UTILIZING MALAYSIAN TRADITIONAL GAMES TO IMPLEMENT KINESTHETIC INTELLIGENCE APPROACH IN INFORMAL SCIENCE LEARNING ENVIRONMENT

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ABSTRACT

Science learning is far more complex and not only limited to learning in the classroom. There is one type of learning that can complement formal learning in school that is known as informal science learning. Informal science learning can occur and has been conducted in various ways. This paper discusses a study conducted in Malaysia which utilized Malaysian traditional games to implement kinesthetic intelligence approach in informal science learning environment. The Malaysian traditional games are referred as games that have become a habit of perpetual succession, something that has become synonymous with the practice of a community, as example *Wau* and *Tarik Upih* games. Kinesthetic intelligence can be developed and nurtured among students by utilizing both games as students interact with their environment and use all or a part of the body to solve problems or investigating science issue in both games.

Key words: *Informal Science Learning; Kinesthetic Intelligence, Malaysian Traditional Games*

1.0 INTRODUCTION

Students believe that science is a subject that is difficult to understand and difficult to learn (Jariah, 2005). Consequently, students used to memorize the science concepts even they do not understand the concepts they had learned in science learning at school. In addition, science learning in the classroom is based on facts and science concepts that are not specific enough to provide students with a holistic understanding. According to Bell, Ledermen and Abd-El-Khalick (2000), it is important for students to know why a scientific idea is used in one condition so that they can relate the scientific knowledge acquired at school with their daily lives.

This shows that science learning is far more complex and not only limited to learning in the classroom or strengthening by using textbooks, but also requires a 'hands-on' activity that is also called exploration with an open mind, which involves students to think critically, provides reflective inquiry that encourages students to make hypotheses and questioning and also be able to develop interest and curiosity among students (Kelly, 2000). According to Lewenstein (2009), great science learning often go unnoticed, occurs outside the school in an informal environment, which includes daily activities, space and designed program. That science learning is known as informal science learning.

1.1 Informal Science Learning

Informal science learning is defined as learning that takes place outside the school environment and not necessarily follow the curriculum (Havasy, 1997), based on experience, unplanned and spontaneous (Marsick & Volpe, 1999; Ainsworth & Eaton, 2010). Therefore, informal science learning applied occurrence of learning at any time without involving a particular place (Kelly, 2000). In addition, FriedHoffer (2007) defined informal science learning as experiential learning, inquiry, hands-on activities and also being a method to increase scientific literacy among students. This is consistent with Crane, Nicholson, Chen and Bitgood (1994) which stated that informal learning as a self-learning experience that allowed an individual to fulfil his/her need and may affect individual's attitudes and change in behaviour. Through this type of learning, students were actively involved in their learning process and gain knowledge from their environment, observation, experience and communication with other people. Thus, in briefly, informal science learning can be defined as a learning process that takes place at any particular place, mostly outside the school environment, which is advantage for students learning.

According to Nooraida, Maznah, Salmiza, Zurida, Anna Christina, Jamalsafri and Mohd Ali (2011), informal learning is needed in order for students to learn science effectively and enjoy the learning process. In fact, Brackney (2008) stated that informal science learning is easier to practice because it is an open learning and do not have any particular teaching method that is differ from formal science learning which teaching process based on curriculum, applicable at the time of schooling and have a complete teaching strategies (Stroud, 2008). Even so, Fenichel and Schweingruber (2010) suggested that informal science learning activities should be designed to potentially trigger students' interest and excitement to learn science. The activities that are designed and carried out in informal science learning suppose can motivate students' interest in science learning consistent with learning process that occurs is more student-centered and based on students' experience.

Furthermore, Fenichel and Schweingruber (2010) also stated that students are supposed to be able to interpret their own observation of the science activities experienced directly by them through hands-on activities. In addition, when students are engaged in informal science learning, their new experiences transform into new knowledge or become adjustments to the existing knowledge. Besides, students can structure the new information when the existing information is repeated through the exploration process in informal science learning environment (Saunders, 1992). This type of learning can improve student understanding of science concepts they had learned in school. Therefore, due to this situation, informal science learning can complement formal science learning in school as mentioned by Middlebrooks (1999), informal science learning will be a value-added to a routine experience in learning science and science subject become more interesting to be learned.

