RESEARCH ARTICLE

DEVELOPMENT AND EVALUATION OF GRADE 7 AND GRADE 8 BIOKIT

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ABSTRACT

The study aimed to develop a manipulative learning material for Grades 7 and 8 science aligned to the enhanced K to 12 Curriculum. Using the project design method to create a prototype of a learning material called "Biokit," the study ran in three phases -- Phase I conceptualized the module for selected science topics of grades 7 and 8; Phase 2: designed the learning materials stated in the module; Phase 3: pilot tested and evaluated the "Biokit" by students and teachers. After the pilot test, the Biokit was assessed as to the materials used, language and style, format and design, content and usability. The results were presented as frequency, mean and rank to show a positive review in the parameters enumerated though results were highly acceptable, parameters with the lowest scores were recommended for improvement. With the results presented, the Biokit may be a good resource to ensure a student-centered, hand-on learning classroom for better attitude towards sciences as well as higher academic achievement.

Keywords: *education, nutrition, school management*

INTRODUCTION

Today's teachers are challenged by difficult task of educating young learners to meet the demands of an increasingly global and modern world. The Philippines is one of the many countries preparing its citizens to address the critical problems in the

economy, society and even that of the environmental. As reported by the Department of Education (DepEd), the 2005-2010 National achievement tests show that many students who finished basic education do not possess sufficient mastery of basic competencies. This apprehension led the Philippine government to implement the K- 12 program. The program which was recently approved and mandated is a move to make the Filipino graduates globally competitive. It will open more windows of opportunity to the Filipinos who will be more equipped to meet the work standards.

In line with these changes, researchers, educators, and educational policy makers show increasing concern on the need for greater emphasis on student-centered science instructions, in response to the increasing issues on students' performance. As reported by Cruz (2005), science teaching has become more flexible, responsive, and dynamic to meet the changing times and to take into account the influences of the contemporary psychologists. As such, there has been a change in emphasis for science teaching. The hows of teaching science is not only limited to Discovery and Process approaches. Other methods, such as the use of material sources or instructional aids supplement the major methods where children learn both content and processes of science (Cruz, 2005). Furthermore, Oladejo et.al (2011) claimed that the place of instructional materials in the effective implementation of any education program cannot be undermined. Instructional materials perform such functions as the extension of the range of experience available to learners, supplement and complement the teacher's verbal explanations thereby making learning experience richer and providing the teacher with interest into a wide variety of learning activities.

A manipulative teaching material is defined as any object from the real world that children can move around, play with or even build model of, to show a scientific concept. They are concrete, hands-on models that appeal to all the senses and can be touched by students. These manipulative teaching materials should relate to a student's real world (Oladejo et al., 2011). Low-cost manipulative materials produced through inventiveness are not an attempt to provide a weak science education, but purchase highly creative and productive system of education that can readily use available

materials which can replace unaffordable teaching materials. This provides opportunities for creativity and critical thinking abilities. Science concepts are learned and internalized by concrete and unspectacular work than proceeding with chalk and teacher talk.

The absence or the insufficient supplies of manipulative materials undoubtedly may affect student's academic achievement in science subjects, specifically on the new K-12 curriculum. This present situation led to the development of learning materials emphasizing topics on life sciences for grades 7 and 8. In order to support the aforementioned claims on the positive effects of manipulative materials in the learning of the students the following objectives of this research were formulated:

1. develop a microlab kit for biology (BIOKIT) based on the K to 12 curriculum for Science Grades 7 and 8;

2. pilot test the BIOKIT to the ITL Grade 8 class and Grade 9 special science class of Las Piñas National High School;

3. establish the usability and acceptability of the BIOKIT tool

CONCEPTUAL FRAMEWORK

Over the years, many educators and experts in the field have argued that science cannot be meaningful to students without worthwhile practical experiences in the school laboratory (Hofstein & Namaan, 2007). According to Kelly et. al., (2000) as mentioned in the works of Bhukuvhani (2010), there is need for engaging learners in physical actions and social negotiations in the learning of science and written materials.

