The development of interactive multimedia based on auditory, intellectually, repetition in repetition algorithm learning to increase learning outcome

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Abstract. This research aims to find out how the development of interactive multimedia based on auditory, intellectually, and repetition can improve student learning outcomes. This interactive multimedia is developed through 5 stages. Analysis stages include the study of literature, questionnaire, interviews and observations. The design phase is done by the database design, flowchart, storyboards and repetition algorithm material while the development phase is done by the creation of web-based framework. Presentation material is adapted to the model of learning such as auditory, intellectually, repetition. Auditory points are obtained by recording the narrative material that presented by a variety of intellectual points. Multimedia as a product is validated by material and media experts. Implementation phase conducted on grade XI-TKJ2 SMKN 1 Garut. Based on index’s gain, an increasing of student learning outcomes in this study is 0.46 which is fair due to interest of student in using interactive multimedia. While the multimedia assessment earned 84.36% which is categorized as very well.

1. Introduction
Education has become a primary requirement for any individual, driven by advances in science and technology in the era of globalization. SMK present as one of supporting the needs of human resources who are ready to work and provides a variety of majors. One of the areas of expertise of interest was the field of expertise of the information and communication technology (ICT).

One of the subjects of the basic ICT skills are Basic Programming or Programming Algorithms. The algorithm is an early stage in understanding computer programming. On these subjects is focused to build logic concerned student programming. Because it is essentially a program created to meet a need, "Algorithms, algorithmic programming solution means the solution of a problem that should be solved by using the computer" [1]. The solution is then elaborated in more detail into a procedure. In tune with the explanation "algorithm is a sequence of steps to solve a problem" [2]. The algorithm is based on the logic of the human mind in order to be understood by the man himself can also be transformed into programming using the programming language. "Through this Programming Algorithm Material, learners are expected to have the ability to think algorithm" [3]. The complexity of algorithms and data structures of matter is material abstract concepts, so it is very difficult to understand by students [4].
Based on the preliminary results of the survey showed half of the students of SMK TIK recognizes that specialization subjects which is considered the most elusive is the programming Algorithm. This is a constraint a satisfactory learning results. Students can withdraw when learning involves many aspects in his body, not just the brain that work, because it will make students increasingly bored. The research of Vernon, Texas University of memories suggests that "memory is done by looking at, say, hear and do as much as 90%". Research results in some students against Felder leading universities in America. In general, his research results showed that 82% of visual learners [4]. In line with Quantum Learning three learning modalities. The third modality is the visual modality, auditory and kinesthetic modality. Dave Meier adds one more intellectual learning style [5]. Intellectual property is part of the brood, created, solve problems and build meaning. That means that used the mind to transform experience into knowledge, knowledge into understanding. In principle there are three learning internal conditions that must exist at the students, one of which is intellectual finesse. Also there are 3 external conditions of the learning principles that affect the learning process of students, one of them i.e. repetition (repetition), the stimulus and the response was the situation needs to be repeated or practiced so that learning can be improved and increasing retention of learning. The exposure of researchers interested in conducting a study with a raised aspect of listening (Auditory), thinking (Intellectually), and repetition (Repetition). The learning model is known for its learning model is AIR (Auditory, Intellectually, Repetition).

Previous research, the results proved that the use of the learning model of AIR supports the learning process. Nirawati research indicates AIR learning model affects the improvement of the strategic competence of students of JUNIOR HIGH SCHOOL in a positive and significant of 60.84%. The results of the research of mathematical communication ability that Maulana students who get learning with a model of the AIR rise better. Results of the study Lies concluded that the ability of the applications students use learning model of AIR better than the conventional model of learning, as seen from the results of calculation of normalized gain G 0.34 G (AIR). Researchers argue that AIR learning model can also support learning Algorithm programming, let alone presented using media or multimedia.

Multimedia comes from the word multi and media. Media derived from medium, meaning intermediaries or introduction. The media is the plural form of medium as the carrier of information communication channels. Education and communication technology Association (Association of Education and Communication Technology/AECT) restrict the media as all forms and the channel used to transmit messages/information [6]. Thus the media learning can be defined as an intermediary (medium) conveying the message (message learning) learning from the source message (message resource) to the recipient of the message (message receive) so that the occurrence of a reciprocal interaction.

