International Journal of Learning and Teaching

Volume 07, Issue 1, (2015) 24-37

www.awer-center/ijlt

Promoting physics in action thru “Laro Ng Lahi-Based” physics activities

Marc Vener del Carmen *, Faculty of Science, Technology and Mathematics, Philippine Normal University, Philippines.
Ferdinand Diano, Faculty of Science, Technology and Mathematics, Philippine Normal University, Philippines.
Marie Paz E. Morales, Faculty of Science, Technology and Mathematics, Philippine Normal University, Philippines.
Abel Ole, Faculty of Science, Technology and Mathematics, Philippine Normal University, Philippines.

Suggested Citation:
Carmen, M., Diano, F., Morales, M., P., E. & Ole, A. (2015). Promoting physics in action thru “Laro Ng Lahi-Based” physics activities. *International Journal of Learning and Teaching*. *7*(1), 24-37.

Received 19 October, 2014; revised 06 November, 2014; accepted 23 December, 2014.
Selection and peer review under responsibility of Prof. Dr. Hafize Keser, Ankara University, Ankara, Turkey
©2015 SPROC LTD. Academic World Education & Research Center. All rights reserved.

Abstract

Culture and game-based physics activities are anticipated to promote active and fun learning of physics concepts. The study features non-conventional design and development of physics activities using traditional Filipino games also known as “Laro ng Lahi”. These non-conventional processes in the development comprise literature reviews, document analyses, and interviews. The eight developed “Laro ng Lahi”-based physics activities are presented as activity pack intended for highschool physics and introductory physics students. Key features of these activities include standard and synchronized rules and game mechanics, aligned and matched competencies in the K+12 science curriculum, inclination to student conceptual development, penchant for the preservation of Filipino culture and traditions, comprehensible texts and procedures and use of locally-available or indigenous materials. Results of the development study show that the “Laro ng Lahi”-based physics activities are content valid based on expert ratings (4.74 out of 5) with moderate to substantial agreement for the inter-rater reliability and an excellent over-all reliability index (0.90) suggesting a good and standard supplementary and support material for classroom use and for a wider goal of promoting active physics learning – Physics in Action.

Keywords: Laro ng Lahi, culture-based, game-based, physics activities, material development

*ADDRESS FOR CORRESPONDENCE: **Marc Vener del Carmen**, Faculty of Science, Technology and Mathematics, Philippine Normal University, Philippines. *E-mail address:* morales.mpe@pnu.edu.ph

1. Introduction

Equally beheld by most countries, UNESCO (2014) asserts that education is a right that transforms lives when it is accessible to all, relevant and underpinned by core shared values. Hence, it is everyone's benefit that it inhabits the core of the post – 2015 development agenda. It endorses a general goal– "*Ensure equitable quality education and lifelong learning for ALL by 2030*" to achieve just, inclusive, peaceful and sustainable societies. This general goal is translated into specific global **targets** to which countries would commit and held accountable for. Quality education and relevant teaching and learning are the important add-ons in the post-2015 agenda's priority areas. Good quality and relevant education is the process of preparing people with skills, knowledge and attitudes to acquire decent work, live together as active citizens nationally and globally, comprehend and prepare for a world in which environmental filth and climate change present a threat to sustainable living and livelihoods, and appreciate their rights. Consequently, UNESCO (2014) highlights the ***curriculum's central role*** in ensuring good quality and relevant education and learning.

Citizens armed with good quality education could make smart decisions and critical choices in using concepts and tools of science and technology and are identified as scientifically literate citizen. For science education and to many countries, attaining scientific literacy for all remains to be a universal goal and a significant challenge (Tan, 2004). Accordingly, Australian Council for Educational Research (2014) relates scientific literacy to the ability to think scientifically and to use scientific knowledge and processes to understand the world around us and to participate in decisions that affect us. It is then considered to be a key outcome of education for all students by the end of schooling. In fact, Gregorio, Buendia, Molera, Flor, de Dios, Ganibe, Balonkita, Dawang & Mirandilla (2011) recap the need for the development of scientific literacy through formal education especially in developing countries like the Philippines. This state of enhanced scientific literacy is much needed in the country that has encountered devastating natural disasters. Geographically, the country is along the Ring of Fire which makes it predisposed to earthquakes and eruptive volcanoes. Also, the country is annually visited by devastating typhoons that caused thousands of losses and infrastructure damages. In fact, Decierdo (2011) recounted the wrath typhoon Sendong brought in Cagayan de Oro that killed over a thousand Filipinos and still thousands more are missing due to flash floods. Lately, in a local newspaper (2014) typhoon Yolanda killed hundreds of thousands Filipinos due to storm surges and floods. Annually, numerous people die and millions of resources damaged due to natural disasters. These catastrophes serve as painful reminder to all Filipinos that in this age, making decisions based on a high level of scientific literacy is a matter of life and death.

Scientific literacy as defined by the American Association for the Advancement of Science (AAS 1990) is the improvement of the habits of mind to enable individuals and groups to solve problems. To be scientifically literate is to be mindful that science and technology are human initiatives with strengths and boundaries, recognizes key concepts and principles of science, is acquainted to the natural world and distinguishes both its diversity and unity for individual and societal purposes. Yager (2012) points out that it is not sufficient that teachers tell students to read a science book and recite on what it says. A science teacher may acknowledge a student responding correctly but it may not be an indication of scientific literacy. DeBoer (2000) construes that scientific literacy is primarily the level of scientific understanding that exists in the adult population. As further claimed, it is something that changes and grows over time. It is the glamor to individuals to be able to read and understand science articles in the international and local newspapers, read and interpret graphs and other figures displaying scientific information, engage in scientifically informed discussion of a contemporary issue, apply scientific information in personal decision making and be able to locate valid scientific information and use all these in making sound judgment for personal, health benefits and safety purposes and precautions.

