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Exploration Physics Concepts In Local Wisdom Mappere Bone South Sulawesi as A Source of Physics Learning: An Analytical Study

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Teaching Materials; Physics
Concepts**ABSTRACT**

The development of physics continues to grow. This is because physics is one of the sciences that study the behaviour of nature with various forms of applicable symptoms. This study aims to explore the concept of physics in Mappere as a source of learning physics, provide information related to one of the local wisdom in Bone, and attempt to preserve Mappere through writing and learning resources analytical study approach. Data collection is used in literature studies, observations, and interviews. Data search is done by finding as many sources of information as possible through scientific studies, journal articles, or reliable sources. The results obtained from this study are that there is a physics concept in the Mappere which can be used as a contextual learning resource for students. In addition, it turns out that local wisdom can be used as a contextual learning resource with their respective characteristics. Thus, it can be concluded that local wisdom can be an alternative in learning in schools in order to provide concrete examples for students to better understand learning, especially in learning physics. It is hoped that research on local wisdom will continue to be developed so that it can provide a real example in education while at the same time preserving the ancestral culture that is more useful.

INTRODUCTION

The development of physics from the past until now continues to grow. This is because physics is one of the sciences that studies the behaviour of nature with various forms of applicable symptoms [1] [2] [3]. In addition, physics is also considered as an abstract science in the sense that it is difficult to understand without a real example [4] [5]. Therefore, there is a need for a concrete and contextual example in learning physics so that students can understand and interpret the learning they are doing. In the current era of very rapid technological development and coupled with the impact of the Covid-19 pandemic, there are so many learning innovations that can be carried out by teachers and students in an effort to support applicable learning. However, not all teachers and students have access to the same technology, so it is necessary to adjust to the conditions and facilities that exist in each school

[6] [7] [8]. The hope is that physics can be a fun science and not scary for all groups, especially students.

Indonesia itself is famous for the diversity of the nation's culture that is unique or has the characteristics of each region [9] [10]. It turns out that this can be used as a learning resource for students and schools that have limited access to technology, namely based on local wisdom. Education can achieve meaningful learning by strengthening the principles of thinking and having a global perspective based on local wisdom [11] [12]. This is supported by Law Number 23 of 2014 concerning Regional Government and Regulation of the Minister of Education and Culture (Permendikbud) Number 79 of 2014 concerning Local Content of the 2013 Curriculum which states that mulok education is the authority of every provincial government. Mulok is a study material or lesson in an educational unit that contains content and a unique local learning process. Thus, local wisdom has great potential to be used as a source of learning for students and schools.

In addition, there have been several studies related to the effects of local wisdom on physics learning. In this case, it is necessary to know that along with the development of the times, teaching physics does not only talk about concepts, formulas, applications, and calculations. However, it has developed more broadly which includes attitude, creativity, critical thinking, and many more. Among them, local wisdom as a teaching process [13], local wisdom as learning material [14] [15] [16], local wisdom as a medium for learning physics [17] [18] [19]. That way, it can be seen that local wisdom has the potential to be used as a reference and reference in learning with the appropriate context.

One of the local wisdoms that exist in Indonesia is Mappere which comes from the Bugis culture of Bone Regency, South Sulawesi Province. *Mappere* has the meaning of playing on a swing which is one of the Bugis culture in the form of a folk party which is held as a form of community gratitude for the success of their harvest [20]. *Mappere* or swing that is played is different from the swing that we often find in life. Mappere that is played has a height of approximately 25 metres and the swing rope used is made of dried buffalo skin with a length of approximately 100-120 metres [21] [22]. In addition, Mappere is made of kapok tree tied with several bamboo trees as a support.

Based on the description of the information above, the authors are interested in conducting further analytical studies related to local wisdom called Mappere. The concept of local wisdom that has existed so far is only a tradition in an area even though it has the potential to be used as a source of learning. The specific objectives of this study are to explore the concept of physics in Mappere as a source of learning physics, to provide information related to one of the local wisdoms in Bone, South Sulawesi, and to try to preserve Mappere through writing and learning resources.