In addition, through informal science learning, students are also given the opportunity to think in a self-focused without formally proclaimed by the teacher about the learning objective was duly achieved after undergoing informal science learning activity (Fenichel & Schweingruber, 2010). This opportunity makes students become responsible to their learning process. Therefore, the learning process is more student-centered. This student-centered learning is a form of constructivism learning.

According to Bruner (1966), students who involved in constructivism learning can control the learning process either by adding or synthesize new knowledge to the existing structures or by changing their understanding based on new experiences. Constructivism learning is consistent with the characteristics of informal learning environment which involve students in learning through various experiences (Crane, 1994) and as a component of the development of knowledge and attitude formation (Anderson, Lucas & Ginns, 2003; Appleton, 1993; Falk & Dierking, 1997). Therefore, informal science learning is also consistent with constructivism learning from learning aspects which emphasizes the process and the product (Falk & Dierking, 1997). Process refers to physical activities, social and self-context involving an interest toward something. Meanwhile, the learning product focused on mind development or conceptual development (Anderson et al., 2003).

2.0 Implementation of Kinesthetic Intelligence Approach in Informal Science Learning Environment by Utilizing Malaysian Traditional Games

According to Braund and Reiss (2004), informal learning may as well be characterized as three main domains namely cognitive, affective and psychomotor domains. Cognitive domain refers to the aspect of scientific knowledge and intellectual skills which are to be developed indirectly through informal learning activity. While, affective domain refers to the positive aspects of attitude and interest that fostered directly when doing informal learning activity and psychomotor domain involves directly aspects of experience with informal learning activity that will be done. Table 1 described briefly the three domains of informal learning.

The three domains as mention in Table 1 contributed to learning field and they also described the hierarchy of learning objectives that always referred to the work of Bloom (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). But, according to Braund and Reiss (2004), the cognitive and affective domains are always been implement, meanwhile, the psychomotor domain is not explored

extensively. Therefore, in order to increase the exploration of the psychomotor domain in informal learning, a study was conducted in Malaysia by implementing kinesthetic intelligence approach in informal science learning environment.

The kinesthetic intelligence is also referred as bodily-kinesthetic intelligence. This intelligence is one type of nine intelligences in Multiple Intelligence (MI) theory. The others are (1) verbal-linguistic: sensitivity to the spoken and written language and using a language to achieve goals; (2) logical-mathematical: ability the use of logical structure including patterns and relationships and statements and propositions through experimentation, quantification, conceptualization and classification; (3) visual-spatial: ability to learn visually and organize idea spatially; (4) musical-rhythmic: sensitivity to pitch, melody, rhythm and tone; (5) interpersonal: ability to understand people and relationship; (6) intrapersonal: ability to access one's emotional life as a means to understand oneself and others; (7) naturalist: ability to recognize and classify the numerous species of flora and fauna in one's environment and the ability to care for, tame, or interact subtly with living creatures or with the whole ecosystem and (8) existential: seeks contexts for real world understandings and applications of new learning which includes personal, communal and curricular connections.

Kinesthetic intelligence is an ability to interact with one's environment and it allows individuals to use all or part of the body to create products or solve problems. In addition, according to McKenzie (2012), kinesthetic intelligence promotes understanding through concrete experience, which can include fine and gross motor tasks that promote understanding of skills and concepts. Therefore, this intelligence will implement in informal science learning environment in order to provide learning experience that can promote and increase students' understandings of science skills and concepts. Besides, Gardner (1993) posited that any intelligence can be educated or developed through learning and they need to be nurtured with appropriate encouragement, enrichment and instruction. This is consistent with Armstrong (1994) who stated that most people can develop any intelligence to a certain level of competency. This means that everyone has the capacity to learn or become better in certain intelligence by instruction and encouragement. Thus, in order to develop kinesthetic intelligence among students, kinesthetic intelligence approach will be implemented in informal science learning environment so that kinaesthetic intelligence can be nurtured among students.