In the Philippines, efforts to enhance scientific and technological literacy are employed to prepare Filipino learners to be knowledgeable and engaged citizens. Tan (2004) accounts the Japan International Cooperation Agency (JICA)-funded five-year program to promote practical work approach in science and mathematics education which was the same project being implemented by Kenya and South African countries. Additionally, the Philippine's department of education (2010) designed science education curriculum framework for the basic education that envisions developing scientific literacy among students that will prepare them to be informed and participative citizens who are able to make judgments and decisions regarding applications of scientific knowledge that may have social, health, or environmental impacts. With this critical need to improve scientific and technological literacy, the government foresees the Philippine science education as path to developing scientifically literate citizens. The new curriculum supports learning of science and technology, cum indigenous technologies to preserve the country's distinct culture. It captures the educational benefits of having a strong sense of ethical aspect of life, linkage of the curriculum to indigenous technology, and preservation of the country's cultural uniqueness and peculiarities. As a case, Abayao (2003) in her study of the indigenous people of Ifugao province found that there is a wide cavity between what is taught in formal schooling and the needed skills of the indigenous people. Similar findings were identified in the study of Kroma (1995) and Jenista (1987).

However, time and again, studies (Selcuk, 2010; Wanbugu & Changeiywo, 2008; Folashade & Akinbobola, 2009) concentrate on finding relevant solutions to the difficulty in learning science, particularly in learning physics and under achievement recorded in physics instruction. Tural (2013) confirmed these claims and reasoned that abstract concepts in physics courses make it too difficult for students to comprehend the subject matter. Often, students believe that physics as a subject matter is difficult (Saleh, 2012; Tural, 2013), boring and irrelevant to their lives (Efthimiou, Llewellyn, Maronde, and Winningham, 2006; Lye, Fry & Hart, 2002 in Tural, 2013). Thus, information learned is quickly forgotten because students do not see connections of the subject matter in their daily activities and real-life.

1.1. Contextualizing in Real-Life Setting

Real life connections in science were first introduced by Campbell, Lazonby, Millar, Nicolson, Ramsden, & Waddington (1994) in the United Kingdom as Salter's approach to address science education issues such as scientific literacy, public understanding of science, and less and less students want to take up science in A-level. As claimed, the aim of the approach is to set science in context as a means of motivating more students to study science. It also expresses a desire to provide students with a more authentic picture of science, and of its role in people's lives, and to encourage them to connect science learning with the rest of their lives. Whitelegg and Parry (1999) described this approach as context-based learning putting forward real world contentious or controversial issues, often social issues, for students to discuss. Notably, Yam (2005) informed that in the United States, context-based learning and teaching helps teachers relate subject matter content to real world situations and motivates students to make connections between knowledge and its applications to their lives as family members, citizens, students or children, and workers. Moreover, contextual teaching and learning strategies emphasize problem-solving; recognize the need for teaching and learning to occur in a variety of contexts such as home, community, and work sites; teach students to monitor and direct their own learning so they become self-regulated learners; anchor teaching in students diverse life-contexts; uses teams or interdependent group structures to encourage students to learn from each other and together; and employ authentic assessment.

Kortland (2007) claimed that in context-based science curricula – such as *ChemCom*, *PLON*, *Salter's Science*, *Chemie im Kontext* and *Physik im Kontext* – practical applications and/or socio-scientific issues start the teaching-learning of science in an attempt to bridge the gap between the often abstract and difficult science concepts and the world the students live in. To date, context-based learning and teaching approach has taken several forms such as problem-based and product based assessment (Yam, 2005); game-based approach (Jones, Caton & Greenhill, 2014), technology-based approach (Van Joolingen, deJong, & Dimitrakopoulout, 2007), and socio-cultural-based approach (Arroio, 2010) and still continuous to evolve to meet the demands of the new generation of students.

1.2. Cultural Learning

Several researches found out that culture correlates with meaning making and knowledge construction of students (Samarov & Porter, 2004; Banks, 1993; Lixin, 2006; Liu, 2009). Samarov (2004) even mentioned that culture affects the way we distinguish and process the world. Consequently, Morales (2014) reported that the effects of intertwining culture with science learning are observed in the improved student concept attainment. Learners see physics as something that would supplement the knowledge of their roots which increases their motivation to learn. They view learning of physics concepts as something that has real-life significance and they engage in deep processing of information and physics concepts using the same schema of thinking they often use as when they do their daily decision making activities. They are able to employ patterns of assimilation similar to how they assimilate daily and real-life concepts. This is similarly situated with the paradigm of context-based learning emphasizing culture as the context and is within the line of study of several research and projects such as Rekindling Tradition (Aikenhead, 2001), Outdoor Physics (Popov, 2008), and Culture and Language Integration in Physics Education (Morales, 2014).

Culture as defined by Pertierra (2002) is an invisible lens through which we see reality. Its sets are pre-given as language, notions of identity, gender, nature and religion. Culture can also be a set of ideas, values, and practices as well as orientation and predisposition towards the world. Furthermore, culture can be tangible such as tools and technology or non-tangible like beliefs, practices and traditions which among others include the national games.