METHOD

The type of research used is descriptive qualitative with an analytical approach to the study. Qualitative descriptive is a technique that draws and interprets the meaning of the data obtained [23] [24]. Data collection used in the form of literature study, observation, and interviews. Literature studies are carried out by finding as many sources of information as possible through scientific studies, journal articles, or reliable sources. Observations were made by observing videos obtained through the relevant Youtube account. Meanwhile, the interviews were conducted online through the WhatsApp application and the like by asking the questions needed to analyze the research topic being carried out.

After that, the data obtained will be reduced, summarized, and analyzed as needed. Furthermore, the data obtained will be assembled into a new discovery that can be useful and become a source of learning for schools, teachers, and students in learning physics based on Mappere's.

The following Figure 1 shows the steps in the research.



Fig 1. Research step

RESULTS AND DISCUSSIONS

The Diversity of Indonesian Local Wisdom

Indonesia is a large country that has so many cultures, ethnicities, and languages in it. Among them are Peucicap cultures from Aceh, Padusan from Central Java, Gawai Dayak from West Kalimantan, Mapasilaga Tedong from Sulawesi, Ngaben from Bali, and many more. With the diversity of cultures in Indonesia, it turns out that it has various potentials in each appropriate field. This can be seen through the results of research conducted by Sholahuddin & Admoko [25] which discusses including:

1. Aceh: Udep tsare mate syahid (live happily, death is accepted by Allah swt), Hukom ngon adat lagge zat ngon sifeut (between law and custom such as substances with their nature) .
2. Malay (Deli, West Kalimantan, Sibolga, West Sumatra): Another depth of fish, where the earth stepped on there the sky is upheld.
3. Batak: Hasangapon, hagabeon, hamoraon, sarimatua (authority, wealth, spread of descent, perfection of life). Nilakka tu jolo sarihon tu pudi (step forward, consider backwards).
4. West Sumatra: Bulek ai dek pambuluah, bulek kato jo mupakkek (round water because of vessels, round words with consensus); Adat ba code syara', syara' ba code scripture of Allah (customs based on law, law based on scriptures)
5. Wamena: Weak Hano Lapukogo (hard to be happy together); Ninetaiken O'Pakeat (one heart one taste).
6. Bugis: Sipakatau (reminding each other); Sipakalebbi (mutual respect); Mali Siparappe, Rebba Sipatokkong (reminding each other, respecting each other, advancing each other).
7. Manado: Baku Beking Pandei (mutually complement each other).
8. Minahasa: Torang Samua Basudara (we are all brothers); Mapalus (mutual cooperation); Tulude-Maengket (devotional work for harmony), Baku-baku bae, bakubaku alas, baku-tongka, bakubaku kase inga (kind to each other, love to love, guide, and remember to remind); Sitou Timou, Tumou Tou (support each other and bring life to life: living humans and for other humans)
9. Bolaang Mangondow: Momosat (mutual cooperation); Tabian's motto, tampiaan's motto, tanoban's motto (love one another, fix one another and miss one another).
10. Kaili: Kitorang brothers (brotherhood); Toraranga (reminding each other), Rasa Risi Roso Nosimpotobe (one heart, one mind, one support, one heart).
11. Poso: (Pamona, Lore, Mori, Bungku and Tojo/Una-Una, Ampana and immigrants: Bugis, Makassar, Toraja, Gorontalo, Minahasa, Transmigration: Java, Bali, Nusa Tenggara): Sintuwu Maroso (strong union: although many challenges, problems, no one can separate the unity of the people of Poso regardless of ethnicity, religion, race and intergroup)
12. Southeast Sulawesi: Kolosara (Samaturu supremacy (Tolala): Unity, mutual cooperation, mutual respect; Depo adha adhati (Muna) : mutual respect.
13. Bali: Manyama braya (all brothers), Tat Twam Asi (same fate), Tri Hita Karana (three causes of happiness), namely Pariangan (harmony with God), Pawongan (harmony with fellow humans), and Palemahan (harmony with the natural environment)
14. Jambi: Protects like betel leaves, hoods like pumpkin leaves, Knits knit like petai leaves (help each other/appreciate each other)
15. East Java: Siro yo insun, insun yo siro (equality or egalitarianism), Antarantaraan ugo (brotherhood).
16. Pandeglang: Saman which functions as an art, tarekat; paths of remembrance and peace of mind, as well as symbols that have magical powers.4 Through Saman activities, the Pandeglang

community can create harmony, harmony that is mutual cooperation in building social and religious togetherness among its citizens, especially for members of the Saman group, which leads to life with

