Phyphox application with PIMCA learning model

L B Mayampoh*, D A Tulandi, J Rende, C Poluakan and A Komansilan
Department of Physics, Manado State University, Tondano, Indonesia

*17505033@unima.ac.id

Abstract. Research has been done related to the experiment of Doppler effects using the phyphox application with the PIMCA learning model. Online laboratories will be the solution in the era of the Covid-19 pandemic, which still requires students to learn from home. PIMCA learning model, introduced by Cosmas Poluakan, is together by experimental steps with the Phyphox application. The purpose of this research is to describe the ability of students to understand the concept of the Doppler effects through Doppler effects experiments. The research method begins with preliminary tests and followed by conduct the experiments with Phyphox after the PIMCA model step. The research was conducted in the physics department of Manado State University on odd semester students. The results showed that the average percentage of pre-test results was 28.125%, while the average percentage after the test was 78.125%. These results show that by doing the Phyphox experiment with PIMCA learning, students can improve their mastery the concept of Doppler effects. The observations also showed that experiments with the Phyphox application with PIMCA model learning steps could be carried out individually. The implications of this study makes it possible to carry out individual experiments at anytime and anywhere.

1. Introduction
The research was conducted in conjunction with Doppler effect experiments with the Phyphox app and the Pimca learning model. The Doppler effect is a very important physical phenomenon, so many different Android applications develop virtual sprouts on Doppler effect experiments, for example with Phyphox applications in execution [1]. This is reflected in the effectiveness and efficiency of work in the industrial world [2]. In the world of physics, the scientific accuracy of data and the display of data is one of the real benefits of digital technological progress [3]. The Phyphox application used here is able to process a large number of common sensors on smartphones and to read the corresponding measurement data graphically [4]. Phyphox was developed at the 2nd Physics Institute of the RWTH Aachen University. It is available for free and without advertising for the operating systems of App StoreTM and Google Play Integrated StoreTM [1].

PIMCA Learning Model is a learning from MOMBI model developed, but emphasized in mr-sr based teaching and learning process. If the MOMBI model is derived from the theory developed by ulrike hanke, namely mental model theory, then a new learning model based on MR-SR from the concept of ZPD Vygotsky was developed. The MOMBI model is based on circumstances that when individuals are confronted with new learning materials or tugas, individuals construct mental models that combine with the willingness of existing knowledge, where mental models are not immediately stored and eventually reconstructed in a scheme that is studied. In this case, learning consists of different sub-processes through 5 teaching interventions of the model model of model-based instruction (MOMBI),
namely: (1) provocation, (2) prejudice activation, (3) presentation, (4) scaffolding, (5) practice. The new learning model, based on MOMBI and mr.SR, is called a 4-step PIMCA (Presentation, Idea Mapping, Conceptualization, Assessment formative) learning model: (1) presentation, which represents the step in which learners get initial information by representing a form of representation. (2) Ideamapping is the phase of learners who construct concepts and building concepts on the basis of information from different forms of presentation. (3) conceptualization, this is the stage in which the learners dance information and, accompanied by pedagogical instruction from teachers/teachers, Serves Ying as a speaker and/or moderator and/or tutor, so that scaffolding functions can take place. (4) a formative assessment, i.e. phases to ensure that the concept of learning know-how is correct. The Pimca learning model was first introduced by Cosmas Polukan in 2020 [5].

A monistic view of judgment and instruction becomes possible if we follow Vygotsky's argument that cognitive abilities arise from interactions in the world and this is always conveyed. In Vygotsky's view, the ability to mature not only by itself, but is the result of an individual, a history of activity with others and with culture [6]. Piotr Galperin (1982) extended this framework in view of its pedagogical implications [7].

2. Methods
The study was conducted in Monday, 5 October 2020. Data is collected via Manado state university faculty of mathematic and science Physics Education odd semester students. The methods used in this study use experimental methods. The first step in this study is to create a practical guide that will be used in the Practicum Guide. Then, after creating practical guidelines, provide tools and materials that are used in practice. This practice is followed by the use of PIMCA Learning. Before doing practice begins with a pretest and then internship is done, the PIMCA steps and in akhri with posttest follows. When performing practical activities, the stage is to prepare tools and materials that are used in practitioners, such as: game cars that emit siren sounds, tripods, phyphox applications installed on Android phones. Here is the game car, which emits the sound of sirens, serves to make a sound, tripod serves to place the phone, Phyphox application on Android phone targets installed or serves to frequency and also the speed emitted by the siren sound of the game car as well as the listener. The siren sounds emitted by this game car are recorded directly on the Android phone. By using the Phyphox application, the frequency and speed of the siren bun of the toy car is recorded by the Phyphox application in the form of a chart, after it has been recorded, then the data is exported in the form of Excell. After being exported in excel from, then the excel application will be made a graph so that you can see the graph formed from the data that has been takes. The use of Phyphox app on Android among others: put the Android smartphone on a tripod finally is w Preparing for ell located, then prepare the game ambulance at one point, then the game ambulance turned /ring. Once all tools and materials have been prepared, open the phyphox aplikasi already installed on the smartphone open setup on the phyphox application to adjust the base frequency to 1000.0 Hz, frequency range of 10.0 Hz, time step 50.0 ms, and speed of sound (sound speed) 340.0 m/s

3. Results
From the histogram data below, in can be seen clearly that there is an increase in students before and after doing the written test. Histogram data can be seen in the image below!
Discussions

To maintain the frequency and speed of the sound source, which goes through the handset with the Phyphox app on the smartphone and is processed with softwar excel [3]. The results of the designation, if the sound source is mute with the Phyphox application on the smartphone, can be seen in the graphic above. From the diagram above the orens colored angular line shows the frequency of the sound source when the sound source is quiet and the listener is quiet, and the gray line shows the speed of the sound source when the sound source is not moving/quiet. Because the sound source is not moving or mute, the velocity occurring is constant or unchanged. The result of the appointment of the frequency and speed of the sound source at the time of the Buni source approaches the listener and knows the listener. The diagram above shows the results of the frequency and speed at which the sound source approaches the listener and away from the chart listener changes differently than with a constant sound source.