Traditional games known as "***Laro ng Lahi***" are described as a compilation of traditional games practiced in the Philippines. The term "***Laro ng Lahi***" was coined by the Samahang Makasining Artist Club Inc. These games are indigenous games commonly played by Filipino children, where they use locally available materials or instruments (Aguado, 2012). Some common "*Laro ng Lahi*" are dock on a rock game (*tumbang preso*), block the enemy game (*patintero*), gilli danda (*syato*), leap frog (*luksong baka*), tag of war (*hilaang lubid*), rubber band game (*dampa*), and marble game (*holen*). 'Laro' is the Filipino generic term for all forms of recreational play (Lopez, 1980). The closest term for the game is the 'palaro' referring to special occasion games that take place during parties, festivals and town fiestas. This would also refer to games that are competitive in nature where each stretch is always brought to a conclusion (Barbosa, 2003). Lopez (2001) recounted that Filipinos like to play games and it is a trait considered as an index of their sociability. Traditional games bring members of the family together after their respective chores andthese traditions strengthen ties that bind families. In adult education, Fiagoy (2000) cited the use of games for practice contextualized within the peoples' culture and experiences. In the education field, traditional or indigenous games are identified as modes to acquire proper sports techniques in preparation for greater or competitive participation in selected sports and recreational activities.

Historically, traditional games in the Philippines were integrated in physical education (P.E.) courses in all levels of educational institutions and sport activities of the local government units, through Senate Bill 1108 and House Bill 2675. These games comprised the major components of the Physical Education curriculum through the efforts of Bureau of Physical Education and School Sports (BPESS) in 1984 (Wilhelmsen, 2012). These efforts supported the provisions of the 1987 Philippine Constitution mandating the State to conserve, promote and popularize the nation's historical and cultural heritage and resources to preserve them for future generations of Filipinos and ensure continuity of Filipino identity and cultural belongingness. To date, the department of education implemented Section 14, Article XIV of the 1987 Philippine Constitution which states that the state shall foster the preservation, enrichment, and dynamic evolution of a Filipino national culture based on the principle of unity in diversity in a climate of free artistic and intellectual expression through advocating *"Laro ng Lahi*" in physical education curricula. As quoted from the bills:

> *“Filipino traditional games and sports have originated from different cultures, some of which have pre-Hispanic origin and are very unique in terms of how are they are played. The Filipinos are known as sports-loving people, creative in every aspects of life and these traditional games are as testament to our passion for play. We are proud to have games from our ascendants that were developed and handed down from generation to generation. However, these priceless ancestral heritage that included sungka, dama, and patintero, have become less popular with the young people. Ironically, some of the traditional Filipino games such as sipa, yoyo and arnis have been adopted by other countries as their own and the fact that they originated from this country has been obliterated into oblivion. These games should remain relevant as they provide the people the opportunity to learn, appreciate and experience aspects of their own culture. Also, they provide essential training in social interaction and help develop camaraderie, sportsmanship and honesty. Hence, encouraging their preservation will mean understanding our cultural values”.*

On the same bills, traditional games and sports included the following: *agawang sulok, araw-lilim, arnis, aso at pusa, bulong pari, bunong braso, dama, garter, hulaan, holen, iring-iring, istatwa, jack-en-poy, jackstone, kapit-bakod, laglag panyo, lawin at sisiw, luksong baka, luksong lubid, luksong tinik, palo sebo, patintero, piko, pitik-bulag, saranggolahan, sipa, siklot, siksik bulak, sungka, suot lungga, taguan, takip-silirn, tatsing, tumbang preso, turumpo, viola, yoyo* and such other traditional games played in the various localities in the country. These native games as believed by Fine (1995) can be the threads that mesh learning situations into the fabric of life. The interconnection of the games with real life situations becomes the true definition of holistic learning, together we become a “community of inquirers” promoting alternative life choices for all students and working collectively to speak out, be heard and effect change.

Considering the confluence of theories and research findings, traditional Filipino games are potential context for culture-game-based physics education. This framework promotes physics in action as when these traditional games are developed into physics activities and support materials to the country’s new curriculum and help improve students’ performance in physics.

2. Purposes of the Research Study

The study aimed to design a compilation of Mechanics activities using traditional Filipino games or “*Laro ng Lahi*.” Specifically, the study sought to realize the following objectives:

1. Develop using unconventional processes “*Laro ng Lahi”* – based activities in Mechanics.
2. Establish the content validity and reliability “*Laro ng Lahi*”-based activities in Mechanics.
3. Determine the inter-class and inter-rater reliability of the *Laro ng Lahi*”-based activities in Mechanics.

3. Methodology

Quantitative research design combined with qualitative approaches was used in the development of "*Laro ng Lahi*" – based Physics activities. The study consisted of three major stages: Preparation, design and development; and validation and reliability determination.

In all the three stages, purposive sampling was done to identify the appropriate participants for each of the stages identified. In the preparation, physical education teachers and students were the identified participants who are more or less very familiar with traditional Filipino games. Interviews were conducted as preliminary processes to designing the "*Laro ng Lahi*"-based physics activities. The participants for the second stage were also purposively chosen on the bases of their being experts in physics and being familiar with traditional games. Finally, the participants in the last stage of the study included 23 students of an introductory physics class.

The instrument used in the validation of the developed activities was adopted from a study of Pantig (2013) and appropriately modified for the developed material. It assessed the activities in terms of objectives, contents, procedures, illustrations/figures/diagrams, language, usefulness, and featured "*Laro ng Lahi*".

