

# The Development of Sound Wave Audacity Base Learning Media Using Ethnoscience Approach of Amanuban Tribe to Improve Physics Teacher Candidates' Science Process Skill

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**Abstract:** *This study is aimed to develop teaching learning media of sound wave using valid, effective, and practical ethnoscience approach of Amanuban tribe. Research method used is ADDIE (Analysis, Design, Develop, Implementation, Evaluation) approach of R & D Method. The implementation of teaching learning media is done in limited scale try out to 27 students of Physics Educational Program of STKIP SoE. Research design applied is one group pretest-posttest design. The developed teaching learning media are students' worksheet based on ethnoscience approach of Amanuban tribe audacity and test of science process skill. The instruments used to collect the data are validation sheets, test of science process skill, and response questionnaire. The result of teaching learning media validation accomplish valid criterion in the aspects of organization, content, and language competence formula. The instrument of science process skill test is valid in content validity, performance validity, and construct validity aspects. The students positive response reaches 90% so it is concluded that the teaching learning media is practical in use. The result of paired t test gets  $t = 19,082$ ;  $p < 0,05$  which means there is significant difference in students science process skill before and after the implementation of the media. The score of n-gain gets 0,7 in high criterion. Therefore, teaching learning media of sound wave based on ethnoscience approach audacity is effective.*

**Keywords:** teaching learning media, wave, audacity, process skill

## 1. Introduction

Culture is the most important part in physics learning. It is because culture primarily gives meaningful relationship among students background knowledge with principles and laws in physics [1]. The effort to create learning environment integrated with culture as a part of science learning is called ethnoscience approach. Several studies show that ethnoscience approach in learning makes concepts in physics more simple, understandable, improves problem solving ability [2], improve science process skill and learning goals [3],[4].

Physics learning using ethnoscience approach fosters the increase of students appreciation toward culture. the increase marked by learning excitement which results in the improvement of learning quality. For example, the use of "wayang saintis" as physics learning media creates exciting, interesting, and impressive learning situation for students so it improves their knowledge [5].

Physics practicum based on culture improves students connection ability toward learning material, directs students to their lifestyle along with learning inside classroom, boost nationalism and patriotism spirit to produce optimistic attitude as in charge society of nation [1]. Javanese culture internalization in inquiry based laboratory activities improves students interpersonal skill and concepts mastery toward electrometrics chemical [6].

Amanuban tribe is one of tribes in Timor island with lots of traditional music instrument such as sene (cymbal) and feuk

bia (cow's recorder). These instruments are different based on how sound is produce, equalizer, and the material. Sene must be beaten to produce sound meanwhile feuk bia must be blown.. Sene is made of iron [7] and feuk bia is made of bamboo [8]. Both of them attractive to be analyzed as learning media of sound wave.

Materials of sound wave being analyzed within both instruments are tone, frequency, and standing wave on pipe organ. The materials are taught in all educational level starting from secondary school up to university. However, tone, frequency, and standing wave concepts learning on pipe organ is taught to students through mathematics approach in ideal circumstance whereas standing wave concepts in pipe organ is a basic concept used to comprehend the resonance of various musical instruments such as guitar, violin [9], and recorder [10].

Experiment on pipe organ topics are often ignored because it requires expensive equipment such as generator function, oscilloscope and resonance tube. Several studies have been conducted for pipe organ experiment using PVC pipe by utilizing free access visual analyzer software [11]. Standing wave experiment using macsopp software [9]. Doppler effect experiment using video and a perfectly accurate audacity software in frequency measurement [12].

Audacity is a program that manipulates the form of digital audio wave, either through direct recording or audio files in forms of WAV, AIFF, and MP3 [13]. The implement of audacity as learning media makes students to hardly feel bored, to understand the characteristics of sound such as

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frequency, amplitude, and timbre [14]. The use of audacity for sound analysis such as bonang barun [15], pentatonic recorder frequency [16], and Amanuban tribe's sene and feuk bia frequency analysis [7],[8]. Some of these studies recommend to utilize audacity software as physics learning media in which facilitate inquiry process.

Science process skill or so called inquiry skill is a skill used by scientists in developing science products. The process skill determine students concept mastery level toward physics materials. If the skill increases, then science concept mastery also increases [17]. Science process skill is categorized into two. The first is basic science process skill which covers observing, measuring, classifying, predicting, and communicating. The second is unified science process skill which covers variable controlling, operational definition, hypothesis formulation, interpretation, experiment and modelling implementation [18].

Learning innovation assisted by multimedia device of science process skill approach improve students' knowledge [19]. The use of this multimedia device gives reinforcement toward the improvement of science process skill and students' achievement [20]. This study is aimed to develop valid, effective, and practical sound wave learning media audacity based ethnosience approach of Amanuban tribe. The development of this media due to improving physics students' science process skill.

