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Application of Unplugged Computer Science Based on Ethnopedagogy as a Teaching Alternative in Basic Programming Algorithms Subjects

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A B S T R A C T

This research is motivated by the lack of equal distribution of technology in regions of Indonesia, including Papua, Sulawesi and even Java, which is still not evenly distributed, so that technology education in some areas is difficult to progress and develop. Therefore, the aim of this research is to design and implement Ethnopedagogy-based Unplugged Computer Science (UCS), creating animation-based media as documentation to make it easier for teachers to understand UCS. The UCS method is a method for teaching computers without using computers and is based on ethnopedagogy, so technology learning can be done using cultural elements, both traditional tools and traditional games from a region in Indonesia. In designing Ethnopedagogy-based UCS, 4 stages are carried out, namely compiling the material, determining the ethnopedagogy tools or games that will be used, mapping the material as well as abstracting ideas for ethnopedagogy-based UCS and preparing steps for Ethnopedagogy-based UCS that will be carried out by teachers and students. The waterfall method is used as a reference for creating animated media as documentation of Ethnopedagogy-based UCS.

A R T I C L E I N F O

1. INTRODUCTION

Nowadays technology is used as a medium and tool in all fields, especially education. Indonesia is an archipelagic country with a very high level of cultural group diversity. The lack of equal distribution of technology in Indonesia has resulted in gaps in various regions. The Unplugged Computer Science (UCS) method is one way to facilitate material by not using a computer at all. Learning is the process of acquiring something new, or modifying something that already exists regarding knowledge (Blackman & Henderson, 2001; Peel *et al.*, 2021), behaviour, skills, values, or preferences. The ability to learn is already possessed by humans, animals, and some machines, there is also evidence that several types of plants can also do some learning (Learmont, 2020). From the description above, Ethnopedagogy-based UCS is a solution for teaching computer science material by not using computers at all and instead using instruments made by educators where the instruments are made according to local wisdom and using materials available in the environment.

The formulation of the problem that will be raised in this research is as follows:

(i)   How is ethnopedagogy-based UCS created as an alternative teaching in basic algorithms and programming subjects?

(ii) How is ethnopedagogy-based UCS implemented as an alternative teaching in basic algorithms and programming subjects at Tribakti Pangelangan Vocational School?

(iii) How to design and build animated multimedia as a tool for ethnopedagogy-based UCS documentation as an alternative teaching in basic algorithms and programming subjects?

(iv) How to measure the results of implementing ethnopedagogy-based UCS as an alternative teaching in basic algorithms and programming subjects at Tribakti Pangelangan Vocational School?

So that this research does not deviate from the planned objectives, and because of the limited time and space that researchers must make it easier to obtain the necessary data and information, the researchers set research boundaries as follows:

(i)   This research only demonstrates examples of applying algorithms or syntax using unplugged computer science methods based on ethnopedagogy, so it does not address learning.

(ii) Ethnopedagogy in this research is limited to only using Sundanese local wisdom.

2. STUDY LITERATURE
2.1. The Nature of Unplugged Computer Science

Interactive evolutionary algorithms are known as methods that are able to solve difficult problems with hard optimization (Bartz-Beielstein *et al.*, 2014; Ho *et al.*, 2004; Gong *et al.*, 2015). This method is used today in creative processes with application to music, design and other arts (Dahlastedt, 2009). Unplugged Computer Science (UCS) is a way and way to introduce and teach students about computers without having to use a computer. In addition to providing students with knowledge about computers, UCS engages student (Blackman & Henderson, 2001) in Computational Thinking (Wing, 2006).

2.2. The Nature of Ethnopedagogy

Learning using culture or ethnopedagogy was first popularized by Dr. Gloria Ladson-Billings in early 1990. She stated that learning using culture is one that empowers students to maintain cultural integrity, while also being successful academically (Ladson-Billings, 1995). What differentiates it is that ethnopedagogy encourages learning to act collectively through culture based on cultural understanding, experience, and ways of knowing the world. This

ethnopedagogy has been accepted and known in educational circles, for example the US Department of Education's Equity Assistance Center helps state that using ethnopedagogy as a tool for measuring equitable educational outcomes for all students and measuring cultural responsiveness as a capability needed by teachers, principals, and school communities overall.

2.3. Understanding Interactive Multimedia

Interactive multimedia is a display designed by a designer so that the display fulfills the function of informing the message and the display fulfills the function of informing the message and has interactivity for the user (Ramli, 2013; Stemler, 1997; Rachmadtullah *et al.*, 2018; Heeter, 2000; Abdel-Aziz *et al.*, 2016; Huang, 2005).