3.1. Design and Development

Document analysis and literature review identified all traditional Filipino games that can be used and translated into physics activities. Literature reviews focused on the nature of the different traditional games and the format of the intended activities. Interview with Physical Education teachers provided standardized traditional games. This was done since variations in methods and rules of the games exist in different places. Survey where a group of physics students ranked the traditional games based on likelihood and popularity gave the researchers idea which traditional games are known to many and may be used as supplements to activities. Interviews with physics professors provided insights on matching the game to the physics concept and science curriculum – physics competencies. The identified games were grouped based on the grade level inclusion of their respective physics concept. Information derived from stage 1 contributed to the initial design and format of version 1 of the "*Laro ng Lahi"*-based Physics activities. The activities included implementation guide, descriptions of activities, rubric scoring guide and assessment instrument packed in an activity book.

Eight activities were developed, where two activities for each grade level from grade 7 to grade 10 were included. The "*Laro ng Lahi*"-based physics activities included: "Dampa" - Distance and Displacement, "Sipa" - Acceleration due to Gravity, "Tumbang Preso" - First Law of Motion (Inertia), "Luksong Baka" - Kinetic and Potential Energy, "Shato" - Projectile, "Holen" - Elastic Collision, "Patintero" - Balance and Stability, and "Hilahang Lubid" - Translational Equilibrium.

3.2. Validation, Pilot Test and Statistical Treatment

Preliminary validation was done by several professors as experts. Their initial ratings were considered, especially their noted corrections, suggestions, and comments, for the revision of the activity pack. Pilot test was done to one intact class, where the eight developed activities were conducted. The pilot testing proper included the execution of the actual activity and answering the activity sheets. After every activity, the students were instructed to record their experiences while performing each activity by answering a given journal. After performing all the activities, the student participants rated the developed activities as well. The ratings and comments of the participants were used as inputs to the third revised version. This version was again presented to the physics and physical education experts for the last leg of validation. These activities were also presented to the intended users to check on the readability and if the statements are comprehensible to them at their level. Furthermore, the researchers interviewed several intended users if they are able to follow the procedure with ease.

Summarized in tables for statistical analysis are the data derived from the pilot test. *Weighted Arithmetic Mean* determined the average value of a subject's scores to describe the acceptability of each criterion. *Standard Deviation* determined the dispersion of the ratings to measure the confidence in statistical conclusions. *Cronbach's Alpha*estimated the proportion of variance that is systematic or consistent in a set of test scores or to test the reliability of scores. *Inter-rater reliability (Kappa)* calculated the degree of agreement among the raters to provide no more than an upper bound on the degree of accuracy present on the ratings.

4. Results and Discussion

This section presents the results of the study that sought to develop "*Laro ng Lahi*"-based Physics activities. Clustered into two parts, findings of the study focus on the developed activity packed containing several designed and validated activities using the traditional Filipino games-context and pilot testing of the activity pack to the intended users.

4.1. The Activity Pack

Design of "*Laro ng Lahi*"–based Physics activities in the activity pack is in harmony with the identified frequently used, played, liked, and enjoyed traditional Filipino game. Standard rules provided by physical education teachers and physics concept-connections of the games confirmed by physics professors distinctly characterize the set of traditional game-influenced activities designed for the activity pack. Table 1 presents the list of traditional games matched with the identified physics concept connection for the intended activities.

Table 1. "Laro-ng-Lahi" and physics concept connections

Game	Concept
Dampa	Distance and Displacement
Sipa	Acceleration due to Gravity
Tumbang Preso	First Law of Motion
Luksong Baka	Kinetic and Potential Energy
Shato	Projectile
Holen	Elastic Collision
Patintero	Balance and Stability
Hilahang Lubid	Translational Equilibrium

The "*Laro ng Lahi*"-based Physics activity pack included an *overview* which presents the general information about the activity pack to give the readers some background knowledge. Other parts built-in are 1) *table of contents* that directs readers to components of the activity pack they desired to check; 2) *implementation guide*, which gives the facilitator basic tips on how to implement the activity in a lesson; 3) *description of activities*, which provides users knowledge about the parts of the Activity Proper; 4)*activity proper*, the actual activities for Mechanics which features "Laro ng Lahi"; 5) *Rubric scoring guide* that offers guidelines in scoring students outputs in the written on *data sheets*; and 6) *assessment instrument*, a 40-item examination that covers all the physics content of the activities.

The *Activity Proper* consisted of three parts: *Supplementary texts, activity instructions and data sheets*. Supplementary texts provided the physics concept-connection and game trivia. Activity instructions included the following parts: *game challenge, game instruments, game area, game background, game mechanics, game phase, game scoring, game rounds and game illustrations*. While the data sheets contained the following: game figures, game recaps, game secrets and convergence and game reflection. Below are illustrations (Figures 1 and 2) of the identified parts of the activities.

