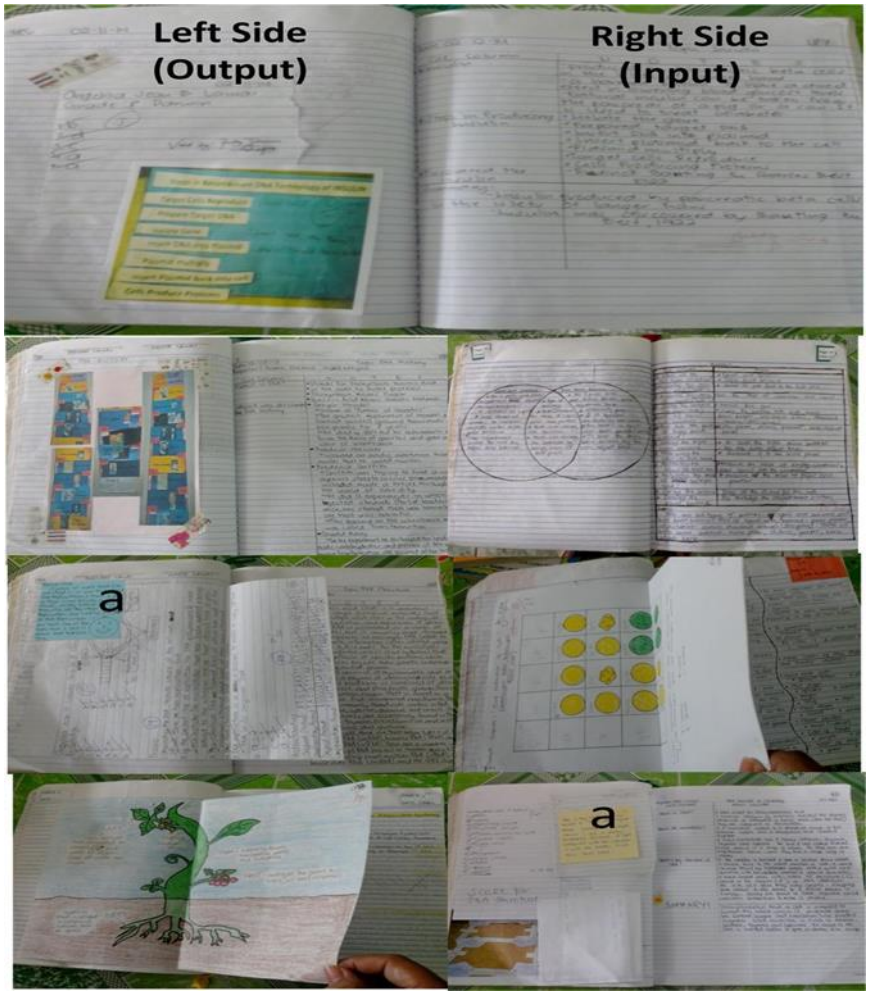
Appendix A-1. Sample of Interactive Science Notebook Students' Output

Showing the cover page of some Interactive Science Notebooks and the preliminary pages of some Interactive Science Notebooks showing a) Information about the students; b) Results of Learning Style Questionnaire; c) Reflection on students' learning style; d) Rubrics; and e) Table of contents.

Appendix A-2. Sample of Interactive Science Notebook Students' Output



The organization of an Interactive Science Notebooks, the left side of the notebook are the students' output including the a) students' reflection on the quizzes results; and on the right side are the student's input.