The ultimate goal of using manipulative materials as a visual aid is to help the students grasp abstract concepts and the written symbols that are used to represent these concepts (Uttal et al, 1997). The result on the studies done by Boomer and Latham (2011) in using manipulative materials in teaching difficult biology concepts showed that students significantly performed better. The findings support the idea that students learn even the identified difficult

concepts more thoroughly by using multiple sensory materials. Thus it gives stronger claim on the importance of providing new, balanced and interesting hands-on manipulative materials which will aid students' learning. Reexamining the Cognitive Constructivist Theory of Piaget it states that learners construct knowledge through experiencing concrete materials in the world in which it supports the aforementioned aim of the positive use of manipulative materials in learning scientific concepts. Researches done on the use of manipulative materials in learning concepts claim that it significantly showed improvement on the performance of the students (Uttal and Sudder, 1997; Boomer and Latham, 2011; 80 Oladejo et al, 2011).

In the K to 12 basic education curricula, emphasis was given to the needs of the learner included in the 21st century skills such as learning and innovation skills and effective communication skills. Learning, therefore, must go beyond the usual passing on of knowledge but rather must address creativity and curiosity as well as critical thinking skills and risk taking in learners. These skills will equip students not only in learning in the classroom set-up but also in facing the real world with real-life circumstances. Furthermore, collaboration, interpersonal skills and interactive communication developed allow expression of oneself and better understanding of the community.

Since the guiding principle of the new curriculum is to have a learner-centered system stating that it's primary goal is to have holistic learning for students, teachers must be trained to create a learner-centered classroom where learning is enjoyed by self-exploration by the learner's own pace and unique style. Therefore, all possible learning tools must be provided to these learners for them to choose which will better suit their needs and interests. Manipulative teaching tool being concrete may be included for hands-on and exploratory learning.

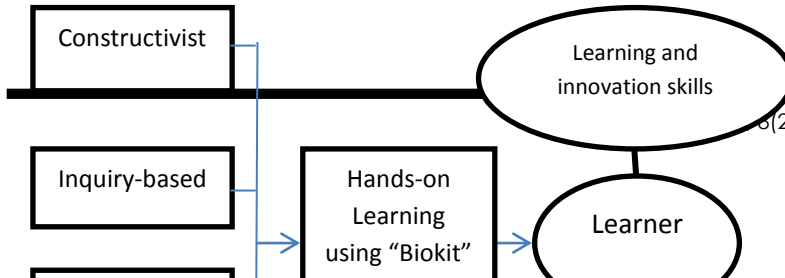

Figure 1. Research Paradigm

This study hopes to benefit pupils of Grades 7 and 8 by providing an effective manipulative instructional tool from which they can learn and better understand various concepts in science. Likewise, the produced BIOKIT aims to aid in teacher instruction and create better classroom interaction between and among teachers and students. Finally, it is the goal of this research to contribute to the improvement of instruction in the Philippine education by promoting hands-on learning in the classroom using manipulative learning materials.

REVIEW OF RELATED LITERATURE AND STUDIES

The review will presents facts, figures, discussions, documents, local and foreign researches and studies that will support the current study on the development of learning tools in selected topics in grades 7 and 8 science of biology. This is primarily to support the impact of such tool in teaching and understanding biology.

Overview of the Development of Philippine Curriculum

The Philippines has been colonized by a number of countries that have influenced the development of education in the country from an informal type to a more formal and centralized type. The transformation of the Philippine education happens slowly through time. The changes started with the Spanish colonizers followed by the American colonizers. Unfortunately, despite these development and changes in the Philippine curriculum, education in the country

is still struggling, its performance consistently found poorly as a whole. For one, the 2013 Quacquarelli Symonds (QS) World University Rankings has listed top universities of the Philippines like University of the Philippines, Ateneo de Manila University, University of Santo Tomas and De La Salle University at 380th, 501st -550th, above 701 and above 601, respectively (Pazzibugan, Dona Z. (September, 2013). "Top PH universities slip in ranking."www.globalnation.com Retrieved 4 October 2014 from http://globalnation.inquirer.net/85325/top-ph-universities-slip-in-world-rankings/). The result reflects the countries learners and learning system as a whole.