Furthermore, by implement kinesthetic intelligence approach in informal science learning environment, students learning in school can be enhanced as mention by Gardner (1995), MI strategies provide many opportunities for students to achieve success in school. This was proven by Hopper and Hurry (2000) in a case study conducted by them. The teacher in that study reported that students' self-evaluation were well informed and constructive. The fact that students were required to touch, to use their hands and their bodies had enriched their learning and the results in the end of topic test suggested that the less able had retained information for longer. Therefore, by implement kinesthetic intelligence approach in informal science learning environment students learning can be more effective.

The kinesthetic intelligence approach in informal science learning environment was conducted outside the classroom by utilizing Malaysian traditional games that are designed to be hands-on science learning activities. Traditional games are not just functioning as games, but also serves as a

learning tool because the game can stimulate intrinsic motivation of students (Malone & Lepper, 1987), experiential learning occurs during playing (Dieleman & Huisingh, 2006), there are pedagogical principles in the design of game-based learning (Becker, 2007) and there are practices that can be shared socially during the construction of knowledge while playing (Gee 2007; Steinkhueler 2008). In addition, science learning through games can increase student interest and involvement in their learning. The study by Lau (2012) has proven that the use of play while learning can increase student interest and participation in science learning and increase their performance in science subjects.

Furthermore, Choong (2009) suggested that play is refers as an activity that enhances intrinsic motivation and give fun during students learning. Besides, play is not only fun, but also important in learning process. According to Choong (2009), play activities may promote the development of language skills, social competence, creativity, imagination and thinking skills among students. Thus, utilize of traditional games to implement kinesthetic intelligence approach in informal science learning environment gives advantages for student learning. In addition, the use of traditional games in informal science learning are also able to create a meaningful learning such as learning to relate science with students daily life (Noor Hasyimah, Zurida, Maznah, Nooraida, Salmiza, Anna Christina, Jamalsafri & Mohd Ali, 2012).

In Malaysia, traditional games are defined as games that have become a habit of perpetual succession, something that has become synonymous with the practice of a community. Traditional games also known as citizen games. In this paper, only two traditional games are discussed which are '*Wau*' and '*Tarik Upih'*. Both games are briefly described below.

2.1 Implement Kinesthetic Intelligence Approach by Utilizing *Wau* Game

Wau is also known as '*Layang-layang'* (kite). This game is one of the traditional games that are favored by the villagers. *Wau* has been played since the 15th century. *Wau* were created in various forms and names like *Bird Wau*, *Fairy Wau* and *Peacock Wau*. Usually *Wau* will be played by two people, one person will hold the kite and another called the '*Juru Anjung'* will hold the rope bridge. When the wind blow, the rope will be pulled against the wind by means of ropes stretched out and pull the *Wau* up high in the air.

Hands-on Science Activities by using *Wau* Game:

Objective:
Identifying the factor that influences *Wau* to go higher in the air.

Material:
Wau or *Layang-layang* (kite); two (2) persons (will be named as A and B in Figure 1)

Science Concept Applied:
Pressure

Procedure:
a) A will hold the *Wau*. While, B will hold the *Wau*'s string as shown in Figure 1.

b) When there is wind, B should pull the strings against the wind and pulled out until the *Wau* flying high in the air.
c) Observe whether *Wau* up high or otherwise when the wind blows strong and when the wind blows slow/weak.
d) Compare the height of *Wau* in both circumstances.

Result/Explanation:
Wau was flying high in the air when the wind blows stronger than when the wind blows slow/weak. This is because when the wind blows strong, the wind pressure on the *Wau*'s surface had increased and the capacity of *Wau* to fly high also increased. Therefore, the factor affecting *Wau* to go higher in the air is the wind pressure. Through this hands-on science activity, students will improve and understand better the concept of pressure.

Figure 2 and Figure 3 show that student doing the hands-on science activity while playing the *Wau* game in order to investigate the factor that influences *Wau* to go higher in the air which related to the concept of pressure. The *Wau* game is supposed to be played on the open place such as open field so that students actively moving their body and freely to move without any hindrance during their informal science learning.