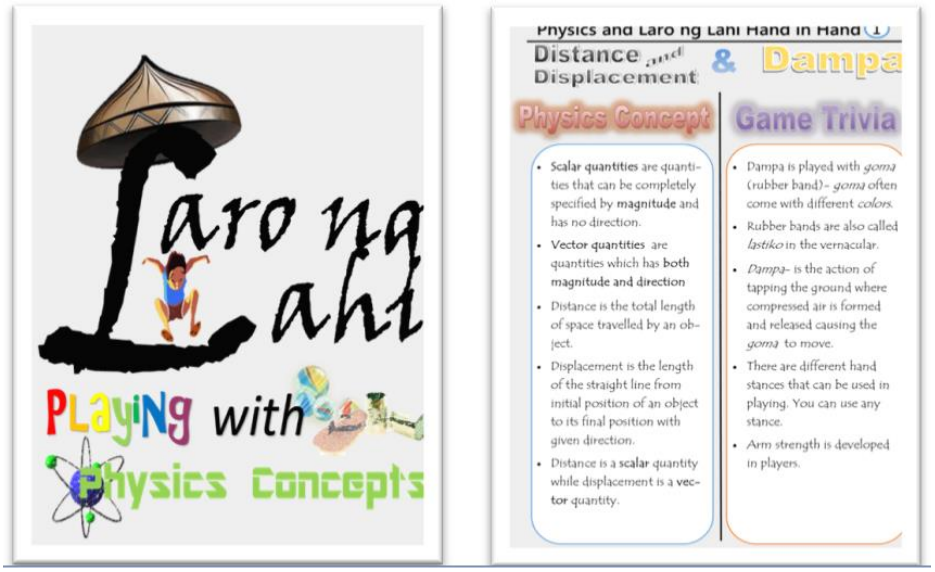
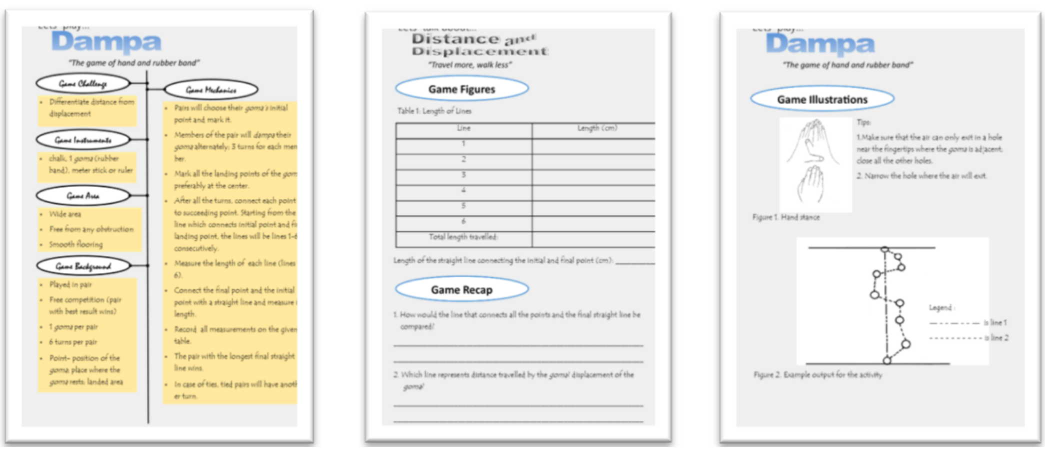


Figure 1: Activity Pack



Validation and Pilot Testing

Figure 2: Featured parts of Laro-ng-Lahi-based Mechanics Activity

Physics professors and physical education teachers validated version 1 of "*Laro ng Lahi*"–based Physics activity pack in two methods: descriptive and quantitative content validation. Only descriptive validation was done for face validation which featured the use of phrases or words to describe the assessment of the activities. These were presented as comments, remarks or suggestions of the experts written in the draft copy of the activity pack. Quantitative content validation made use of the Pantig's (2013) instrument. A summary of the average ratings is presented in Table 2 with the verbal interpretation provided by the validation instrument.

Table 2. Mean Rating of the Activity Pack

Area	Mean	Verbal Interpretation
Objectives	4.75	Highly Acceptable
Contents	4.68	Highly Acceptable
Procedures	4.81	Highly Acceptable
Illustrations, Diagrams and Figures	4.65	Highly Acceptable
Language	4.67	Highly Acceptable
Usefulness	4.79	Highly Acceptable
Featured "Laro ng Lahi"	4.80	Highly Acceptable
Overall Mean Rating	4.74	Highly Acceptable

The means of the different constructs or area were determined by getting the ratio of the sum of the ratings per expert, the total number of items of the validation instrument, and the number of experts who rated the activity pack. For a more reliable computation, Statistical Package for Social Sciences (SPSS) generated output was used instead of manual calculations. All evaluators rated the developed activity pack 4.74 out of 5.0 suggesting a high position in the continuum of the Likert scale range. This recommended a good quality curriculum material (activity pack) in construction and valid content wise in all the specified areas. Thus, experts found the activity pack highly acceptable as a whole package in terms of the individual constructs. They assessed that content, objectives, procedures and illustrations are coherent, congruent, has fluidity and in harmony with the physics competencies of the curriculum. They do not see any pattern of developing alternative conceptions for the students. They find the activity pack useful and the language is appropriately suited to the end-users. Raters’ agreement is presented in Table 3.

Table 3. Measure of Inter-rater Reliability of Experts’ Validation

Area	Kappa Value (κ)	Verbal Interpretation
Objectives	0.58	Moderate Agreement
Contents	0.52	Moderate Agreement
Procedures	0.63	Substantial Agreement
Illustrations, Diagrams and Figures	0.50	Moderate Agreement
Language	0.44	Moderate Agreement
Usefulness	0.67	Substantial Agreement
Featured "Laro ng Lahi"	0.60	Moderate Agreement
Overall Kappa Value	0.58	Moderate Agreement

Table 3 shows the inter-rater reliability of the ratings of the four expert validators. The presence of agreement within validators, though moderate, shows that there is a good possibility but by no means a guarantee, that the ratings do in fact reflect the facets they are purported to reflect. On the other hand, the value of kappa which is still several points distanced from an “Almost Perfect Agreement” implies that the raters may differ in views with regards the content validity of the activities. Gleaned from the table, good agreement of the raters are on usefulness and procedures in the activity which are the integral parts of the activities in the activity pack.