International education surveys have affected the implementation of the K+12 curriculum in the Philippine Education System. The structure is to have a compulsory kindergarten and additional two years of education at the secondary level which will offer subjects either for vocational skills development or for pursuance of a college/university diploma. This curriculum also adjusted the number of years of basic education so that it will be comparable to other countries. Equally, it will give other learners training in vocational skills so that employment is still possible even without a college or university diploma.

The Enhanced K to 12 Basic Education Program

As early as 1990s, educators and researchers have already studied and pointed out the discrepancies of the educational system of the Philippines compared to the ASEAN member countries. This is proven by the relatively poor performance of primary and secondary students in science and mathematics compared to other countries. The country's rank in the 2003 and 2008 Trends in International Mathematics and Science Study (TIMSS) has proven the existence of the problem.

Table 1 shows among the participant countries in 2003 TIMMS, grade four science and mathematics ranked 23rd out of 25 participating countries while high school science and mathematics were at 43rd out of 46 countries, and 34th out of 38 countries, respectively. In 2008, when only the science high schools participated in the Advance Mathematics category, the country ranked last.

Table 1. Philippine Average Trends in International Mathematics and Science Study (TIMSS) Scores

	Scores	International Average	Rank	Participating Countries
2003 Results				
Grade IV				
Science	332	489	23	25
Mathematics	358	495	23	25
HSII				
Science	377	473	43	46
Mathematics	378	466	34	38
2008 Results				
Advanced Mathematics	355	500	10	10

Source: TIMMS, 2003 and 2008

The primary goal of the enhanced K to 12 Basic Education Program according to DepEd is to create a functional basic education system that will produce productive and responsible citizens equipped with the essential competencies and skills for both life-long learning and employment (www.ceap.org.ph). To achieve these, the education agency supported the program giving students quality education that is internationally recognized and comparable, and correcting the wrong understanding of what high school education should achieve. The curriculum is designed in a spiral progression wherein subjects will be connected continuously from one grade level to the next in increasing complexity to achieve maximum understanding of concepts, as integrated with each other across subjects. In this structure, science subjects would be learned from Grades 3 to 10 in a spiral fashion. Biology in Grade 7 includes topics on cells, levels of organization, reproduction and ecological relationships, while Grade 8 biology centers on the introduction to the digestive system, the cell cycle and biogeochemical cycles. Other topics distributed for Grades 9 and 10 (DepEd Curriculum, 2011).

Student's Learning Styles

The spiral fashion of presenting knowledge to the students in an increasing degree of complexity is dependent on students' learning styles. According to Keefe (1991) as cited by Gonzales (2011), learning style refers to the cognitive, affective and psychological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment. It is an interaction of the three stated aspects that lie in learners and

must be deduced by teachers to be tapped for effective instruction as the topics become more and more complicated. Unfortunately, according to Grasha (cited by Gonzales, 2011) some students may have more than one style of learning, and that their dominant qualities are the ones often seen in the classroom. Therefore, a balance in the teaching and learning styles may not be in complete equilibrium from one topic to another, since some students may have other styles with other topics. The learners then are the ones responsible for restructuring their thoughts and new ideas. Therefore, it is important for educators to form instruction while considering different learning styles of students.