2.2 Implement Kinesthetic Intelligence Approach by Utilizing *Tarik Upih* Game

Tarik Upih is a traditional game that is usually played by children. *Upih* is frond/ "base" of Areca's leaves. Normally, when this frond became old, it will fall to the ground. Frond that fell to the ground will be used to play *Tarik Upih* game. Areca's leaves from the fronds are cast and been made upstream or place to pull the sheaths. *Tarik Upih* can be played by two or more individuals depending on the size of the *Upih*. An individual will be a handyman pull and the others just have to sit on the *Upih*.

Hands-on Science Activities:

Objective:
Identifying the factor that affect the force to pull *Upih* (Areca's frond).

Material:
Upih; three (3) persons (will be named as A, B and C in procedure part)

Science Concept Applied:
Force
Procedure:
a) A will pull the *Upih* occupied by B as shown in Figure 4. Observe the condition of A during the pulling process.
b) Then, A will pull the *Upih* occupied by C (Figure 5). Observe the condition of A during the pulling process.
c) Compare the condition of A during the pulling process of B and C in terms of difficulty to pull.

Result/Explanation:
A difficult to pull the *Upih* occupied by C compared to pull the *Upih* occupied by B. This is because a greater force is needed to pull the heavier load. Therefore, factor affecting the force to pull a load is the heavy of the load.

The Figure 6 shows the *Upih* which is used to play *Tarik Upih game*. Students conducted the hands-on science activity while playing the *Tarik Upih* game and identifying the factor that affect the force to pull *Upih*. The *Tarik Upih* game is also need to be played on the open or large place such as open field so that students can actively move their whole body and freely to move without any hindrance while playing the game.

As the result from hands-on informal science activities by utilizing *Wau* and *Tarik Upih* games, students can increase their kinesthetic intelligence as they used their mental abilities to coordinate their own bodily movement while playing both games. This is consistent with Brualdi (1996) who stated that kinesthetic intelligence challenges the popular belief that mental and physical activities are unrelated. This means that through kinesthetic intelligence, mental and physical activities are related to each other which involved physical coordination and dexterity, using fine and gross motor skills. For this reason, it is important to encourage students to explore and exercise their kinesthetic intelligence. In addition, by implementing kinesthetic intelligence in informal science learning environment through Malaysian traditional games, learning become more effective thus as students were very active in monitoring their own learning, exploring and investigating the science problems or issue in each hands-on science informal activities by themselves. Besides, the science learning also become more interesting compare to the science learning in the classroom as students were having so much fun while doing the hands-on science informal activities through *Wau* and *Tarik Upih* games.

3.0 CONCLUSION

Kinesthetic intelligence approach which had been implemented in informal science learning environment by utilizing Malaysian traditional games such as *Wau* and *Tarik Upih* games is a type of learning that not only makes science more interesting and fun to learn, but also be able to enhance the scientific skills, knowledge and understanding on a scientific concept among students. Besides, through the implementation of this approach, kinesthetic intelligence can be developed and nurtured among the students. The beacon of kinaesthetic intelligence can shed light, for students on how young people can be helped to access, manage and develop their own learning processes. In addition, traditional games such as *Wau* and *Tarik Upih*, which is an ancestral heritage of Malays can also be sustained. Therefore, it is concluded that kinesthetic intelligence approach which have been implemented in the informal science learning environment by utilizing Malaysian traditional games are effective and making science learning more meaningful by enhanced students learning and related the science learning with students' daily lives.

REFERENCES

Ainsworth, H. L. & Eaton, S. E. (2010). *Formal, Non-Formal and Informal Learning in the Sciences.* Report published by Onate Press. ISBN: 978-0-9733594-5-9

Anderson, D., Lucas, K. B., Ginns, I. S. (2003). Theoretical Perspectives on Learning in An Informal Setting. *Journal of Research in Science Teaching*, 40(2), 177-199.

Appleton, K. (1993). Using theory to guide practice: teaching science from a constructivist perspective. *School Science and Mathematics*, 93(5), 269-274.