With all the comments and suggestions integrated in the activities of the activity pack, second version of the product was pilot tested to a group of introductory physics students. Table 4 shows the result of the summarized data from the students’ rating.

Table 4. Measure of Reliability of Students' Ratings

Area	Alpha Value (α)	Verbal Interpretation
Objectives	0.91	Excellent
Contents	0.71	Acceptable
Procedures	0.76	Acceptable
Illustrations, Diagrams and Figures	0.77	Acceptable
Language	0.84	Good
Featured "Laro ng Lahi"	0.75	Acceptable
Overall Alpha	0.90	Excellent

As gleaned from Table 4, the reliability of the different constructs/areas of the activity pack ranges from 0.71 to 0.91 verbally interpreted as acceptable to excellent. Overall alpha of the activity pack is found within the "Excellent" range, which ascertains that the instrument has a high index of reliability and is recommended as a standard instrument good for classroom purpose or for much wider goal. Summarized in Table 6 are the specific features and statistical characteristics of the activity pack.

Table 5. Summary of statistical characteristics of the Laro-ng-Lahi-based Mechanics Activity Pack

Laro-ng-Lahi-based Mechanics Activity Pack
• *n (experts) = 4 • Content Validity ○ Over All Mean = 4.72 out of 5.00 • Inter-rater reliability: 0.58 • Reliability: 0.90

Quantitative measures of the activity pack's content validity, inter-rater reliability and reliability index suggest a valid and reliable curriculum material in Physics which features the integration of traditional Filipino games in making Physics learning fun, active, and engaging. Dynamic approaches to teaching and learning a difficult and abstract subject may be enhanced using culture-, game-, and context-based activities. As noted in the journal logs of students who were asked to conduct the activities for the pilot-run, they did enjoy and had fun while learning. Below are the summarized students' journal entries that support these claims.

Table 6. Summarized students' Journal Entries

Game	Common Impressions	Points for Improvement/ Problems/ Difficulties	Suggestions
Dampa	• Fun • Hard	• Game area • Doing the act of *dampa*	• Teach and practice *dampa* before the activity
Sipa	• Fun • Easy to play, hard to gather data	• Maintaining same maximum height • Measuring maximum height • Hitting *sipa* consecutively	• Have more materials to aid the game • Set a fixed maximum heights
Tumbang Preso	• Fun • Hard • Tiring	• Hitting the *lata* • Mechanics	• Analyzing the concept through comparison to points is ineffective
Luksong Baka	• Fun • Hard • Tiring	• Jumping over the *baka* • Being the *baka* • Game Mechanics	• Let stronger students to become *baka*

			• Make mechanics more specific • Advise students to wear comfortable attire
Shato	• Fun • Hard • Boring • Confusing	• Game Mechanics • Air resistance • Observing small stick • Manipulating and measuring the assigned angle	• Improve instruction regarding the angle • Have provisions regarding the angle
Holen	• Fun • Hard • Boring	• Identifying which case was observed • Hit other marbles • Game Mechanics	• Put walls as boundary to keep the marbles inside the area
Patintero	• Fun • Hard • Easy • Tiring	• Game Mechanics	• Have more people to guard the hand ad feet movements of line guards • Tie the feet of the defender • Change the game • Improve the concept
Hilahang Lubid	• Fun • Tiring • Dangerous	• Game Area • Game Mechanics • Game Instruments	• Let the students use glove • Use softer rope • Have different person to time and to record • Have equal number of girls and boys per group

The final product ("*Laro ng Lahi*"-based Physics Activities) integrated all suggestions collected from the pilot run specifically identified in Table 6. These comments and recommendations enhanced the activities and revisions done made the activity pack ready for the ended users. The researchers developed eight "*Laro ng Lahi*"-based activities in mechanics. These activities can be performed by junior high school students within the given period of time in a particular high school setting. The expected contents for the competencies of Grade 7 to Grade 10 are covered where the degree of success of students is measurable. These can also be used by students enrolled in introductory physics courses. The activities included in the activity pack incorporated easy to visualize illustrations, diagrams and figures to aid and allow students to view concepts from different perspectives and different forms. Appropriate language was used for easy comprehension of students.

Along with the statistical characteristics of the activity pack, there are other more featured advantages and traits when these are used in the classroom as aid to learning Physics. "Laro ng Lahi" used in the activities are valid and properly integrated to the concepts, where the chosen traditional games are among those most common in Filipino student's cultural or social context. "Laro ng Lahi" as class activity promotes collaboration among students. It also serves as a good source learning experience. The activities can be easily reproduced and the materials used in the activities are indigenous materials.

The developed activities can improve and develop students' critical thinking skills and conceptual understanding in physics which can further lead to application of concepts to real life situations. It has the capability to elicit and address common misconceptions of students for they are free to explain the line of reasoning of their answers. The activities can also be used as assessment tools for the teacher.

5. Conclusion and Recommendations

The developed activities have a great potential to improve and develop students’ critical thinking skills and conceptual understanding in physics. These activities have the capability to elicit and address common misconceptions of students and may also serve as context- and problem-based assessment tools for the teacher.