3. METHODS

Figure 1 is a picture of the research design carried out by the researcher. This research consists of 5 stages.
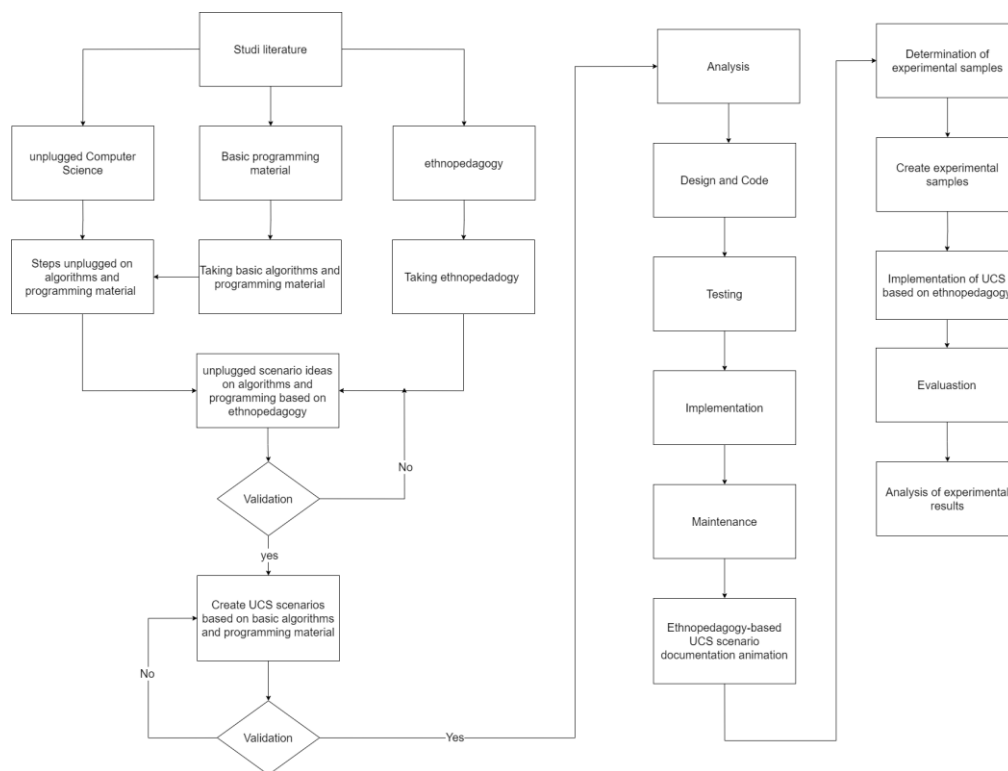

Figure 1. Research design.

3.1. Planning

At the design stage, researchers conducted a literature study first. The literature studies carried out were divided into three groups, namely UCS literature studies, ethnopedagogy literature studies, and basic programming material literature studies.

(i) UCS literature study: The literature study carried out was looking for national and international journals related to UCS. This literature study was carried out to determine the characteristics of UCS, the application of UCS, and everything related to UCS.

(ii) Etnopedagogi literature study: Ethnopedagogical literature studies are journal data collection activities, both national and international regarding Ethnopedagogy to

determine the characteristics of Ethnopedagogy, Application of Ethnopedagogy, and everything related to Ethnopedagogy.

(iii) Literature study of basic programming materials: Literature study of basic programming materials is an activity to collect and search for data originating from books that can be taught through UCS.

3.2. Creating UCS Idea Scenarios Based on Ethnopedagogy

After the literature study was carried out, the researcher then thought of ideas regarding Unplugged steps for the algorithm material that had been determined and matched them with the Ethnopedagogy that the researcher had thought of.

Researchers then created a UCS scenario based on Ethnopedagogy in Basic Programming. To determine the feasibility of the scenario/idea created by the researcher, the material has been judged by 3 people who according to the researcher are appropriate and suitable for determining the feasibility of the material, namely 1 lecturer at the UPI Computer Science Study Program, and 2 teachers concerned with Basic Programming Algorithms.

3.3. Design and Development of Multimedia-Based Documentation

The development of animated learning media was created by researchers based on material that had been judged by several experts using the waterfall technique. The media created is an interactive animation that contains UCS based on ethnopedagogy. The animation has been judged by 3 people who according to the researchers are appropriate and suitable for determining the appropriateness of the material, namely 1 lecturer at the UPI Computer Science Study Program, and 2 teachers concerned with Basic Programming Algorithms.

3.4. Experiment

The researcher then carried out experiments according to the scenario and applied the media that had been created.

3.5. Analysis of Experiment Results

From carrying out research or experiments, results will be produced which will then be analyzed and processed according to qualitative methods and conclusions will be drawn from the results that have been analyzed. After obtaining all the data, a draft of the research or experiment that has been carried out is made as physical evidence that the researcher has carried out the research or experiment, so that it can be read by everyone and as reference material for the development of further learning research.