Armstrong, T. (1994). Multiple intelligences: Seven ways to approach curriculum. *Educational Leadership, 52*(3), 26-28.

Becker, K. (2007). Pedagogy in Commercial Video Games. In *Gibson, D., Aldrich, C. et Prensky, M.(Eds.) Games and Simulations in Online Learning : Research and Development Frameworks*.Hershey PA. ; London: Information SciencePub.

Bell, R.L., Lederman, N.G. & Abd-El-Khalick, F. (2000). Developing and acting upon one's conceptions of the nature of science: A follow-up study. *Journal of Research in Science Teaching,* 37, 563–581.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H. & Krathwohl, D. R. (1956). Taxonomy of Educational Objectives: Handbook I: Cognitive Domain. New York: Longman.

Brackney, D. L. (2008). *Influence of field study on learning and attitudes toward science*. ProQuest.

Braund, M. & Reiss, M. (2004). *Learning Science Outside the Classroom*. London and New York.

Brualdi, A. C. (1996). Multiple Intelligences: Gardner's Theory. ERIC Digest.

Bruner, J. (1966). *Towards A Theory of Instruction*. Cambridge: Harvard University Press.

Choong Lean Keow. (2009). *Series of Teacher Education: Students and Learning Environement for Bachelor of Education.* 2nd Edition. Published *by* Kumpulan Budiman Sdn. Bhd.

Crane, V. (1994). *An Introduction To Informal Science Learning and Research.* In informal sciene learning, ed. V. Crane, H. Nicholeson, S. Bitgood and Chen, M. Dedhem, MA: Reserach Communications, Ltd.

Crane, V., Nicholson, H., Chen, M., Bitgood, S. (1994). *Informal science learning: What Research says about television, science museums, and community-based projects. Dedham, MA*: Research Communications Ltd., and Ephrata, PA: Science Press.

Dieleman, H & Huisingh, D. (2006). The Potentials of Games in Learning and Teaching About Sustainable Development. *Journal of Cleaner Production*: 18. ISSN 0959-

6526.

Falk, J.H. & Dierking, L.D. (1997). School field trips: Assessing their long-term impact. *Curator,* 40, 211-218.

Fenichel, M. & Schweingruber, H. A. (2010). National Research Council. 2010. *Surrounded by Science*. Washington, DC: National Academies Press.

FriedHoffer, B. (2007). *Why An Informal Science Intervention*. Maxwel Auditorium, Singapore, 29 Nov-3 Dec 2007.

Gardner, H. (1983). *Frames of Mind: The Theory of Multiple Intelligences*. New York: Basic Books.

Gardner, H. (1995). Multiple intelligences as a catalyst. *English Journal, 84*(8), 16-18.

Gee, J.P. (2007a). *What Video Games Have To Teach Us About Learning and Literacy*. 2nd edition. New York, NY, United States, Palgrave Macmillan.

Havasy, R. A. D. P. (1997). *The Effect of Informal science Achivement and Attitude of High School Biology Students*. Thesis of Doctor of Philosophy. Teachers College. Columbia: Columbia University.

Hopper, B. & Hurry, P. (2000). Learning the MI Way: The Effects on Students' Learning of Using the Theory of Multiple Intelligences, Pastoral Care in Education: *An International Journal of Personal, Social and Emotional Development*, 18:4, 26-32.

Jariah Mohd Jan. (2005). Making up Gender: Fictional Worlds and Fictionalising Ourselves. In Rosli Talif et al. (eds.) *Beyond Barriers Fresh Frontiers: Selected Readings in Languages, Literatures, and Cultures*. Serdang: UPM Press. Chapter 6, 56-64. ISBN 983- 3455-01-8.

Kelly, J. (2000). Rethinking the elementary science methods course: a case for content, pedagogy, and informal science education. *International Journal of Science Education*, 22:7, 755-777.

Lau Lim Ging. (2012). The effects of Play Approach while Learning in Learning Process of Year Four Students. Collection of Action Research Articles PISMP SN January 2009, Action Research Seminar IPG KBL, 195-209.

Lewenstein, B. V. (2009). *Learning Science In Informal Environments: People, Places, and Pursuits***.** Final Report of the NRC Committee on Learning Science in Informal Environments.