17. South Kalimantan: Kayuh baimbai (collaborating), Gawi sabumi (mutual cooperation), Sirih Basusun (wholeness), Menyisir sisi tapih (introspection).
18. Dayak Kanayatri: Adil ka'talimo, bacuramin ka'saruga, ba sting ka'jubata (fair fellow, heavenly mirror, dependent on the One); Rumah Betang (together and tolerance); Handep-habaring hurung (values of togetherness and mutual cooperation); Betang (long house spirit)
19. Dayak Bekati: Janji baba's ando (promise must be kept); Janji pua' take japu japu (don't promise just words).
20. Dayak Bahau: Murip ngenai (prosperous prosperity); Te'ang liray (excellent among others: healthy competition)
21. West Nusa Tenggara Province: Saling Jot (giving each other), Saling pelarangin (mutual mourning), Saling ayon (visiting each other; gathering), Saling ajinin (mutual respect), Patut (good, commendable, things that are not excessive), Patuh (harmonious, obedient, peaceful, tolerance, mutual respect), Patju (diligent, never give up hope), Tatas, Tuhu, Trasna (knowledgeable, moral/ethical, society).
22. Sasak (Lombok): Together with anyong fingers (together melted in one), Embe aning the needle ito aning the thread (where the needle goes to the thread), Endang kelebet laloq leq impi (don't be too fascinated by dreams), Endaq ngegaweh rampant cupak (don't wear or act like a cupak), Endaq ta beleqan ponjol dait kekekuk (don't make the rice bowl bigger than the rice bowl), Endaq ta ketungkulan with nyuling sisok (don't fall for the singing snail), Idepta nyam meri, beleqna embuq teloq (such as trying to raise ducklings when they grow up to pick up their eggs), Keduk lindung, bani raok (dare to find eels, you must dare to hit the mud), Laton Kayuq must be blown by the wind (every tree is hit by the wind)
23. Mbojo (Bima): Bina Kamaru mada ro kamidi ade, linggapu sedumpu nepipu ru boda (don't put your eyes to sleep and stay still, use a wooden pillow and cactus thorn mattress), Arujiki jimba wati loa rak ba mbe-e (sheep's fortune cannot be obtained by goats), Ngaha rawi pahu (say, work should produce reality)
24. DIY/Yogyakarta: Alon-alon asal kelakon (let's go slowly as long as safe: be careful), Sambatan (help each other)
25. Solo Central Java: Ngonono yo ngonono neng ojo ngonono (that's how it is but don't be like that) , Mangan ora mangan yen ngumpul(eating not eating together)
26. Lampung: Sakai samboyan (togetherness and help), Alemui nyimah (respect for guests), Bejuluk Beadok (giving good titles/nicknames to people).
27. Bengkulu and Rejang Lebong: Adat bersendai sorak, sorak bersendai kitabullo, Tip-tip ade mendeak tenaok ngen tenawea lem Adat ngen Riyan Cao (every guest is greeted with customs and procedures), Where the tembilang is chopped there the ground is dug up (Bengkulu), Naek ipe bumai nelat, diba lenget jenunjung (Rejang lebong, similar to Malay), Titik mbeak maghep anak, tuwai ati tau si bapak (small should not be considered a child, old is not necessarily the father), Kamo bamo (family and prioritize the interests of the people), Amen ade dik rujuak, mbeak temnai benea ngen saleak, kemin gacang sergayau, panes semlang sisengok, sileak semlang si betapun (if there is a disaster, don't look for a scapegoat, cool a hot heart, so that the wound is cupped and does not bleed). The Tabot tradition, is one of the traditional ceremonies in Bengkulu City "the Tabot ceremony", which is a traditional celebration held from the 1st to the 10th of Muharram every year to commemorate the death of Hasan and Husein, the grandson of the Prophet Muhammad SAW by the Yazid family from the Shia, in war at Karbala in 61 Hijri 5 . At Tabot celebrations such as the Sekaten celebration in Yogyakarta, various exhibitions and competitions for fish, telong-telong and other arts were held which were participated by art groups in Province so that they became an event for people's entertainment and became one of the annual tourist calendars. Tabot as a local genius acts as a counterbalance to the incessant influence of external pressure. Local genius here can be interpreted as intelligence of local people to manipulate the influence of outside culture and existing culture into a new form that is more beautiful, better and compatible with local tastes and at the same time the area itself.
28. Sampang (Madura): Abantal ombak asapo' angin (cushions, blankets with wind), Lakona-lakone,

kennengga kennengge (do well what is your job and occupy well what has been assigned as your place), Todus (shame), Ango'an poteo tolang, e cutting potea mata (betty white bones than white eyes)

29. Ambon (Maluku): Pela Gandong (beloved brother, Strengthening brotherhood through mutual cooperation in life), Gendong beta-gendongmu jua (my pain is yours too).