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Teaching Science

Despite the use of different learning styles, the National Education Association (NEA) survey made in the year 2000 found out that more instructional time is devoted to lecture than any other sciences. According to Woods (2002) across all biology lessons only 26% of instructional time is spent doing hands-on or laboratory activities, which are usually short-term exercises that do not mirror scientific investigations. Thus NEA recommends the following regarding biology instruction: the primary purpose of the course should not be about memorization but the acquisition of knowledge and intellectual growth from careful observation of nature; biology should precede chemistry and physics; physiology should be taught during the later part of the high school years; students should make careful sketches and drawings of observed specimens; the usefulness of the laboratory component should be emphasized; the laboratory component should comprise at least 60% of the class time; and laboratory activities should integrate the use of technology to provide a stepping stone to the increasing scientific technological demands of schooling. In education, it is very important to identify the learning styles of students to be able to instruct effectively usually by designing teaching according to specific styles that best suit the learners.

The paper of Flores (2008), as cited in the study of Rinaldi and Gurung (2009), found that students with varied learning styles clearly preferred activities that matched their learning styles. The study also stated that it is not necessary to modify teaching styles, but a need to design activities to increase educational outcomes and student satisfaction. Smith, Richards, Shields, Hayes-Klosteridis, Robinson and Yuan (2004) stated that the expression "hands-on, minds-on," summarizes the philosophy incorporated in biology activities – namely, that students will learn best, if they are actively engaged in the making process and if their activities are closely linked to understanding important biological concepts. This would entail student's active participation in manipulating concrete objects, and creativeness just like in constructing models that can present abstract concepts and principles (Liwanag, 2009).

Daly and Bryan (2006) discussed models as instructional tools and stated that the use of models is indispensable for a teacher in visualizing concepts as they represent ideas. Furthermore, models according to Daly and Bryan (2006) may represent ideas, objects, events, processes, or systems. This representation creates a vehicle through which the object, event, or idea can be conceptualized and understood (Corpuz and Salandanan, 2003). Gilbert (2005)

enumerated and discussed different types of models as assimilated by learners starting with the mental model in which a person visualizes an object in his mind. This is followed by the expressed model which explains when a person tries to explain or present a mental model in another form. Consensus and historical models are expressed models which have gained acceptance within the scientific community. Finally, the teaching model is the one specifically used to teach a difficult consensus or historical model to learners, represented in different ways when used.

Presently, models have been utilized by many teachers in instruction because of their appeal to students in different grade levels and consequently positive effects in their learning. To formalize, Stone, McAdams, Stroble, and Watkins (2007) emphasized the importance of models as a virtual-analysis-based education by stating that physical models enhance active learning experiences; are assessment tools for spatial and physical concepts; may alleviate learning disabilities; and finally, may help alleviate gender disadvantage due to differences in spatial reasoning and cognition. Some examples of instructional models would be interactive boards, card games, field works which can further attain the objective of effective learning through an activity-based instruction or the use of manipulative learning materials. In support of the claims favoring hands-on learning, Yang's study (2010) held that college students who reportedly were not interested in science felt so because science involved lectures and book works, worksheets, tests and memorization of facts. In the same study, it was mentioned that students had higher interest in science when they were able to experience it, as opposed to being told about it, which is usually the case.

METHODOLOGY

1. develop a microlab kit for biology (BIOKIT) based on the K to 12 curriculum for Science Grades 7 and 8;
2. pilot test the BIOKIT to the ITLGrade 8 class and Grade 9 special science class of Las Pinas National High School;
3. establish the usability and acceptability of the BIOKIT tool

This study employed the project design method done by creating a prototype model of a material under consideration. There are three basic stages involved in the study. Stage 1 is the development of the BIOKIT for Grades 7 and 8. Stage 2 covers the pilot testing of the

BIOKIT made, and stage 3 the establishment of the usability and acceptability of the BIOKIT tool.