Malone, T. W. & Lepper, M. R. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning. In R. E. Snow & M. J. Farr (Eds.), *Aptitude, Learning and Instruction III: Conative and Affective Process Analyses* (pp. 223-253). Hilsdale, NJ: Erlbaum.

Marsick, V. J. & Volpe, M. (1999). The Nature of and Need for Informal Learning. In V. J. Marsick and M. Volpe (eds.), *Informal Learning on the Job,Advances in Developing Human Resources*, No. 3. San Francisco: Berrett Koehler.

McKenzie, W. (2012). *Intelligence Quest: Project-Based Learning and Multiple*

Intelligences. International Society for Technology in Education. ISBN 978-1-56484-309-8.

Middlebrooks, S. (1999). Children's imaginative play in the urban environment. *Journal of Museum Education, 24*(2), 23–25.

Noor Hasyimah Haniza, Zurida Ismail, Maznah Ali, Nooraida Yakob, Salmiza Saleh, Anna Christina Abdullah, Jamalsafri Saibon, Mohd Ali Samsudin. (2012). Module of Using Traditional Games for Informal Science Learning.Universiti Sains Malaysia. Yusran Publishing House.

Nooraida Yakob, Maznah Ali, Salmiza Saleh, Zurida Ismail, Anna Christina Abdullah, Jamalsafri Saibon & Mohd Ali Samsudin. (2011). *Informal Science Learning Communities Outside the Classroom*. Yusran Publishing House.

Saunders, W. L. (1992). The constructivist Perspective:implications and teaching strategies for science. *School Science and Mathematics*, 92 (3).

Steinkuehler, C. (2008). Massively multiplayer online games as an educational technology: An outline for research. *Educational Technology*, 48(1), 10-21.

Stroud, N. S. (2008). *Teaching and Learning Science in a Museum: Examining the Role of Attitudes toward Science, Knowledge of Science, and Participatory Learning in an Astronomy Internship for High School Students.* Thesis of Doctor of Philosophy. The Graduate School of Arts and Sciences. Columbia: Columbia University.

Table 1

Cognitive, Affective and Psychomotor Domains of Informal Learning

Domains of Informal Learning	
Cognitive	Development of knowledge and intellectual skills: scanning of knowledge, the comprehensive meaning, application of knowledge, data analysis, synthesis and evaluation of new information, artifacts and solutions.
Affective	Attitudes and appreciation of and interest in the phenomena and events. Method for forming attitudes and values and how people connect with others.
Psychomotor	How sensory input is filtered and led to action. Students' action become more skilled, more coordination and adaptation with increasing of experience and expertise.

Source: Braund and Reiss (2004)