## 2. Research Methodology

Research methodology used was ADDIE model of Research and Development [21]. The study was conducted during wave learning. The subjects of this study were 27 students in Physics Department of Physics of STKIP SoE. Research design applied in implementation phase was one group pretest posttest design [22]. The design was chosen to analyze deeper the effectiveness of learning media in improving Physics teacher candidates' science process skill. Data collection instruments were validity sheets, science process skill test, and questionnaire.

Learning media validation instrument was developed using Likert scale under criteria: 1 = very bad; 2 = bad; 3 = quite; 4 = good; 5 = very good. Validation instrument of the test was developed using Gutman scale under criteria: 0 = invalid; 1 = valid. Students' response questionnaire toward learning media implementation was developed using Likert scale under criteria: SS = strongly agree; S = Agree; R = uncertain; TS = disagree; STS = strongly disagree. Learning media validity test and syllabus quantitative descriptive rather than validity criteria. Learning media practical analysis used quantitative descriptive rather than practical criteria. Learning media was stated practical if students' response > 70%. Learning media effectiveness analysis used paired sample t test by 95% reliability level [23]. t test was used to find out significance of science process skill difference before and after treatment by implementing sound wave learning media audacity based ethnosience approach of Amanuban tribe.

Students' science process skill improvement analysis for each indicator used gain normalization [24]. N-gain score

criteria: low (0-0,03), medium (0,3-0,7), high (07-1,0). Learning media was stated effective if there was significant science process skill before and after treatment and science process skill improvement by n-gain  $\geq 0,3$  on quite good criteria.

## 3. Result and Discussion

Early analysis result shown that the lack students' ability in relating sound concept with local heritage, the unavailability of sound wave practicum media, students had not recognize and used audacity software in sound frequency analysis. The observation result toward Amanuban tribe culture found that traditional musical instruments such as sene and feukbia could be integrated as sound wave learning media. Sound wave frequency analysis could utilize cheap and free access audacity software. Based on preliminary study then learning media design such as students' audacity base ethnosience approach worksheets and science process skill test instrument. Students worksheet development was based on scientific inquiry learning steps and science process skill development that was observing facts, formulating problems, formulating hypothesis, determining variable, designing experiment, collecting data, analyzing data, and summarizing [25], [26]. The developed worksheet consisted of resonator diameter impact experiment toward sene sound frequency of Amanuban tribe, and pipe organ feuk bia open experiment. The design result of learning based on scientific inquiry phase as shown in Figure 1a, 1b, 1c, 1d, and 1f.



Figure 1a: Concept map of worksheet student

### EKSPERIMEN 1 PENGARUH NADA DAN DIAMETER RESONATOR TERHADAP FREKUENSI BUNYI SENE

#### A. FAKTA

Perhatikan Gambar 1. Seperangkat sene (gong) suku Amanuban.



Gambar 1. Sene Amanuban

Sene adalah seperangkat alat musik tradisional suku Amanuban yang terbuat dari besi, dibunyikan dengan cara ditabuh/dipukul yang terdiri dari 3 pasang. Berdasarkan nada yang dihasilkan dari nada tertinggi ke terendah sene dibedakan menjadi 3 pasang yaitu pasangan laban, pasangan kbolo dan pasangan ote.

Secara teori bahwa nada sebanding dengan frekuensi, artinya semakin tinggi nada yang dihasilkan maka frekuensi bunyinya semakin tinggi, demikian sebaliknya.

Figure 1b: Example of presentation of experimental facts 1



Gambar 2. Ukuran diameter lubang resonansi

Amatilah Gambar 2, menurut Anda faktor apa saja yang mempengaruhi frekuensi bunyi sene?

**B. RUMUSAN MASALAH**

Berdasarkan hasil observasi Anda, tuliskan rumusan masalah yang tentang hubungan nada, diameter resonator, dengan frekuensi. Tuliskan rumusan masalah!

**C. HIPOTESIS**

Tuliskan hipotesis Anda!

Figure 1c: Example of presentation of experimental facts 2

**D. VARIABEL EKSPERIMEN**

Berdasarkan rumusan masalah tuliskan jenis variabel bebas, variabel terikat dan variabel kontrol.


Variabel bebas = .....  
 Variabel terikat = .....  
 Variabel kontrol = .....

**E. DESAIN EKSPERIMEN**

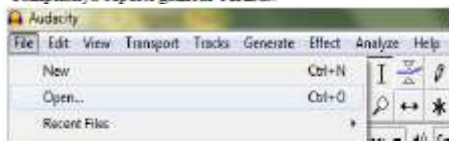
1. Alat dan bahan

- a) Rekaman audio sene
- b) Laptop/PC terinstal software audacity

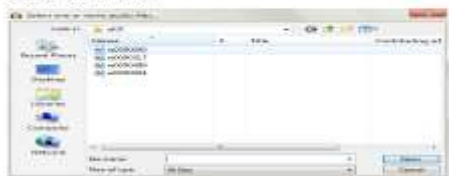
2. Prosedur Kerja

- a) Membuka software audacity pilih icon  klik kanan open atau double klik.
- b) Membuka audio melalui audacity dengan cara: klik file-pilih open.