From the high scores on the different constructs: objectives, contents, procedures, illustrations, diagrams and figures, and language of the activities developed, it can be said that these activities are fit for use in science classes as support materials in the Enhanced basic education science curriculum. Teachers can use these activities as supplements to the structured laboratory activities in introductory physics courses. The intentions of these developed and validated activities are similar to that of Popov (2008), who found that outdoor physics can trigger students’ thinking and give them deeper understanding of concepts and methods in physics. Similarly, Wijaya (2008) used Indonesian traditional games as experience-based activities and contextual situation to build students’ reasoning and to reach the mathematical goals of linear measurement. Aligned with humanistic, effective, and fun learning process, Indonesian traditional games helped students comfortably and easily learn mathematics. Moreover, Nyota and Mapara (2008) recounted that Shona traditional children’s games and songs resulted to and provided a rich environment or social context that sustained children’s curiosity and exploration of their immediate world as they play. Additionally, the process of exploration of social context of the games was highly rewarding and motivational for students. It was found that the use of traditional games teaches children to have an understanding of some aspects of their biophysical environment.

Although games are very helpful as learning aids, the non-standard rules and mechanics of the traditional Filipino games posed several issues in the development procedure. It is suggested games be synchronized and systematized in terms of rules and mechanics according to the practices and traditions of the specific area or ethnic group. Quantitative method in the activities may also be integrated in the developed activities to match and supplement the conceptual facts and principles promoted and developed by the activities. Researchers may also look into the possibility of developing the same activities using “Laro ng Lahi” in varying difficulty which can be used in the different levels of basic education system.

Games in the developed activities are anticipated to allow students to immediately apply skills they acquire that will make them competent and knowledgeable. Thus, with the use of the developed activities, students’ motivation and learning will increase. They are well designed for ease of administering to students and can also be used as an assessment tool which can be helpful in detecting students’ misconceptions. It is also aligned to the K-12 curriculum assessment scheme where performance based evaluation is given priority. They can be used in mechanics as collaborative in-class activity where students can help one another allowing them to learn easier and can develop their communication skills.

Finally, these activities are can help to sustain Philippine indigenous games with intentions associated to the concept of the Section 14, Article XIV of the 1987 Philippine Constitution that the state shall foster the preservation, enrichment, and dynamic evolution of a Filipino national culture. This makes learning physics an active process through sports and games promoting physics in action. The use of locally available materials or use of indigenous materials that defines playing traditional Filipino games conform to the governments’ desire to encourage the use of locally-produced learning materials on which students are more familiar with and have experience with. These targets support Morales’ (2014) findings that students preferred contextualized activities and use of tangible and non-tangible culture of students which bring in familiar setting and schema that always manifest in all their cognitive, affective and psychomotor activities.

References

Abayao, L. (2003). Ifugao knowledge and formal education-system of learning in the Philippines. *Cultural Survival Quarterly* 24(7). Retrieved June 6, 2013, from: www.culturalsurvival.org/publications/cultural-survival-quarterly/philippines/ifugao-knowledge-and-formal-education-systems-l

Aguado, D. (2012). The traditional Filipino street games are alive in the Philippines, Retrieved: November 22, 2013, from: http://dickieaguado.wordpress.com/2013/10/03/the-traditional-filipino-street-games-are-alive-in-in-the-philippines

Aikenhead, G.S. (2001). Integrating Western Aboriginal Sciences: Cross-Cultural Science Teaching. *Research in Science Education, 31*(2), 337-355.

American Association for the Advancement of Science (1990). *Science for All Americans.* Oxford: Oxford University Press.

Arroio, A. (2010). Context based learning: A role for cinema in science education. *Science Education International, 21*(3), 131-143.

Banks, J.A. (1993). Multicultural education: characteristics and goals. In J. A. Banks & C. A. Mc Gee Banks (Eds.), Multicultural education (2nd ed.), 3-28. Boston: Allyn and Bacon.

Barbosa, A.C. (2003). Traditional Games in the Philippines. Retrieved November 28, 2014 from: http://ncca.gov.ph/about-culture-and-arts/articles-on-c-n-a/article.php?subcat=13&i=10

Campbell, B., Lazonby, J., Millar, R., Nicolson, P., Ramsden, J., & Waddington, D. (1994). Science: The Salters' approach-a case study of the process of large scale curriculum development. *Science Education*, *78*(5), 415-447.

DeBoer, G.E. (2000). Scientific Literacy: another look at its history and contemporary meanings and its relationship to science education reform. *Journal of Research in Science Teaching*, *37*(6), 582-601.

Decierdo, P. (2011). Typhoon Sendong and the necessity of scientific literacy in the Philippines. Retrieved November 25, 2014 from: http://filipino freethinkers.org/2011/12/23/typhoon-sendong-andthe-necessity-of-science-literacy-in-the-philippines/

Efthimiou, C., Llewellyn, R., Maronde, D., & Winningham, T. (2006). Physics in Films: an assessment. *arXiv preprint physics/0609154*. Retrieved May 18, 2012, from: http://arxiv.org/ftp/physics/papers/0609/0609154.pdf

Fiagoy, G. (2000). Adult Education and Indigenous People in the Philippines. Metro Manila. UNESCO Institute for Education.

Fine, G., A. (1995). Accounting for rumor: the creation of credibility in folk knowledge. Pp. 123-36 in Regina

Bendix & Rosemary Zumwalt (ed.), Folklore Interpreted: Essays in Honor of Alan Dundes. New York: Garland, 1995.

Folashade, A., & Akinbobola, A., O. (2009). Constructivist problem based learning technique and the academic achievement of physics students with low ability level in Nigerian secondary schools. *Eurasian Journal of Physics and Chemistry Education*, *1*(1), 45 -51.