The word multi in multimedia can mean more than one. Multimedia is narrowly channeling information from a source to a receiver with the use of more than one kind of intermediary. The media could be audio, visual or audio-visual. Multimedia more specifically as one of the ICT products in education that covers a variety of media in a single interactive learning software [7]. Multimedia specialties are defined as technologies that optimize the role of the computer as a medium that displays text, sound, graphics, video and animation, integrated and interactive. Interactive is a component that must be present in a multimedia. In a Word, online interactive KBBI translated as "are mutually do the action; relationships; mutual active ". Simply interactive multimedia allows the existence of interactions between users and multimedia so that multimedia is not one-way direction in delivering material and users are not the passive role when the learning process.

Based on the elaboration of the above problems, researchers interested in conducting research with the title "Development of Interactive Multimedia Based on Auditory, Intellectually, Repetition In Repetition Algorithm Learning to improve Learning Outcomes".

2
2. Methods

2.1. Research Method and Procedure
The research method used is the Research and Development or R & D. procedure which consists of five phases, namely analysis, design, development, implementation, and assessment.

2.1.1. Analysis Phase/Stage. Conducted the analysis with the study of literature and field studies. The study of literature by collecting data and information on interactive multimedia; Auditory Intellectually Repetition learning model; the development of interactive multimedia based of AIR learning model. Field studies conducted by distributing questionnaire to the students, school observation, interview subject’s teacher to find out the real state of affairs regarding the learning algorithm.

2.1.2. Design Phase/Stage. a) Formulate the material on learning Basic Programming and is associated with Auditory, Intellectually, Repetition Learning Model; b) Formulate test items related to the learning material to later be developed into testing instrument; c) Design interactive multimedia flowchart based on auditory, intellectually, repetition; 4) Design interactive multimedia storyboard based on auditory, intellectually, repetition.

2.1.3. Development Phase/Stage. Produce interactive multimedia based on auditory, intellectually, repetition in Basic Programming subject. The steps include making multimedia main framework, multimedia content filling like pictures, text, audio, and animation in learning materials as well as in evaluation. After that validation step is taken by material and media experts to ensure the validity and worthiness of the developed product. Next step is refinement so the product is ready for implementation.

2.1.4. Implementation Phase/Stage. Conducting field test to SMK students Special Interest TIK. Students were given pretest, multimedia tryout, and posttest and multimedia assessment by the students.

2.1.5. Assessment Phase/Stage. Interactive multimedia assessment by the students after the implementation of multimedia. Students learning outcome is also measured.

2.2. Location and Research Subject
Research subject population are SMK TIK. Sampling is done by probability sampling technique, which give each subject possibility to be a sample. Since the population is too large so we use cluster random sampling. This sampling done in two stages. Stage one determining sample SMK TIK. In this stage SMKN 1 Garut is chosen. The second stage School administration gave permission to conduct the research in grade XI TKJ 2 with 32 students.

3. Result and Discussion

3.1. Analysis Stage

3.1.1. Students Questionnaire. Based on data now obtained information that the Basic Programming including most subjects are not of interest. Directly proportional to almost half of the students, i.e. 45% stated that the Basic Programming is the most difficult to understand. Some of the material from the Basic Programming, almost all the students loved the material selection algorithm, 19% liked the Repetition Algorithm, and 3% each choose the Array and Matrix. For Basic Programming material that is most difficult to understand, half the students choose the remaining half of the Array, select selection algorithm, repetition and Matrix. Based on this information the researchers select the Repetition Algorithm material will be used as Interactive Multimedia content-based Auditory,
Intellectually, Repetition. While the response or responses of students towards interactive multimedia, almost all students (89%) said interested or support the existence of Interactive Multimedia Development.

3.1.2. School Observation. Researchers conducting the observation to SMK Negeri 1 Garut. This is done so that researchers got an overview regarding the curriculum, learning facilities, teachers and students in the field of ICT Skills. Some things that are obtained from the results of observation: a) SMK Negeri 1 Garut apply curriculum 2013 guidelines; b) SMK Negeri 1 Garut provides several expertise packages, among others, TIK (Computer Science) has two Departments Computer Network (TKJ) and Multimedia (MM). Both departments have two classes, the number of students for each class ranges from 36 to 39; c) Specialization teachers in SMK Negeri 1 Garut are from proper educational background to the subject they are teaching, although not all of them come from teacher college. Most of them come with Computer science background (non-education); d) The school has adequate computer laboratory facility, spacious classrooms, well-ventilated, Air-conditioned, well-lighted; the school also has 40 unit productive and operational PC complete with high specifications and accessories (Microphone, headphone); equipped with complete network facilities for intranet and internet.