Tampilanya seperti gambar berikut.



Muncul kotak dialog:



Pilih file kemudian klik open.

Figure 1d: Define experiment variables and designs

Tampilan pada software audacity sebagai berikut :

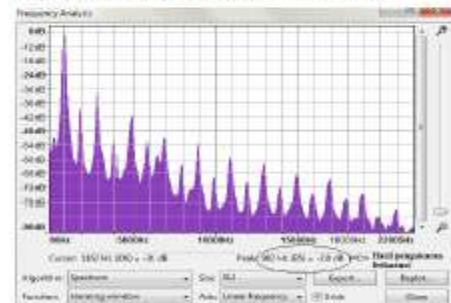


c) Tahap analisis frekuensi

Blok grafik tampilan audio kemudian klik Analyze – pilih plot spectrum seperti gambar berikut:



Maka tampilan analisis frekuensi sebagai berikut:



Arah kursor pada frekuensi dengan intensitas tertinggi untuk mengukur frekuensi bunyi sene.

- d) Interpretasi analisis frekuensi baca data yang dilingkari pada kotak dialog diatas contoh: 912 Hz ini menunjukkan frekuensi audio sene yang diukur.

Figure 1e: Hint of frequency analysis with audacity

**F. ANALISIS DATA**

- 1. Isilah pengamatan Anda pada Tabel 1.

Tabel 1. Data nada, diameter lubang resonansi dan frekuensi

Nada (terendah-tertinggi)	Diameter lubang resonansi = d (cm)	Frekuensi = f (Hz)
1		
2		
3		
4		
5		
6		

- 2. Gambarlah Grafik nada-f, d-f menggunakan bantuan ms. excel.
- 3. Tulislah interpretasi Anda terhadap grafik nada-f, d-f!

**G. KESIMPULAN**

Apakah hipotesis Anda diterima atau ditolak? Tuliskan kesimpulan Anda!

Figure 1f: Presentation of data and conclusions

Expert validation was applied toward sound wave learning media audacity based ethnoscience approach of Amanuban tribe and science process skill test. Aspects observed by experts in learning media scoring were complete and indicator approach, content, organization, and language. Scoring toward organization aspect covered material map concept, and worksheet using direction. Content aspect covered clarity material delivery and its adjusment with scientific inquiry phase, time allocation, learning phase demand ot develop science process skill. Language aspect covered correct and accurate language usage, understandable sentences, and systematic and organized delivery.



**Table 1:** Expert's validation result

No	Observed aspects	Validator			Average	Criteria
		1	2	3		
1	Competence formula	4	5	4,5	4,5	Good
2	Organization	4,5	5	4	4,3	Good
3	Content	4	4,6	4,3	4,3	Good
4	Language	4,3	4,6	4,3	4,4	Good

The average score of the three validator was 4,4 on good criteria from competence formula aspect, organization, content, and language. Therefore, sound wave learning media audacity based ethnosience approach of Amanuban tribe was stated valid and applicable. Based on validator's suggestion, then some revisions were done for the learning media cover design in Figure 2a and 2b.



**Figure 2a:** Cover before revision

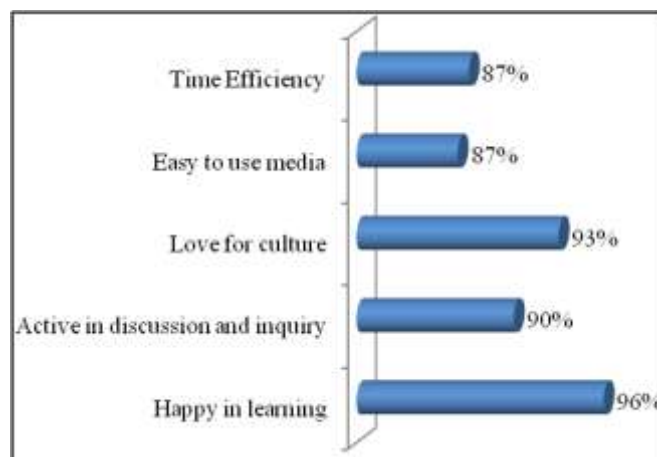


**Figure 2b:** Cover after revision

Aspects scored by experts toward science process skill test were content validity, depicted test accuracy with main competence, and determined indicator, validity performance depicted sentence structure accuracy which did not involve ambiguity, construct validity, depicted test's parts which had measured the developed science skill process.