And there are many more local wisdoms that exist in Indonesia. Some of the things presented above are part of local wisdom in Indonesia.

Ethnoscience

Ethnoscience is a branch of science that examines the relationship between culture and science. Ethnoscience is the study of scientific knowledge derived from local wisdom or hereditary culture [26] [27]. Ethnoscience is a belief in an area which can be studied and proven scientifically [28] [29]. In this case, of course, every ethnoscience has the same limitations as other sciences. This is evidenced by research from [26] [27] which states that ethnoscience has a scope in the fields of science, flora and fauna, ecology, medicine, and agriculture.

In addition, current ethnoscience knowledge cannot be separated from everyday life, especially in the world of education. This is in line with the results of research from Nuralita [28], Novitasari et al [29], and Puspasari et al [30], which states that ethnoscience plays an important role in learning and science. The existence of ethnoscience turns out to have a good impact on the education sector from the elementary school to high school levels. That way, ethnoscience becomes a very good science to learn because it provides real examples for the learning that is carried out.

Ethnoscience in physics learning is an innovation that relates scientific knowledge to socio-cultural conditions [31] [32] [33]. Indonesia, which is known for its various cultures in each region, can be an opportunity in developing learning innovation strategies that are closely related to students. In an effort to realize this strategy, a local culture is needed that can explain the concept of physics in everyday life. Local wisdom can be an alternative that can be used as teaching material to improve student achievement [34].

Ethnoscience study of the Mappere

Based on the results of the study which was strengthened by the results of interviews, it was stated that Mappere is one of the cultures that exist in Bone Regency, South Sulawesi. Mappere comes from the Bugis language which means swing. However, the swing referred to here is not like the usual swing. This is because Mappere has a height of approximately 15-20 metres. In addition, Mappere is not played or carried out regularly, but in a certain time series. The following Figure 2 shows a visualization of *Mappere*.



Fig 2. *Mappere culture*

Mappere is carried out as a form of gratitude for the community because the harvest produced is abundant. On the other hand, mappere has several conditions to play including; (1) the participant must be a woman, (2) there is a man in charge of swinging, (3) must wear a *bodo'* (traditional dress of the Bugis tribe). Meanwhile, during the event, a number of housewives will prepare meals for residents who come from outside the village. Please note, this *Mappere* has always been accompanied by *massempe'* cultural traditions. However, in this case, we only need to discuss *Mappere* culture.

The concepts of physics in the Mappere

This study will describe the concepts of physics contained in *Mappere's* local wisdom. The following are some of the concepts obtained through the analysis of the studies that have been carried out:

Equilibrium

In making local wisdom *Mappere* certainly cannot be made arbitrarily. This requires special techniques that have been trained in its manufacture. One of the techniques needed is to pay attention to whether each component or material must be the same so that the *Mappere* that will be produced is also in balance. Figure 3 shows an illustration of *Mappere* for more details.

