

# The Development of Learning Tools Using Software in Informatics Engineering Department

Nurdiansah Nurdiansah<sup>1</sup>, Patta Bundu<sup>2</sup>, Jasruddin<sup>2</sup>, Abdul Saman<sup>2</sup>

<sup>1</sup> *STMIK Dipanegara Makassar, Indonesia*

<sup>2</sup> *Universitas Negeri Makassar, Jalan Bonto Langkasa, Makassar, Indonesia*

**Abstract** – Software learning tools orient students to think critically about learning actively. The success of the application of this software learning tools for Algorithm and Programming materials depends on the role of lecturers, readiness, strategy, techniques and learning methods used as a medium of learning addressed to STMIK Informatics Engineering students in Makassar. Factors that support the implementation of learning in the classroom are planning of applying learning tools that are used, namely learning tools software. It includes semester implementation plan, lecturing unit, teaching materials, and student activity sheet. Therefore, the formulation of the problem in this study is how is the level of validity of learning tools software developed by the Department of Informatics Engineering?. The purpose of this study is to describe the level of validity of the developed learning tools software in the Department of Informatics Engineering. The validity was obtained based on the assessment of the media expert's validator and the material expert on instructional tools made by the researcher including learning device software, teaching materials, semester implementation plan, lecturing unit, the student activity sheet and learning outcome test.

**Keywords** – Development, Software, Learning Tools

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**Corresponding author:** Nurdiansah Nurdiansah,  
*STMIK Dipanegara Makassar, Indonesia*  
**Email:** [nurdiansaheducation@gmail.com](mailto:nurdiansaheducation@gmail.com)

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## 1. Introduction

Referring to the Law of National Education System Number 20 of 2003 on National Education System, education means conscious and well-planned effort in creating a learning environment and learning process so that learners will be able to develop their full potential for acquiring spiritual and religious strengths, develop self-control, personality, intelligence, morals and noble character and skills that one needs for him/herself, for the community, for the nation, and for the State. National education is an education based on Pancasila and the 1945 Constitution of the Republic of Indonesia which is rooted in the values of religion, the national culture of Indonesia and responsive to the demands of the changing times.

The role of mobile technology has expanded its functionality. Initially, mobile technology serves as a means of supporting communication among people. However, the more human needs the more innovations that can be applied to facilitate their needs. Nowadays, it is easy to find online learning methods that are performed in the classroom. It is easy to find online learning methods that are done in the classroom. Almost every campus has a Wi-Fi network so that the students can access the information they need. Therefore, the role of textbooks will be reduced because it is replaced with access to knowledge and information from the computer or mobile devices such as tablets and smartphones.

Additionally, various features of mobile devices provide opportunities for application developers. Several learning applications can be utilized in education. One of them is the application of e-learning on the mobile device which is usually referred to m-learning.

Based on the description above then the problem of this research is: how is the level of validity of learning tools software developed by the Department of Informatics Engineering?. Therefore, the purpose of this study is to describe the level of validity of the

developed software learning tools in the Department of Informatics Engineering.

Therefore, there are some reasons why the researchers conduct this study in Private Universities that is STMIK Dipanegara Makassar. First, based on the preliminary survey, the researchers found that in every lesson the use of media and learning facilities have not been maximized. Second, the variation of learning model by lecturers is still lacking. Third, interest and student achievement are still low. Therefore, it is deemed necessary to use the software as learning tools.

## 2. Literature Review

### 2.1. Development

In essence, development is a formal and non-formal educational effort that is conducted consciously, planned, directed, organized and responsible for introducing, grow, guide, and develop a balanced, whole, harmonized, balanced personality base of knowledge, skill according to talent, desires, and abilities. It serves as a provision of its initiative to add, enhance, and develop itself towards achieving dignity, quality and optimal human capabilities and independent personality [1]. Along with the development of the times, it will undoubtedly be followed by the development of science.

There has been much renewal conducted in science to improve the standard of human life. One of the enhancements is the learning medium that is carried out by various researchers on development. It is stated that development research is a process or steps to develop a new product or refine a product that has been existing before [2]. The product can be hardware, software, and so forth. Media development (Research and Development) is a research method used to produce a particular product, and test the effectiveness of the product [3].

### 2.2. Software

The nature of software is different from hardware. Hardware is a real component that can be seen and touched by humans. On the contrary, the software cannot be touched and viewed physically. Furthermore, software does not appear physically and as intangible object, but we can operate it. Software is a command (computer program) that provides the desired function and performance when it is executed [4]. This software is a record for machines to store commands, as well as documents and other archives.