In Figure 1, the pre-test and post-test histograms of the histogram clearly show that there is an increase in post tests. The measurement results show how the concept of physics is applied to the

4. Discussions

To maintain the frequency and speed of the sound source, which goes through the handset with the Phyphox app on the smartphone and is processed with softwar excel [3]. The results of the designation, if the sound source is mute with the Phyphox application on the smartphone, can be seen in the graphic above. From the diagram above the orens colored angular line shows the frequency of the sound source when the sound source is quiet and the listener is quiet, and the gray line shows the speed of the sound source when the sound source is not moving/quiet. Because the sound source is not moving or mute, the velocity occurring is constant or unchanged. The result of the appointment of the frequency and speed of the sound source at the time of the Buni source approaches the listener and knows the listener. The diagram above shows the results of the frequency and speed at which the sound source approaches the listener and away from the chart listener changes differently than with a constant sound source.

In Figure 1, the pre-test and post-test histograms of the histogram clearly show that there is an increase in post tests. The measurement results show how the concept of physics is applied to the
Doppler effect material. Students also improve understanding of how to use Phyphox apps on smartphones. Internship Android-based Doppler effect material shows the convincing advantages and understanding of students about the internship of Phyphox applications. Smartphones are popular with many people today, without giving any restrictions on social status. Even in college, smartphones are very useful for students as a learning tool. This is due to the many services or applications that are used to perform experiments/practices easily and easily [8]. Practical sizes and devices with different sensors turn smartphones into "mobile mini-laboratories", which is physically very interesting for practice [9]. With the 2nd Institute of Physics RWTH Aachen Phyphox Application (physical telephone experiment), which was developed by the university, many of these sensors are readable and the measurement data are graphically displayed for use. The sound source is ejected from the game ambulance and brought closer to the smartphone-installed Phyphox app [1]. The Phyphox app can detect the frequency and speed at which an Ang sound is emitted from the siren sound of an ambulance. Creative demonstrations with virtual labs and Phyphox applications on Doppler effect materials are helpful for students to conduct practical/remote experiments or independently [10]. The Doppler effect is used to determine changes when the sound source is muted and when the source approaches the listener and is gone.

5. Conclusion
Students who practice physics with the Phyphox application are more independent than those who practice directly in laboratorium nam [6]. Experimenting/practicing by following the steps of the PIMCA learning model can effectively and efficiently improve the understanding of the concept of student internship. The phyphox application can also be used for various learning models and is practically used as a laboratory. Practicum using the phyphox application can make students independent in conducting an experiment.

Acknowledgement
Thanks to DRPM (Directorate of Research and Community Service) of Indonesia governmant who has given funds through Prof. Dr. Cosmas Poluakan M, Si chairman of a research project 2019-2020; thanks to the committee IWMANSELEN 2020 which facilitated author as a presenter. Thank you also to the Rector of Manado State University and Dean of the Faculty of Mathematics and Natural Sciences. Thank you to the promotor of my research teammates who have helped a lot during the research.

References
[1] Benjamin G, Heidrum H, Josef R, C, S, & S K 2017 Smartphone Expemente zu harmonischen pendelschwingungen mit der App phyphox. Didaktik der Physik, 1-7.
[2] Kumar A, Anderson N, Phillips WD, Eckel S, Campbell GK and Stringari S 2016 Minimall destructive Doppler measurement of a quantized flowing-shaped Bose-Einstein condenasate New Journal of Physics 18 pp 1-8
[3] Eiji S, Tatsuo K, Tomohiro M, Yusuke T & Yasumasa H 2010 Doppler effect in fragment autoionization following core-to-Rydberg excitations of N2 New Journal of Physics 12 pp 1-10
[4] Adam M, Widiastuti M L, Rizki Z, Sani S & Tia J 2020 Simple Experiment of Doppler Effect Using Smartphone Microfon Sensor Jurnal Penelitian Fisika dan Aplikasi 10(01) pp 1-10
[5] Poluakan C 2020 Model asesment formatif berbasis Semiotic Resources dalam pembelajaran fisika (Manado)
[6] Alex K, Boris G, Vladimir A S & Suzanne M M 2003 Vygossky's Educational Theory in Cultural Context Sociocultural Theory and teh Practie of Teaching Historical Concepts pp 1-22
[7] Matthew P E 2018 The Origins of Dynamic Assessment: Sociocultural Theory and the Zone of Proximal Development Dynamic Assessment pp 23-41
[8] Jose A, G T., Juan C C P, & Juan A M 2014 The acoustic Doppler effect applied to the study of linear motions Eur J Phys 35 pp 1-9
[9] Jose G T A, Juan C P & Juan M A 2014 Acoustic Doppler Effect applied to the study of linear motions *Eur. J. Phys.* **35** pp 1-11

[10] Rosenqvist L, K, Wisner, A, de. Brito Naves, M, B., R, F., I, H., . . . S, S. L. 2001 Femtosecond dissociation of ozon studied b the Auger Doppler effect *Journal Of Chemical Physics* **115** pp 1-7