For Stage 1, the instructional material developed is a biology kit consisting of models, cards, interactive boards and others. The project creation started with the conception of module type written activities in selected topics of Science Grade 7 namely sexual and asexual reproduction, ecological relationships, animal and plant cells, and levels of organization and Science Grade 8 namely digestive system, mitosis and meiosis, Mendelian genetics, biodiversity and nutrient cycling. The conceptualized activities were then concretized by designing pieces of instructional materials to be manipulated by students and expected to bring about better learning outputs. This first part of the material development was accomplished by the Biology professors of Philippine Normal University (PNU). The second part involved the actual creation of the designed/conceptualized materials which were mostly made of resin materials (for the cell and reproduction pieces); laminated pictures and cards (for the ecology, biodiversity, level of organization and reproduction pieces); magnetic boards, chromosomes and concept pieces (cell division, Punnett square and nutrient cycling activities) and styrofoam and rubber tubing (digestion). This process was done through the combined efforts of externally hired artists and the professors themselves. All the created materials were then packed in a specially designed BIOKIT wooden box together with a manual guide for teachers and activity sheets for students. Seven sets of the prototype were reproduced (for each grade level) ready for pilot testing.

Stage 2 was accomplished by having Grade 8 pupils of the Institute for Teaching and Learning of Philippine Normal University use the BIOKIT 7. There were 26 out of 35 pupil participants in Grade 8 Magiting class handled by one professor. These learners already had their Grade 7 biology last year. BIOKIT for Grade 8 was in turn tried by 35 out of 35 Grade 9 pupils coming from Pascal section of Las Piñas National High School who have finished Grade 8 Biology in the previous year. The current Science Grade 7 and 8 Teachers were allowed to facilitate the use of the BIOKIT with the help of the manual guide incorporated in the kit. After which, both the teachers and the students were requested to answer the researcher-made survey questionnaire.

Stage 3 confirms the usability and acceptability of the kit as an instructional material. The only instrument used to ascertain these parameters are the two survey questionnaires for the end users, one for the pupils and another for the teacher. The acceptability level was measured using a 4-point Likert Scale gauging the degree of agreement of the respondents on the indicators presented in the questionnaire. Data were then tallied, tabulated and analyzed. The reliability, inter-rater, inter-class correlation for the pilot testing and evaluation phase were also considered.

RESULTS AND DISCUSSION

The group was able to produce 4 activity materials for each BIOKIT Grade 7 and Grade 8. Figure 1 presents a sample photo of the developed materials.

Figure 1. Sample BIOKIT developed materials

For both Grades 7 and 8, the materials made were a combination of resin-made tools, laminated cards, pop-up boxes, magnetic boards and styropor-based pieces. Each material was designed with consideration of play of colors to make it look attractive, handy and easy to manipulate. Initially the wooden box with all its contents was quite heavy, but the sliding compartments that allow pulling out the necessary activity at one point solved the issue.

Before the actual use of the Biokit, the manual guides were first subjected to an expert evaluation. Four experts were requested to accomplish the evaluation form. The group comprised of Public

School Master Teacher, Private School Assistant Principal, Doctor of Education and a Doctor in Biotechnology. Table 2 summarizes the evaluation result.

Table 2. Expert Evaluators' Rating of the Biokit Manual Guide

Criteria	WM	Rank
Format and Design		
1.The printing is clear and readable.	4.0	2
2.The quality of the paper is acceptable.	4.0	2
3.The layout is attractive and uniform.	3.6	5
4.The fonts used are comprehensible and appropriate.	4.0	2
5.The spacing on the pages contributes to the ease of reading and responding.	3.9	4
AWM / Overall Rank	**3.9**	**1**
Language and Style		
1.The language an style is appropriate for the grade level.	4.0	1
2.The instructions were written in an understandable manner.	3.8	2.5
3.The manual is free from grammatical errors.	3.0	5
4. The manual is free from punctuation and construction errors.	3.8	2.5
5. The activities follow the sequence of topics of Kto12 curriculum.	3.7	4
AWM / Overall Rank	**3.7**	**3**
Content		
1.The activities follow the competencies of the Kto12 curriculum.	4.0	2
2.The illustrations and diagrams support the topic of discussion per activity.	4.0	2
3.The discussions give the most important basic information regarding the topic.	3.2	5
4.The questions after the activity supports further learning of the students.	4.0	2
5.The manual covers all relevant topics of biology in Grade 7.	3.8	4
AWM / Overall Rank	**3.8**	**2**