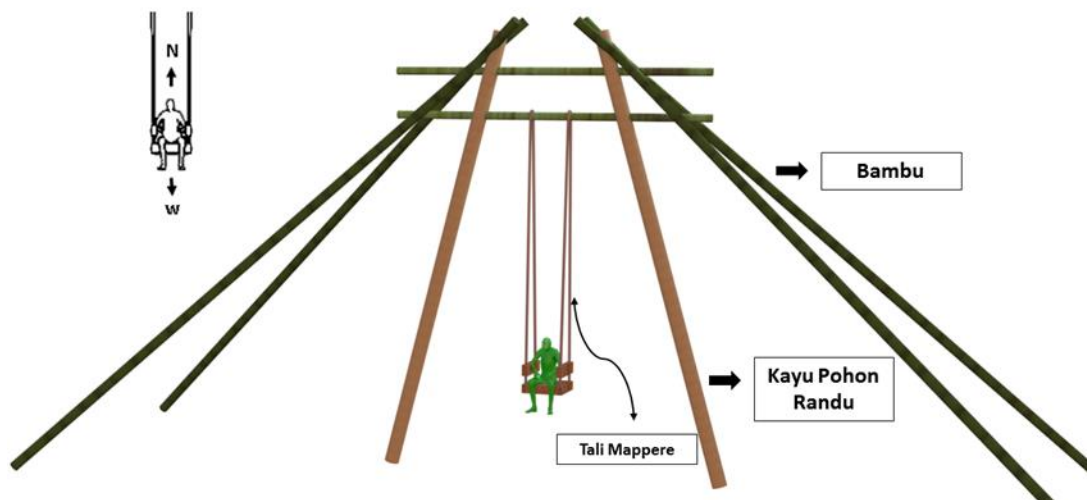


Fig 3. Illustration of *Mappere*

Figure 3 shows an illustration of *Mappere's* local wisdom. From the illustration above, we can get information that in making *Mappere* there are the main ingredients used such as kapok tree wood (2 sticks), bamboo (4 sticks with an addition as a connector at the top), and swing rope (to taste). Based on the results of interviews, there are several areas in Bone that use dried cowhide as a swing rope and some use ropes such as tug of war ropes. According to the concept of equilibrium [35] [36] [37], an object is said to be in equilibrium when the following two equations apply:

$$\sum F = 0 \tag{1}$$

$$\sum \tau = 0 \tag{2}$$

Based on the equation above, it is known that *Mappere* uses the concept of equilibrium $\sum F = 0$ because all the weight of the material used must be centred on the centre of gravity of the person who will ascend to *Mappere*. In addition, rope, kapok tree wood, and bamboo must have relatively the same length, especially on the *Mappere* rope used. When the *Mappere* rope is not the same length, there will be a risk for the person who is riding, for example, the rope will break, the swing will switch left and right, the height will not be stable. Therefore, it is necessary to use the concept of balance in the *Mappere* tradition.

The Period and frequency vibration

The motion that occurs in *Mappere* is a simple harmonic motion on a pendulum or swing which has a point of balance, load, trajectory, and the length of the rope used.

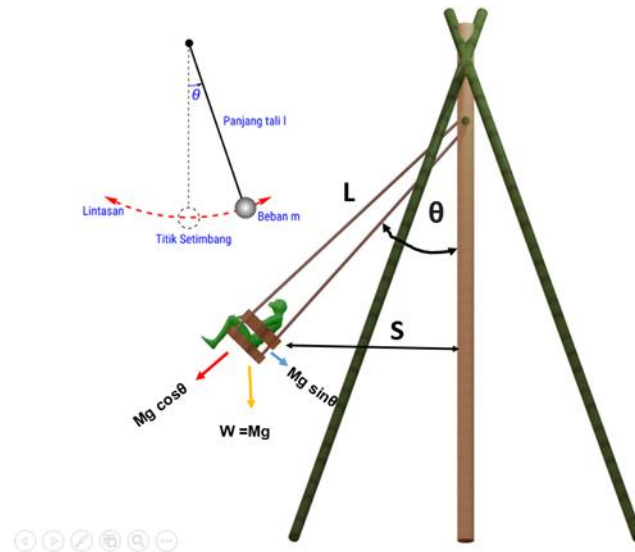


Fig 4. The concept of period and frequency on *Mappere*

Based on Figure 4, it can be seen that in the *Mappere* tradition it has the same concept as the period and frequency of simple vibrations which are closely related to Newton.

$$F = m \cdot a \tag{3}$$

$$-m \cdot g \cdot \sin \theta = m \cdot a \tag{4}$$

For small angles applies, $\sin = \frac{S}{L}$ assuming that $S = Y$ so that equation (4) can be written

$$-m \cdot g \cdot \frac{Y}{L} = m \cdot a \tag{5}$$

$$a = -\frac{g}{L} \cdot Y \tag{6}$$

Keep in mind the equation for harmonic vibration is:

$$Y = A \sin \omega t \tag{7}$$

$$v = \frac{dy}{dt} = A\omega \cos \omega t \tag{8}$$

$$a = \frac{dv}{dt} = -A\omega^2 \sin \omega t \tag{9}$$

$$a = -\omega^2 A \sin \omega t \tag{10}$$

$$a = -\omega^2 Y \tag{11}$$

After that, if equation (11) is substituted into equation (6), then we get:

$$-\omega^2 Y = \frac{g}{L} Y \tag{12}$$

$-\omega^2 Y$ to remember $\omega = \pi f = \frac{2\pi}{T}$, so that

$$\frac{4\pi^2}{T^2} = \frac{g}{L} \tag{13}$$

$$T^2 = 4\pi^2 \frac{g}{L} \tag{14}$$

$$T = \sqrt{4\pi^2 \frac{g}{L}} \tag{15}$$

$$T = 2\pi \sqrt{\frac{g}{L}} \tag{16}$$

$$f = \frac{1}{\pi} \sqrt{\frac{L}{g}} \tag{17}$$

need to remember that $f = 1/T$ or $T = 1/f$. With the information $T =$ period of vibration (s), $f =$ frequency of vibration (Hz), $L =$ length of rope (m), and $g =$ acceleration of gravity (10 m/s^2).

The Law of conservation of energy

In the *Mappere* tradition there is also a law of conservation of energy. This can be seen through the results that once the push is given, it can make repeated movements. After an in-depth analysis, it turns out that the mechanical energy contained in *Mappere* is always constant. The following Figure 5 presents an illustration of *Mappere's* movement.

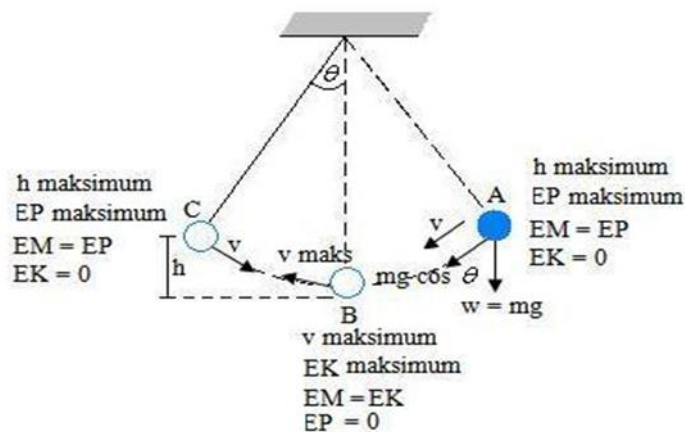


Fig 5. Illustration of the concept of conservation of energy

Based on Figure 5, it is found that the sum of kinetic energy and potential energy is always constant. If the kinetic energy increases, then the potential energy will decrease, and vice versa. When *Mappere* is at the farthest deviation, namely at positions A and C, then the potential energy that applies is maximum, while the kinetic energy is zero. On the other hand, when *Mappere's* position is at the lowest position, namely at point B, then the potential energy is zero while the mechanical energy is maximum. This is in accordance with the findings of James Prescott Joule (1816-1869) who said that energy cannot be created and destroyed, but can only change from one form to another [38]. Mathematically it can be written as follows:

$$E_{m1} = E_{m2} \tag{18}$$

$$E_{k_1} + E_{p_1} = E_{k_2} + E_{p_2} \quad (19)$$

$$\frac{1}{2}m_1v_1^2 + m_1gh_1 = \frac{1}{2}m_2v_2^2 + m_2gh_2 \quad (20)$$

The concept of physics in Mappere's Local wisdom, turns out to have a close relationship with the concept that exists in the usual swing, only it is distinguished by the tradition that applies in it. Then the difference in size is very visible and the materials used.

CONCLUSION AND SUGGESTION

Based on studies and analyzes that have been carried out on the local wisdom of Mappere Bone, South Sulawesi, it can be concluded that this Mappere tradition is a tradition of the Bugis tribe in Bone. In addition, the implementation is carried out once a year as a sign of gratitude for a successful harvest. In addition, there are several physical concepts that exist in the Mappere Tradition, including the concept of balance, frequency and period of vibration, and the law of conservation of energy. On the other hand, Newton's law concepts can be used on the concepts that have been discussed. That way, Mappere's local wisdom can be an alternative teaching material that can be used by teachers in learning physics to provide concrete examples and is closely related to students, especially in Bone Regency/City, South Sulawesi.

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