Local Wisdom Related to STEM Education

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Abstract. This study aimed to clarify plausibility of developing STEM education learning activities based on Thai local wisdom. Research method regarded document analysis. The author previous research about toys and local wisdom were analysed for STEM education. The local toys in northern part of Thailand were selected to represent how they could be used in classroom for STEM education. Two kinds of toys were explained. These included (1) Bunbeu and (2) E-plor. The paper clarified the components of toys, how to play the toys, and STEM knowledge behind playing the toys. This study may have implications for STEM education learning activities.

1. Introduction
STEM education is the goal of science and technology teaching and learning for providing in 21st century. In order to enhance students to apply knowledge for real life problem solving, STEM education becomes the vision of education. STEM education provided the teaching integrated among Science, Technology, Engineering and Mathematics. Explore contents or theory in science, select the appropriate technology, design with engineering and use mathematic to calculate [2].

Current understandings of science, technology, engineering and mathematics (STEM) learning among children and adults, in a variety of settings, including schools, but also contexts such as the home, community-based activities, after-school programs, the workplace, museums, science centers, zoos and aquariums, as well as across a wide range of digital media (Dierking and Falk, 2016)

The learning activities can create with local learning resources in the school and around the community also local wisdom. Students will learn about 4 topics of STEM and at the same time they will learn about customs traditionalism and folklore.

Science is the contents to explain the phenomena of nature of the world also create knowledge and technology to improve the way of life.

By the way local wisdom is the knowledge in the community transfer from generation to generation and integrates knowledge to improve appropriate way of life too [3].

2. Content
Local wisdom was the knowledge of predecessor to improve the way of life and it whole of interdisciplinary such as art, culture, mathematics, science etc. and separate to 7 groups: food, residence, cloths, medicine, career, recreation and transportation as diagram 1 [3].
Figure 1. Diagram group of Local Wisdom.

Table 1. The example of local wisdom in each groups.

| Local wisdom Group | Physics                                                                 | Chemistry                  | Biology                                                      |
|--------------------|-------------------------------------------------------------------------|----------------------------|--------------------------------------------------------------|
| 1. Food            | Trapper, trap, hook                                                    | Rasin                      | Living Source of animal                                      |
|                    | Lever, Tension, elasticity, Gravity, Potential energy, Moment, Circular |                            |                                                              |
|                    | motion                                                                  |                            |                                                              |
| 2. Residences      | Equilibrium, Machine, transfer weight, air flow, roof slope for pour   | Glue, Rubber               | Kind of trees for instruction and plant                      |
| Kalae House        | rain                                                                     |                            |                                                              |
| 3. Cloths          | Fiber, Cotton, Silk                                                    | Composition of fiber,      | Kind of cotton and silk                                       |
|                    | Toughness, Flexibility, Thermal insulation                             | Strength of acid and base, Adsorption |                                                              |
| 4. Medicine        | Kind of force of finger hand and foot of massager                       | Thai herbal medicine       | Tendon of human body Blood circulation system                |
|                    |                                                                         |                            | Muscle system, Psychology                                    |
| 5. Transportation  | Wheel and axis, lever, Wedge, Force, Power, Velocity, acceleration,    | Proprerties of metal       | Kind of trees to make wagons                                 |
| Wagon              | Inertia, Expansion and contraction of matters                           |                            |                                                              |
| 6. Career          | Stress and strain, Equilibrium                                         | Insecticide                | Kind of bamboo                                               |
| Wickerwork         |                                                                         |                            |                                                              |
| 7. Recreation      | Newton’s law, Circular motion, air pressure, Momentum                  | Glue, Rubber               | Kind of bamboo to make local toys                            |
| Local toys         |                                                                         |                            |                                                              |

Except the science knowledge that found in local wisdom, local technology could find too and satisfy with STEM education.
This example of local wisdom will show you how to use for STEM education.
Bunbeu was the kind of local toys that found in the North region of Thailand. It looked like a windmill put in the bamboo canteen with rope to pull and it will spin. It composed of bamboo canteen, stick, propeller, and rope [4].

1. Bamboo canteen
2. Stick
3. Propeller
4. Rope

**How to play**
Round the rope on the stick then pull it the propeller will spin and made sound “breu breu”. It made fun for children.

**Science knowledge found in Bunbeu**
If you see Bunbeu in the top view it look like a wheel and axle [6].

Bunbeu turned round and round because it had inertia and sound “breu breu” was the propeller pass through air. The circular motion of it was the knowledge that can teach for children.

2.1. *How to use Bunbeu in the STEM education*
The science knowledge that analyze from Bunbeu can develop the activities in STEM education as follows

Wheel and axle student can design size of propeller and stick to decrees force to turn round the stick but the propeller will turn round faster (Engineer) and calculate the length of the stick relate to propeller (Mathematic). How to sharpen the stick and propeller to best turn round by ask from the Bunbeu maker (Technology).
Inertia depend on the weight, student can design size and thick of propeller or take something put on the top of propeller to increase weight (Engineer). Calculate size and weight of propeller and length of rope to pull stick (Mathematic). Ask the Bunbeu maker or search data how to sharpen angle of propeller to catch the wind (Technology).

Sound student can design thick of propeller (Engineer) or design several geometry shape of propeller (Mathematic) to make several of sound. Select several materials to make propeller by enquire about this from Bunbeu maker or search data from internet to make pitch or loud of sound (Technology).

Circular motion Student can design several length of propeller to make several radius for linear velocity and angular velocity (Engineer). Calculate radius from length of propeller was diameter (Mathematic) and will know velocity (Technology).

The other local toy that express is call “E-plor”

E-plor is the local toy that to shoot like a gun it made from bamboo canteen with stick to push bullet to shoot. It composed of

![Figure 5. Compose of E-plor.](image)

1. bamboo canteen
2. bamboo stick
3. bullet made from kaffir lime fruit or jute fruit or grass leave or wet paper

**How to play**

Put the bullets in edge of bamboo canteen then push stick in the hole of bamboo canteen until bullet shoot with sound.

- Science knowledge found in E-plor

To shoot the bullet of E-plor used air pressure that show in the picture 4 [5].

![Figure 6. air pressure to shoot the bullet.](image)

The other science knowledge that found in E-plor was friction about bullet and bamboo canteen, velocity of bullet and projectile motion

2.2. *How to use E-plor in the STEM education*

The science knowledge that analyze from E-plor can develop the activities in STEM education as follows

Air pressure student can explore size and lengths of bamboo canteen relate air pressure (Engineer). Calculate size relate length of bamboo canteen to impact air pressure (Mathematic). Use several material to make canteen by ask from E-plor maker or search data from documents (Technology).
Friction student can try to make bullet from several materials to shoot (Engineer) by calculate distance of bullet fall (Mathematic) and shape of bullet to shoot (Technology).

Velocity student can design size and lengths of bamboo canteen relate velocity (Engineer) and calculate velocity of bullet that shoot from bamboo canteen (Mathematic). Adjust bamboo canteen to improve velocity of bullet (Technology).

Projectile motion student can design activity to test E-plor how far of projectile motion to shoot bullet (Engineer), calculate distance of bullet that shoot fall (Mathematic) And design E-plor how to shoot bullet far (Technology).

3. Conclusion
Local toys are the example of local wisdom that can create several activities for STEM education. Teacher can apply local wisdom to teach in class suitability but should survey and analyze local wisdom obviously before to use.

References
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