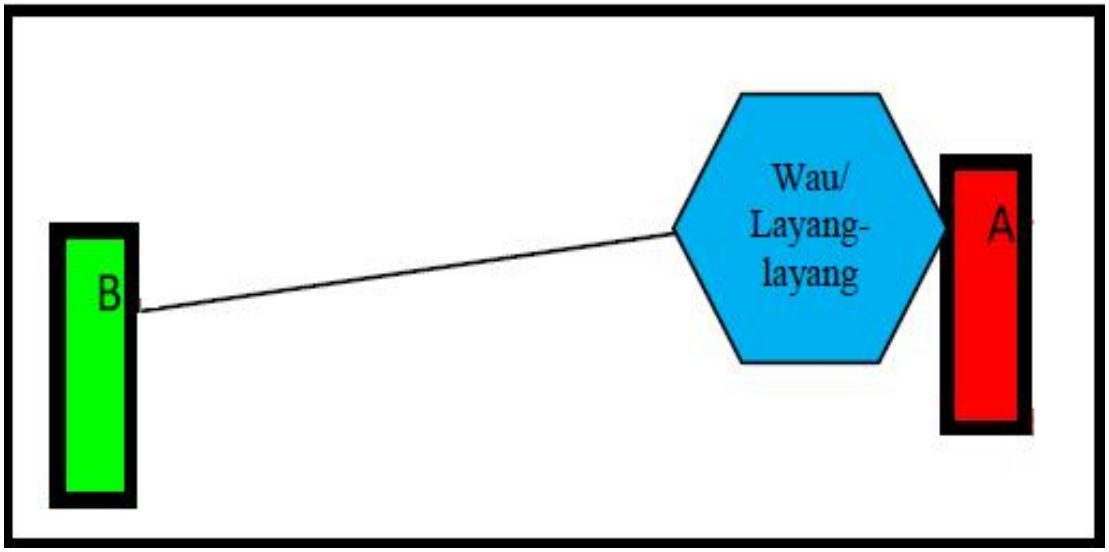

Figure 1 *Positions of A and B in Wau Game*

Figure 2 *Playing Wau at the Open Field*

Figure 3 *Wau Flying High in the Air*

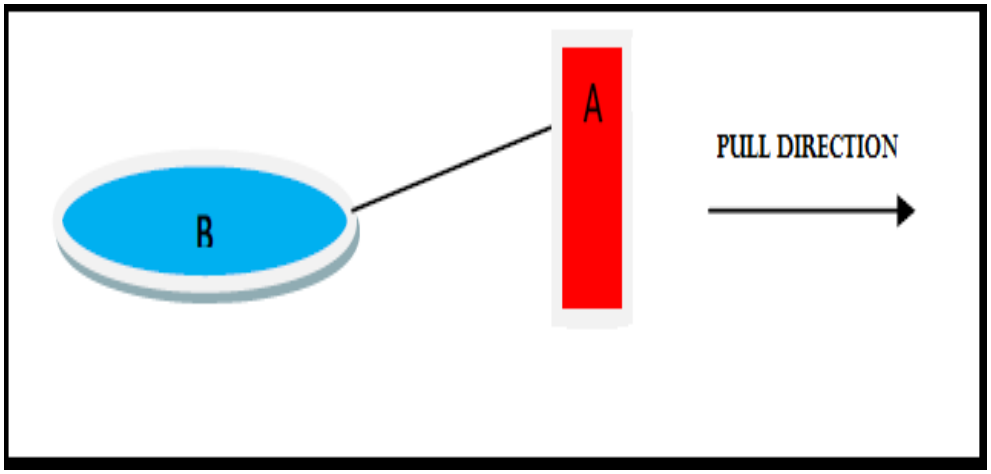

Figure 4 *Positions of A and B while Playing Tarik Upih*

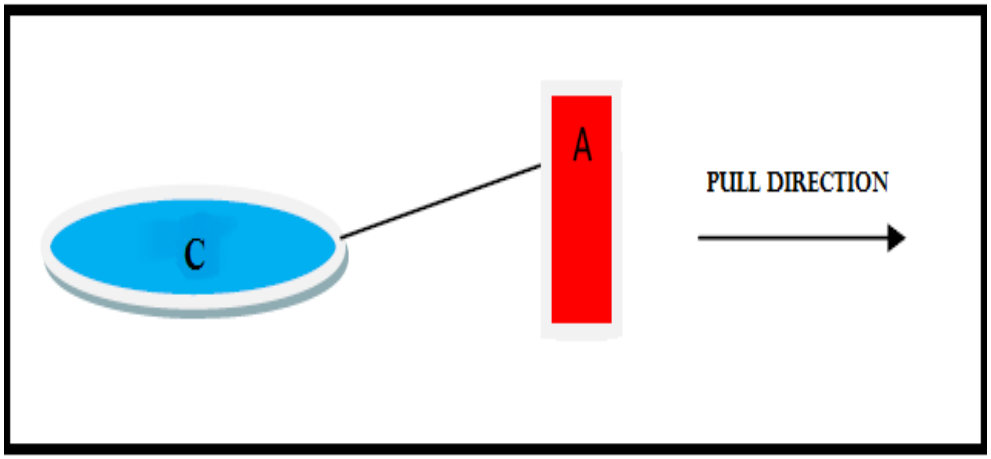

Figure 5 *Positions of A and C while Playing Tarik Upih*

Figure 6 *Upih – the Areca's Frond*