Gregorio, J., R. Buendia, R. Molera, B. Flor, B. de Dios, J. Ganibe, A. Balonkita, C. Dawang and N. Mirandilla (2011). Philippine education sector assessment project. *International Technology Management Corporation (INTEM)*. Retrieved March 16, 2015, from: https://www.academia.edu/1433995/Philippine_Education_Sector_Assessment_Report

Jenista, F.L. (1987).The white apos: American governors on the Cordillera Central, Quezon City, Philippines: New Day Publishing.

Jones, J., Caton, H., & Greenhill, D. (2014). Using game-based learning to engage people with Physics: how successful could 'Junkyard Physics' be?. *The Higher Education Academy*. Retrieved March 16, 2015, from: https://www.heacademy.ac.uk/sites/default/files/resources/PSI-259-Paper.pdf

Kortland, J. (2007), Context-based science curricula: exploring the didactical friction between context and science content. Paper presented at the *ESERA Conference 2007*, Malmo (Sweden)

Kroma, S. (1995).Popularizing science education in developing countries through indigenous knowledge. *Indigenous Knowledge and Development Monitor, 3*(3).

Liu, K. K. (2009). Grade-level standards-based science outcomes for English language learners and language minority students: A review of the literature (LEP Projects Report 6). Minneapolis, MN: University of Minnesota, *National Center on Educational Outcomes*. Retrieved June 30, 2011, from: the World Wide Web: http://cehd.umn.edu/NCEO/OnlinePubs/LEP6/

Lixin, X. (2006). Bridging the gap between teaching styles and learning styles: A Cross-cultural perspective. *TESL-EJ (Teaching English as a Second language*), *10*(3).

Lopez, M. L. (1980). A study of Philippine games. Quezon City, Philippines: U.P. Press.

Lopez, M. L. (2001). A Study of Philippine Games. Quezon City, Philippines: U.P. Press.

Lye, H., Fry, M., & Hart, C. (2002). What does it mean to teach physics 'in context': a first case study. *Australian Science Teachers*, *48*(1), 16-22.

Morales, M. (2014). Cultural and epistemological profile of Filipino learners. *Electronic Journal of Science Education*, *18*(6).

Morales, M. (2014). Culture and language sensitive physics on student concept attainment. International *Journal of Learning and Teaching*, *6*(1), 1-12.

Morales, M. (2014). The impact of culture and language sensitive physics on concept attainment. *International Journal of Learning, Teaching and Educational Research, 2*(1), 1-29.

Nyota, S., & Mapara, J. (2008). Shona traditional children's games and play: Songs as indigenous ways of knowing. *Journal of Pan African Studies*, *2*(4), 184-202.

Pantig, R. (2013). The effect of ranking tasks on student's understanding of electric circuits. Unpublished paper – Philippine Normal University: Manila.

Pertierra, R. (2002). The Work of Culture. De La Salle University Press. Philippines: Manila, 21-49.

Popov, O. (2008). *Developing outdoor physics project using the activity theory framework*. In: GIREP 2008 International Conference. University of Cyprus 18-22 August 2008: Physics curriculum design development and validation, 2008.

Saleh, S. (2012). Dealing with the Problem of the Differences in Students' Learning Styles in Physics Education via the Brain Based Teaching Approach. *International Review of Contemporary Learning Research*, *1*(1), 47-56.

Samarov, L. A., & Portner, R.E. (2004). Communication between cultures 5th Ed. Belmont CA: Wadswortth

Selcuk, G.S. (2010). The effects of problem-based learning on pre-service teachers' achievement, approaches and attitudes towards learning physics. *International Journal of Physical Sciences*, *5*(6), 711-723.

Tan, M. (2004). Nurturing scientific and technological literacy through environmental education. *Journal of International Cooperation in Education, 7*(1), 115-131.

Tural, G. (2013). The functioning of context based physics instruction in higher education. *Asia- Pacific Forum on Science Learning and Teaching*, *14*(1), 4-1

Van Joolingen, W.R., de Jong, T., & Dimitrakopoulout, A. (2007). Issues in computer supported inquiry learning in science. *Journal of Computer Assisted Learning*, *23*(2), 111-119.

Wanbugu, P.W., & Changeiywo, J.M. (2008). Effect of mastery learning approach on secondary school students' physics achievement. *Eurasia Journal of Mathematics, Science and Technology Education*, *4*(3), 293 -302.

Whitelegg, E., & M. Parry (1999). Real -life contexts for learning physics: meanings, issues and practice. *Physics Education*, *34*(2), 68 -72.

Wijaya, A. (2008). Design Research in Mathematics Education: Indonesian Traditional Games as Means to Support Second Graders' Learning of Linear Measurement. Utrecht: Utrecht University.

Wilhelmsen, T. (2012). Physical activity in the everyday life of children. Trondheim: Norwegian University of Science and Technology.

Yager, R. (2012). Is science literacy an appropriate major goal for science education?. National Science Teachers Association Blog. Retrieved March 16, 2015 from: http://nstacommunities.org/blog/2012/08/19/is-science-literacy-an-appropriate-major-goal-for-science-education/

Yam, H. (2005).What is contextual learning and teaching in physics?. Retrieved November 4, 2010 from Contextual Physics in Ocean Park. Retrieved from: http://www.phy.cuhk.edu.hk/contextual/approach/tem/brief_e.html

______ (2014) UNESCO. Position Paper on Education Post- 2015. Retrieved August 15, 2014 from: http://en.unesco.org/post2015/

______ (2014) Australian Council for Education Research. Scientific Literacy. Retrieved March 16, 2015 from: http://www.acer.edu.au/ozpisa/scientific-literacy