4. RESULTS AND DISCUSSION
4.1. Making lesson plans involving UCS steps based on ethnopedagogy as alternative learning

The creation of an ethnopedagogy-based UCS carried out by researchers was made in stages as in **Figure 2**. In **Figure 2**, there are 7 steps to produce "UCS Learning Stages based on Ethnopedagogy and Animation Documentation".

In **Figure 2**, the first step is determining and creating a material topic that explains and explains the material completely. The second step, namely selecting Sundanese tools and games for ethnopedagogy, explains the history and characteristics of Sundanese tools and games that are candidates for ethnopedagogy. The third step, namely creating an ethnopedagogy-based UCS idea, explains the creation of an ethnopedagogy-based UCS as

well as mapping the candidate Sundanese tools and games that have been determined. The fourth stage, namely the preparation of teaching aids and the creation of teacher and student activity stages in the classroom using ethnopedagogical-based UCS, explains what must be prepared and what the activities of teachers and students are in the classroom when using ethnopedagogical-based UCS learning. The fifth step is the expert judgment stage for the stage's teacher and student activities. The sixth step is an explanation of how animation as documentation regarding ethnopedagogy-based UCS is created, and the final stage is expert judgment for the animation that has been created.
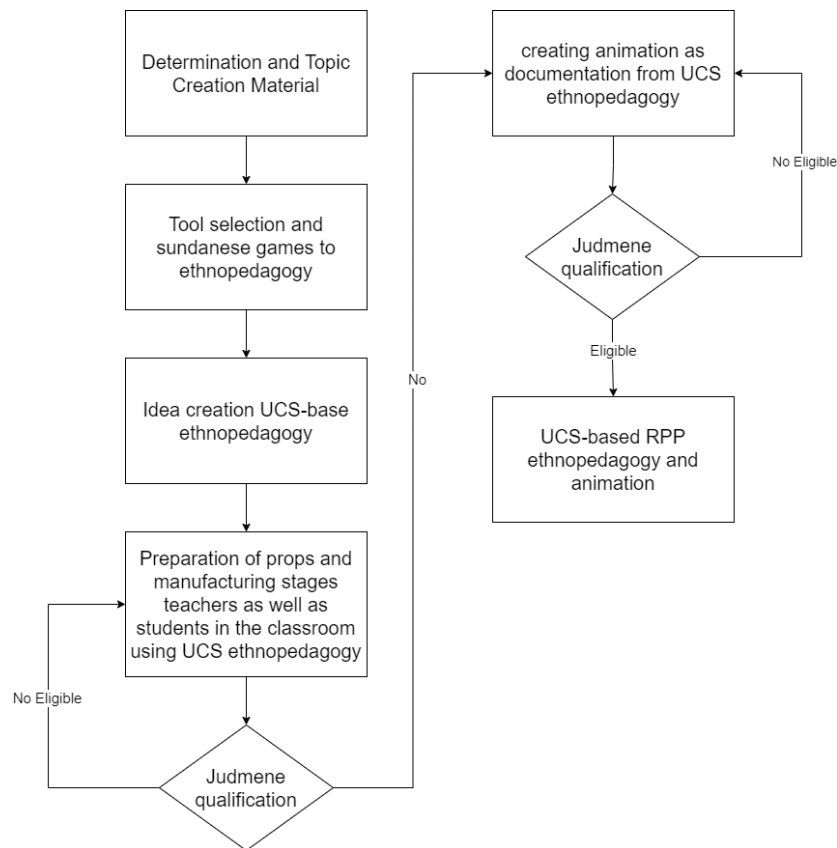

Figure 2. Steps for Making Ethnopedagogy-based UCS and Documentary Animation.

4.1.1. Determination and selection of material topics

The material taken or selected by the researcher is determined directly by the researcher due to the limited knowledge possessed by the researcher. The material chosen is also not complex material, thereby minimizing the level of difficulty for researchers, teachers, or users of the UCS being created. There were 8 materials selected by the researcher, including binary, bubble sort, branching, sequential search, for loop, array, selection sort and do-while loop.

The material chosen in this research is as follows:
(i) Binary conversion material in the conventional learning process.
(ii) Bubble sort material in the conventional learning process.
(iii) Branching material in the conventional learning process.
(iv) Sequential search material along with teaching examples.
(v) Statement for the conventional learning process.
(vi) Array material along with teaching examples.
(vii) Selection sort material along with teaching examples.
(viii) Do-while loop material along with teaching examples.

4.1.2. Preparation of UCS abstractions or ideas based on Ethnopedagogy

From the material that the researcher has determined, the researcher maps the tools that will be used for each material topic according to the characteristics of the instrument. A tool or instrument can not only be used on one material but can be used on more than one material. Mapping the instrument to the material topic produces the idea of UCS based on ethnopedagogy. The following is a UCS idea based on ethnopedagogy.