The average validation score of science process skill test instrument from the three validator was 3 on good criteria, on content validity aspect, figuration validity, and construct validity. The implementation of learning media was done on classroom learning along three time meetings. Students

response survey toward learning media implementation was done at the end of the meeting. Students response was given on Figure 3.



**Figure 3:** Students' response graphic

Based on figure 3, students response average toward learning media implementation was 90% above 70% practical criteria. Learning media implementation fostered fun learning environment, boosted students to participate actively in discussion and investigation because they are challenged by new things. This learning media was esily understood and communicate also improved time allocation efficiency. This finding supported Massangcay (2015) and Trimaryana (2016), they were batangueno implementation of Philippine's culture [1] and traditional game rorodaan of west Java [27] increased students' interest, innovation, activness, achievement, and learning effectivity.

Students who learned using this audacity based learning media of ethnosience approach od Amanuban tribe increased students'affection toward the culture. Physics learning through ethnosience approach improved appreciation toward local culture (Atmodjo, 2015), and improved students character [28]. Physics experiment related to culture could be seen as a way to preserve Indonesian culture [29].

**Table 2:** t test and n-gain result

	Mean	SD	T	df	p	n-gain
Pretest	14,15	12,012	19,082	26	0,000	0,7
Posttest	73,63	14,283				

Based on Table 2 students' science process skill average posttest was higher than pretest's average. There was significant difference of science process skill test before and after treatment using sound wave ethnosience base learning media of Amanuban tribe ( $t = 19,082$ ;  $p < 0,05$ ). The n-gain score of science process skill improved on 0,70 on high criteria. The result of this study was similiar to Atdmodjo's studi [4] which found that sicence learning through ethnosience approach improved sciece process skill by average 60%-80% on high criteria. Ethnosience base acid and alkali learning of Demak community cold improve students study result on high category [28].

To find out the effectiveness of learning media, n-gain counting was done the improvement in each indicator of science process skill. The result was provided in Figure 4.

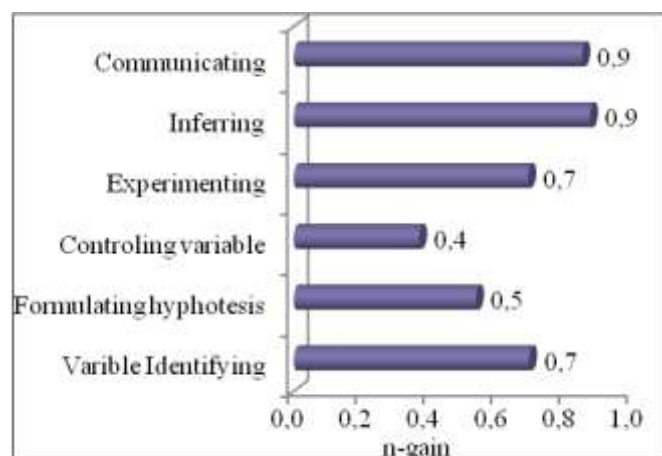


Figure 4: n-gain graphic per science process skill indicator

Figure 4 shown that science process skill on high category was identifying variables, experimenting, inferring, and communicating, meanwhile the medium category was placed by formulating hypothesis, and controlling variables. The improvement of this process skill indicator was because the utilization of audacity in sound wave experiment to analyze and determine sound frequency. During the experiment, students could also describing connection graphics between tone and frequency, diameter and frequency, the length of wave frequency of Amanuban tribe's musical instrument.

The use of audacity software as a learning media fostered the development of science process skill of physics teacher candidates on identifying variables, formulating hypothesis, controlling variables, experimenting, inferring, and communicating. This result was different from Guevara's study [19] which shown that the use of computer such as power point and computer animation through multiple representation approach increased science process skill on collecting data, experiment design, and drawing conclusion aspect. These difference was caused due to the use of integrated ethnoscience ICT boost students confidence to do experiment based on what they observed.

Therefore, based on t-test and n-gain result, it was concluded that sound wave audacity base learning media using ethnoscience approach of Amanuban tribe was effective to improve science process skill of physics teacher candidates.

#### 4. Conclusion

Base on the result of sound wave audacity base learning media using ethnoscience approach of Amanuban tribe development study, it is revealed that the learning media is valid on competence formula, content, organization, and language aspects. The test instrument is valid based on content validity, performance validity, and construct validity aspects. This learning media is practical to be used on student response who are 90% agree that learning media makes students happy to learn and do investigation, active learning, and improving their appreciation, to their culture. This learning media is effective to improve their science

process skill on identifying variables, formulating hypothesis, experimenting, inferring, and communicating indicators. The improvement reaches 0.7 on high criteria with significant difference on their science process skill before and after the treatment of the learning media.

#### 5. Acknowledgment

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