With 4.0 as the highest rating, it was revealed that all of the 3 criteria got a verbal rating of Strongly Agree with Format and Design given the most favored rating of 3.9. Per evaluator, individual average rating ranged from 3.2 to 4.0. Statistical analysis using Kappa coefficient showed high degree of agreement of the experts as to the acceptability of the "Biokit" manual guide, format and design, language and style and content. Kappa coefficient value is at 0.9868. After considering the minor revisions given by the experts, the manuals were modified accordingly and then reprinted. The final copy is included in the Biokit box.

Having used the Biokit as their instructional tools, the teacher-users evaluated them accordingly. The teacher-evaluators were public school science teachers, master teacher and secondary school head teacher.

Table 3 shows the overall rating.

Table 3. Teacher Evaluators' Rating of the Biokit Instructional Tool

Criteria	WM	Rank
Format		
1.Topic overview gives enough detail to get main idea across.	4.0	2
2.Establishes the scientific concept of the activities.	4.0	2
3. Presents the objectives and overview of the activities.	3.6	5
4. Activities are logically sequenced.	4.0	2
5. Sections are uniform in every activity.	3.9	4
AWM / Overall Rank	**3.9**	**1.5**
Language		
1. Appropriate.	4.0	1
2. Consistent.	3.0	5
3. Free from grammatical errors.	3.6	2
4. Sentences properly constructed and punctuated.	3.4	4
5. Simple and easy to understand.	3.5	3
AWM / Overall Rank	**3.5**	**4**
Usability		
1.Identifies all materials used in the activites.	4.0	1.5
2. Provides concise step- by- step description of procedure.	3.7	1.5
3. Sample diagrams and illustrations are clear and accurate.	3.8	4.5
4.Tables for data are provided and appropriate.	3.7	4.5
5.Activity sheets are user friendly.	3.8	3.0
AWM / Overall Rank	**3.8**	**1.5**
Materials		
1.Attractive.	4.0	1
2.Durable.	4.0	4.5
3.Non hazardous, nontoxic and safe.	3.8	2.5
4.Locally available.	3.8	4.5
5.Easy to set up.	3.9	2.5
AWM / Overall Rank	**3.9**	**3**

It can be noted from table 3 that Format and Materials gained the highest score of 3.9. Usability registered third in rank and Language the least. Nevertheless, all categories gained a qualitative interpretation of strongly agree. Individual average rating ranged from 3.0 to 4.0. Statistical analysis using Kappa coefficient showed high degree of agreement of the teachers as to the acceptability of the "Biokit" as an instructional tool as to format, language, usability and materials. Kappa coefficient value is at 0.9688. Looking into the indicators under the Format category, teachers view the Biokit as an instructional tool that satisfies the necessary criteria for proper presentation of a lesson that can lead to student understanding of the concept a lot easier for the teacher to facilitate and for the students to follow. With three indicators given a perfect score, this criterion only leaves item 3 and item 5 under considerations for improvement: presentation of objectives and overview of the activities, and uniformity of sections in every activity.

For the category of used materials, verbal interviews have noted the lack of strength of magnets to hold the pieces in place, especially when they are held upright for presentation. This was considered for improvement by the researchers.

In the category of usability, teacher evaluators were positive in all

parameters presented. However, there is a need for very minor revisions for clarity and accuracy of diagrams and illustrations, provision and appropriateness of tables and user-friendliness of activity sheets.

Finally, in the language category, consistency in language got the least rating, as explained by the fact that the manual is written by more than one writer, thus is subject to variation. Nevertheless, revision of this section is considered.

On the part of the students, Usability ranked first for Grade 7 and second only for Grade 8. On the other hand, both groups agreed that packaging has the least rate though the average weighted mean still shows acceptability. Table 4 summarizes the findings.