3.1.3. Interview Teachers. Researchers interviewed some subject mapping ICT teacher areas of expertise. Based on the results of field studies to interview teachers the following information are: a) Programming Basic compulsory subjects is mapping the areas of expertise that are complicated, not easy to form a pattern of thought students, understanding the limited results of the student teacher, students are less able to develop concepts, especially the students glued to the programming code without the familiar grooves of the concept of algorithm programming, plus the number of hours of instruction is applied to curriculum only 2 hours of instruction per week even though the weight of the material to be delivered very much and take a long time to form students understanding; b) Similar learning method applied they are lecturing, simulation and practice; c) Basic Programming material for class X semester 1 and 2 including: basic concepts algorithm; programming languages; data types, variables, operators and expressions; algorithm selection and branching; repetition algorithm; and the development of algorithms; d) Repetition Algorithm Material is given to students of grade X semester 2; e) Programming language taught in Basic Programming are Pascal and C.

3.2. Design Stage

3.2.1. Material. The material to be used is repetition algorithms. Repetition algorithm of subject matter in the Curriculum syllabus 2013 include: a) Repetition condition in the beginning; b) Repetition with the condition at the end; c) The repetition condition is derived from user input; d) Repetition as the counter go up; e) Repetition as the counter down. To make it easier, the researcher divided Repetition Algorithm into 4 sub-materials as follow: a) Preliminary Material, covers main concept and basic structure of Repetition Algorithm; b) Repetition Algorithm FOR material, including repetition of structure using the C programming language, including the case of repetition, the repetition of the ascending descending, the value the user input, the counting numbers (integer) and counting the alphabet (char); c) Repetition Algorithm WHILE material and DO WHILE, encompassed the repetition condition in early (while), repetition with the condition at the end (do while), repetition structure using the C programming language; d) Additional material, including a comparison of the use of repetition of structure FOR, WHILE and DO-WHILE; as well as the use of repetition in repetition. Material is formulated and linked into the Auditory, Intellectually, Repetition Model as follows.

Audiority which is the delivery of material in addition to using the visual (text, images) is also equipped with audio in the form of narrative material. The main thing you want to accomplish at this point is learning that focuses on audio (listening).
Intellectually which is the delivery of the material should be able to lure students to think and give the reaction of action in multimedia, it is known by the term interactive. Awarding simple questions or complex can be done for the achievement of these points, the form of the question can range from the input notes, or clicking the buttons, or click Options in the form of a ratio, and so on.

Repetition which is the delivery of the material should be repeated. A special menu is provided for material, both of which have not been studied or who've never learned, so that subsection any material can be studied again anytime. In addition at the time of submission of the material, each sub material there is break in some parts, it is aimed to give the opportunity to the users to be able to proceed to the next section or a repeating section. Points is coupled with a complete material and its evaluation.

3.2.2. **Ability Test.** Instruments used to measure learning outcomes in the form of a question of testing capabilities. The question of the form of multiple choice made as many as 30 rounds with 4 choices of answers. The creation of this problem is adapted to the scope of the material to be presented in multimedia. After ready the question tested beforehand in SMK Puragabaya, Bandung. Validity test show that out of 30 items 22 are valid and 8 are not. Based on reliability study, the score is \( r_{11} = 0.916 \) can be interpreted fall into “very high” criteria.

3.2.3. **Flowchart.** Flowchart describing the process flow of multimedia learning be made overall. The depiction of the model of learning Auditory, Intellectually, Repetition is not visible on a flowchart designed. Generally the flow of Interactive Multimedia based Auditory Repetition, Intellectually, as follows

Multimedia can only be accessed by the user who owns the account. Then the process early multimedia is a login or sign in for those who already have an account. If you don't have an account and would like to have an account can sign-up or register. For the account successfully registered will be heading directly to the material automatically the introduction and should be solved until evaluation. Next access the other menus on multimedia.

Menus found on the multimedia is main page (home page), page content, the page recaps value, usage instructions page, the information page for the author and the reference page. There are also additional features namely profile and the settings of the music. The main material consists of 4 sub material, i.e. material introduction, for, while -do while and additional.

3.2.4. **Storyboard.** Storyboard is the idea of visualization will be poured on the product to be created. It also describes what will be displayed in the multimedia, such as text, graphics, and audio. On the storyboard was designed a few pages such as the sign in page, list page, main page, page content, the page recaps value, usage instructions page, the information page for the author and the reference page.