4.1.3. Preparation of abstracts or UCS ideas based on Ethnopedagogy

Each material is made into learning steps. Ethnopedagogy-based UCS learning steps are created after steps a and b have been completed. Researchers combine inspiration from points a and b to create ethnopedagogy-based UCS learning.

4.1.4. Preparing teaching aids and creating activities for teachers and students in class using ethnopedagogy-based UCS

The ethnopedagogy-based UCS learning used in this research certainly uses media or instruments in its learning. In making instruments or media that will be used as tools in ethnopedagogy-based UCS learning, several tools and materials are needed, including 1 set of angklung (One set of angklung usually consists of 7 angklung). Each angklung has a different size and tone. The larger the size of the angklung, the lower the pitch. Angklung can be obtained by purchasing or made by professionals.

The teaching steps created by the researchers are in **Table 1**. **Table 1** explains how bubble sort material can be taught through Ethnopedagogy-based UCS.

Table 1. UCS Learning Steps Based on Ethnopedagogy in Bubble Sort Material.

No	Activities	Teacher/Student
1	Seven students came forward and lined up according to the teacher's instructions	Student
2	Give random angklung to representatives	Teacher
3	Compare the size and pitch of the angklung of student i with student i+1 according to the teacher's instructions.	Student
4	Students change standing positions if the angklung is bigger and the pitch is lower than the one on the right, but if the angklung is smaller and the pitch is higher than the standing position remains, and the comparison is continued by the next student.	Student
5	Repeat activity 6 n-1 times until there is no exchange of positions between students according to instructions.	Student
6	Explains the conclusion of the lesson	Student
7	Adding missing student conclusions	Teacher

4.1.5. Design and development of animation documentation

The design and development of this documentation uses the waterfall method with 5 stages, namely needs analysis, design, implementation, testing and maintenance. Every material raised is created or documented into animation.

4.2. Results

Figure 3 shows the percentage of respondents' answers from the questionnaire given to students. Based on **Figure 3**, the majority of students answered agree and strongly agree to the questionnaire given.
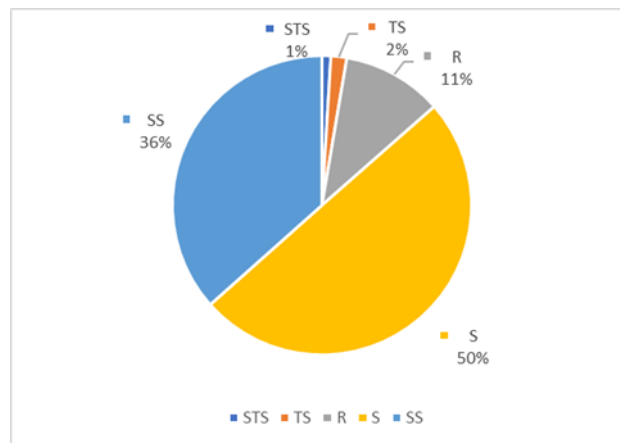
Figure 3. Answer Percentage.

5. CONCLUSION

From the findings and discussion of the research that has been carried out, it can be said that research regarding the application of Ethnopedagogy-based UCS as an alternative teaching in basic programming algorithms subjects has produced several conclusions including:

(i) Designing Ethnopedagogy-based UCS as an alternative teaching in basic Alpro subjects is easy to do with the ideas from researchers that have been discussed.

(ii) The implementation of UCS at Tribakti Pangalegan Vocational School was successfully carried out in accordance with the experimental implementation scenario created by the researcher. The implementation of Ethnopedagogy-based UCS went smoothly and obtained data as expected for analysis.

(iii) The design and development of animated multimedia as a documentation medium was successfully carried out and demonstrated to teachers and can be said to be a success as a documentation medium. Teachers can understand and conclude learning from animation with evidence. Teachers can say that Ethnopedagogy-based UCS can be applied in remote areas, is easier to understand, provides cultural insight and so on as explained in CHAPTER 4.

(iv) The results of the analysis of the application of Ethnopedogogy-based UCS as an alternative to teaching in virtual basic algorithms and programming lessons can be said to be successful because more students said they liked it, interesting, happy, active, not bored, more understanding, enthusiastic, did not make students confused, useful, easier than conventional learning and also provides students with insight into Indonesian culture indirectly.

By achieving all the objectives set by the researcher at the beginning of the research, it can be said that this research was successfully carried out well and produced research results that can be said to be successful.

Suggestions for other researchers who raise similar themes or titles, it is better to take other material so that it will be useful, and more material can be delivered using Ethnopedology-based UCS as well as to use different tools or take different areas to use so that Indonesian culture will also be raised and preserved.

Future researchers are also advised to highlight learning so that it can be applied better. Don't forget to discuss, explain in more detail based on the concepts of the material because, the end of learning is not taking exams unplugged but conceptually or conventionally.

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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