Table 4. Studen Evaluators' Rating of the Biokit Instructional Tool

Criteria	WM Grade 7	Rank	WM Grade 8	Rank
Usability				
1.Easy to manipulate and set-up.	3.8	1	3.6	2.5
2.Instructions are clear.	3.6	2.5	3.6	2.5
3.Manual is congruent with the expected concepts.	3.3	5	3.5	4.5
4.Provides concise step-by-step description of procedure.	3.5	4	3.9	1
5.User friendly.	3.6	2.5	3.5	4.5
AWM / Overall Rank	**3.6**	**1**	**3.6**	**2**
Packaging				
1.Systematic arrangement of materials.	3.6	2	3.9	1
2.Diagrams are clear and easy to follow.	3.7	1	3.5	2.5
3. Attractive.	3.4	4	3.5	2.5
4.Materials will not easily break.	3.5	3	3.4	4.5
5.Materials are non-hazardous and non-toxic.	3.3	5	3.4	4.5
AWM / Overall Rank	**3.5**	**2.5**	**3.5**	**3**
Language				
1.Simple and easy to understand.	3.6	2	3.8	2
2.Appropriate to the level of the students.	3.7	1	3.8	2
3.instructions are stated clearly.	3.4	4.5	3.5	4
4.Define new terms appropriately.	3.4	4.5	3.4	5
5.Instructiions are logically sequenced.	3.5	3	3.8	2
AWM / Overall Rank	**3.5**	**2.5**	**3.7**	**1**

Considering the indicators under usability, the students find the kit and the manual user-friendly and easy to manipulate. However, verbal comments (as reflected in Appendix D) generally state that there are pieces missing and broken or malfunctioning in two of the seven boxes. The overall review of the Biokit showed many comments on the positive attitude and increased comprehension of students in selected biology topics. The manual itself was easy to understand and follow, as mentioned by the students. Packaging wise, they said that the materials are very attractive, looks

expensive and non-toxic. The slight imperfections like disarranged magnet boards, broken pieces of materials and difficulty in pulling out drawers from the heavy boxes prevented the students from giving a perfect 4.0 rating.

In general, Grade 8 Biokit was given a better rating than Grade 7 Biokit, particularly in the Language criteria. This may be attributed to a prior review on the Grade 7 Biokit which gave the researcher information on how to write the second Biokit better. The Grade 8 Biokit was noted to have more damaged materials compared to the Grade 7 Biokit that appeared more durable because of their size and number.

CONCLUSIONS

Based on the data gathered and the verbal reviews given by the students, this project study, therefore, concludes the following:

1. Development of BIOKIT activity tool is a possible, feasible and rewarding project that is highly appreciated and valued.
2. Pilot -testing the tool to the Grades 7 and 8 students gave an observable confirmation of how the BIOKIT can be an effective, enjoyable teaching tool that can enhance learning
3. The Biokit instructional tool has been found to be effective tool for instruction and was suggested to incorporate improvement in the following areas:
   a. Durability and strength of the magnetic pieces of chromosomes
   b. Leaks and paint blots in the digestive system model once fluid is introduced
   c. Missing pieces of some materials
   d. Disorganized magnetic boards
   e. Some materials are confusing to use
   f. Heavy box and a little difficult to open
4. The evaluation results of the BIOKIT manual guide and acceptability as an instructional tool by experts and teachers, respectively showed high degree of agreement by the evaluators based on used statistics.

RECOMMENDATIONS

Based on the conclusions drawn, it is recommended that the Biokit for mass production be improved.

1. Magnets must be strong enough to adhere to the board for class presentations.
2. Beads making the chromosomes must be very much secured to avoid loss of parts.
3. The use of oil-based paint for the digestive system to avoid runoff of paint due to water leaks. At the same time, tubing system must also be checked and improved to avoid leakage.
4. Double check the manual guide to ensure congruency of materials with the methods to be used.
5. Use of customized plastic boxes to lessen weight of the Biokit box.

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