Sign in page form input form to enter a user name and password, as well as the sign in button. On the page Listing consists of several input form to enter user data, as well as the button list. On the main page contains a slide show photo-related multimedia. The material consists of 4-page menu go to page the material for each material. On the page of each material going learning process or delivery of material by using the model of learning Auditory, Intellectually, Repetition. At the end of the submission material will appear the Advanced button go to page evaluation. The evaluation page contains 5 question multiple choice randomly processed so that each user gets a different problem, with 4 options of answers in the form of a radio so that it is not possible to select more than one answer, also the end key to end the evaluation and display the results of the evaluation of the on-page recap of value. Value of the Recap page a table that contains the value of the results of the evaluation of all material status, have also resolved if the value of the evaluation of the minimum standards, if not status unresolved. There is also a page of instructions use of multimedia, information and References as a complement of multimedia.
3.3. Development Stage
At this stage do Interactive Multimedia production-based Auditory, Intellectually, Repetition. The production begins with the creation of a database, a Web-based frame along with programming, Presentation material, and integrating the presentation material on the web-base.

He make database using MySQL with the name mulintair. The database is used to store user data, the question of the evaluation and the results of the evaluation.

Making the interface accompanied by PHP programming as controller the flow program, database and session settings liaison at the time user authentication. Next is the formulation of repetition algorithm material using Auditory, Intellectually, Repetition learning method. Material presentation created using Adobe Flash. Then integrated in web-base. Presentation material-making starts with a sound recording of the narrative material using RecordPad Sound Recorder. Sound recording results is then filtered and given a name in accordance with the unique code in order to facilitate narrative upon the use of sound or voice revenue into the media.

In addition to the sound recording, prepared some examples the case of Repetition Algorithm accompanied settlement. Case resolution form code program using the C programming language and executed using the MinGW compiler using Command Prompt interface. The results of the execution of the program recorded using screen recorder bandicam. Printscreen program code and screenshots of the results will be used as case material execution manufacture of presentation material.

After all the presentation material ready, continued the process of making the presentation material by incorporating sound and displays visualizations in the form of moving images, still images, simple text that represents the meaning of the narrative.

After the stage production is completed, enter the validation process by media experts and material to find out the feasibility of the product being developed, so that these products can be applied in school.

Validation by media expert using instrument LORI, with the results of expert judgement of the media of 85% on the quality of the content of the study, 90%, 80% on the feedback and adaptation, motivation 100%, 80% on the design presentation, 87% in user interaction, 90% on accessibility, 80% on reusability and compliance standards, obtained an average percentage of feasibility of 86.8% which could be categorized very well.

While the validation by an expert of the material using Wahono instrument, with the General aspects obtained results in 75%, 77%, learning aspects of the substance of the material 69%, and the average percentage obtained the feasibility of 73.7% which can be categorized good.

3.4. Implementation Stage
Multimedia tryout is conducted to 38 students of SMKN 1 Garut grade X TKJ-TIK. Interactive multimedia is preinstalled in the intranet server of Computer Lab. So that client PC can access multimedia easily. Besides, it is to make calculation of test result easier.

Implementation begins with pre-test, then students choose a random seating with a PC that is connected to a local network so that it can access the multimedia. PC-equipped headphones to listen to audio multimedia. Multimedia accessible via web browser, direct students to the sign in page, the home page multimedia. After the teacher gave an explanation in general the use of multimedia, students can start the lesson. Teachers go around and help students who are having difficulty. Teachers can see the results of the evaluation of each student on a database on the server. Each student is given the freedom to do learning and exploration of multimedia. There are some students who completed the study quickly, some of the other are more slowly.

Once that is done, then the students were given a final evaluation (post-test) using the same problem with the initial evaluation. The evaluation results made into student learning result measurement.
3.5. Assessment Stage
In addition to doing final evaluation, also carried out an assessment of interactive multimedia Based Auditory, Intellectually, Repetition by the students. Based on data obtained showed good responses from students. Quantitative assessment of students on the software aspects obtained 84.76% 83.33% learning aspect, and the highest rate in aspects of visual communication of 84.98%. The overall rate of 84.36%, can be categorized as very good.

3.6. Discussion

3.6.1. Interactive Nature of Multimedia. Multimedia that is developed is an interactive multimedia. This is apparent from several menus to choose from. Students can begin learning if pressing the material selected, the learning is done based on the readiness of each student. Also in the form of interactive capabilities to accommodate the user's response. A response in the form of pressing buttons or menu, enter text, choose an option, and so on. Multimedia user response and hold all the supply response is a reply, so the interaction between users and multimedia.

Interactive elements give students the freedom to determine the free learning material is selected and there is a status settlement. Students can easily open up the subject matter chosen. Multimedia interactive nature can make students more active, spirited, and interested in learning. Also make students to tailor the needs of students to study a material. Compared to the usual multimedia, students don't just watch and interact directly.

3.6.2. Auditory, Intellectually, Repetition Based Multimedia. Interactive multimedia is developed according to Auditory, Intellectually, and Repetition Learning model concept. These three points are packaged and integrated in the interactive multimedia. More detail is displayed as follows.

The auditory point presented in the form of audio or sound from the narrative material. In addition to the visualization of material, the user is more focused on his/her hearing, since the presentation of the material fully assembled from the narrative material.

Intellectually points formulated in shape and pattern on the presentation material that can provoke students to think and give a response of action on multimedia, this is known by the term interactive. Awarding simple questions or complex can be done also with the form of a question.

Points of repetition on multimedia applied with the option of material can be selected anytime and can be done more than once. Additionally, on submission of material can be repeated with a break on some parts of the material, it is aimed to give the opportunity to the users to be able to proceed to the next section if you already understand or repeat that section if less familiar.

3.6.3. Conformity/Compatibility with Learning Media Criteria. This interactive multimedia through media validation by experts and media material. In addition to this multimedia tested to the students and the results showed a positive response with excellent category and meets the criteria of learning media software, learning, and visual communication.

Aspect software can be categorized very well. Usability of multimedia can be categorized very well. It is based on assessment of students who strongly agree multimedia is easy and convenient to use. Reliability of multimedia can be categorized very well. It is based on assessment of students who strongly agree multimedia does not easily bogged down and there is no error. Multimedia compatibility can be categorized very well. It is based on assessment of students who strongly agree multimedia can be used and run on another computer.

Aspects of the learning can also be categorized very well. Multimedia interactivity can be categorized very well. It is based on assessment of students who strongly agree multimedia response is easy to understand and to respond to any multimedia instructed users. Motivation contained in multimedia can be categorized very well. It is based on assessment of students who strongly agree multimedia gives the spirit of learning and multimedia add knowledge. Suitability study of multimedia
can be categorized very well. It is based on assessment of students who strongly agree multimedia provides material and the questions or problems that correspond to Basic Programming lessons.

Aspects of visual communication can also be categorized very well. Multimedia visual elements can be categorized very well. It is based on assessment of students who strongly agree the appearance and composition of color and interesting explanation of the multimedia material in the form of visual elements not too quickly or slower. Audio in multimedia can be categorized very well. It is based on assessment of students who strongly agree the voice on a multimedia pull and add motivation. Multimedia layout can be categorized very well. It is based on assessment of students who strongly agree look interesting multimedia menus and menus are positioned correctly.

3.6.4. Compatibility with Learning Principles. In developing this interactive multimedia author take also into considerations learning principles.

The development process of this multimedia incorporate interactivity, so that the students do not become just passive learner they actively participate directly accessing multimedia for various purposes. This is compatible with active principle in learning that students respond to every learning activity. This Interactive multimedia makes students active and have initiative to do independent learning.

There are learning materials on the status of the settlement. Students must pass each completed evaluation of learning on a specific matter. Evaluation results the user relied upon status settlement, if the results of the evaluation of the above minimum standards, then the status of the completion of the material had already been resolved, but if the results of the evaluation of the minimum standards, then the status of the resolution of unresolved material and users have to repeat learning such material. The number of repetitions of each material infinite, users can perform learning and evaluation as often as possible. So in accordance with the principle of repetition that aims so that every human being possessed of power can be routed so as to become more sensitive and growing.

In this multimedia there are also elements of reinforcement and the inverse, results that appear when the user successfully pass the evaluation, failed to pass the evaluation, and has been a repeat as much as the time of evaluation. It is intended to let the students know the results of their actions, so that students become more excitement when the results they used to do it well or a challenge to be able to work on better yet if the results are unfavorable. With the principle of strengthening and revert these students become more excitement in learning to produce better learning results than ever before.

4. Conclusions
On this interactive multimedia implementation begins with a pre-test or test start and end with the final test or post-test. Based on preliminary test results obtained average value of students is 39.71. While the average results obtained at the end of the test is 56.94. After acquiring the data start and end tests then carried out the calculation of the gain and retrieved the index gain 0.46. Then from the index gain obtained this multimedia can enhance student learning outcomes. Increased earned belongs to category fair. This is due to the weight of the algorithm material to be intense and difficult, so the use of interactive multimedia is not enough to just try it once. In addition the use of interactive multimedia in learning new programming Algorithms first performed, so that students interest more to Interactive Multimedia. However overall it can be concluded that the auditory-based interactive multimedia, intellectually, repetition can be used to improve the results of a study on the subjects of Basic Programming, Algorithmic material repetition, especially students of SMK Negeri 1 X Class Garut areas of expertise in ICT, TKJ Skills Package.

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