### 2.3. Learning Tools

The learning tool is one factor that has an essential role in the learning process. Without the availability of learning devices, the learning process cannot run well. It can have implications for not achieving the planned learning objectives. The learning tool is a collection of learning resources that enable lecturers and students to do learning activities.

Concerning implementation, learning tools consist of various components depending on the needs of each person. A learning tool should have at least five main components such as syllabus, semester implementation plan, lecturing unit, teaching materials, and student activity sheet.

### 2.4. Previous Related Findings

#### 2.4.1. A Review of Research on Mobile Learning in Teacher Education

This systematic review of 37 articles on mobile learning and teacher education is timely in light of growing interest in mobile learning and a lack of syntheses in the context of teacher education. Findings are drawn as well as the approaches and strategies for implementing mobile learning and mobile tools in different teacher education contexts. First, the review revealed that the number of articles published has significantly increased over the last five years, with contributions from researchers around the world. This trend is consistent with other review findings on mobile learning [5,6]. Second, there was a scant report of theoretical and conceptual perspectives. Third, survey studies revealed that perceptions, attitudes and usage patterns among teachers varied. Fourth, mobile learning was reported as mainly beneficial in teacher education contexts. Fifth, while there are notable exceptions, challenges or issues to integrate a mobile learning component in teacher education programs and curriculum were duly noted. Finally, several pedagogical affordances support mobile learning integration into teacher education settings. As educators begin to understand the potential of mobile learning in education, the role of teachers and teacher educators in integrating mobile devices becomes essential in addressing students' learning needs across several disciplines. This study presents findings and recommendations to help researchers, teacher educators, and policy makers develop research-informed guidelines and theoretical models to suggest methods on how to integrate mobile learning into teacher education [7].

#### **2.4.2. *Development and Evaluation of an Interactive Mobile Learning Environment with Shared Display Groupware***

In this study, the researchers integrated the Shared Display Groupware (SDG) concept with the use of mobile devices to design a learning activity and develop a mobile learning environment. The two-phase seven-step learning activity was designed to examine the characteristics of plants by means of observation and classification of plants. The SDG supports the simultaneous sharing and discussing of information among group members within the mobile learning environment. The system also supports the concurrent use of all individual and group tasks. Each task may be carried out without the interruption to any other ongoing tasks.

The results of the empirical study demonstrated that students positively evaluated on the questionnaire. For example, students reacted positively when surveyed on the convenience of the SDG functions for sharing information and creating a common focus during group discussions. Most students answered that they were willing to use the SDG again. In addition, the results of the learning achievement test demonstrated that students had improved their abilities to create conditions for classifying plants through the support of the SDG together with mobile devices under the learning activity design [8].

The empirical study described in this paper was only a small-scale study with sample consisting of one class and a one-group pretest-posttest design. This limitation may have influenced the validity of the results. Therefore, it is suggested that further studies be undertaken with a large sample, under a two-group experimental design to verify the results described in this paper. Another limitation is that the period of the study was short, which caused a lack time to observe plants and create sufficient conditions for the classification of plants. A significant amount of time was needed for students to familiarize themselves with operations of the SDG in group discussions. Therefore, a long-term experiment is required for examining students' learning effectiveness by using the SDG for the support of the learning activity. In addition, students' comments may also be gathered and analyzed for the improvement of the interface design of the SDG creating a more flexible design for use.

#### **2.4.3. *Transforming teacher education practices with theoretically sound approaches***

Teacher educators need to go beyond the tools' potential to explore pedagogical benefits of mobile learning within their own content areas. This change will help pre-service and in-service teachers realize

the pedagogical advantages of mobile learning that may shift their perspectives toward the integration of mobile devices into their teaching environments. While a number of studies presented the benefits of using mobile devices within field experiences, more research is needed to understand its unique applications as well as its impact on mentor teachers', pre-service teachers', and teacher educators' successful implementation of school-based practicums. To understand the sustained effect of mobile learning initiatives in teacher education programs, teacher educators and researchers also need to conduct longitudinal studies observing classrooms over time as well as enacting pedagogical approaches to mobile devices within actual classroom settings [9].

#### **2.4.4. *Investigating additional strategies for mobile learning integration and expanding data corpus on mobile learning***

Further research needs to investigate how different types of mobile learning projects, time requirements, and site contexts have an impact in the way teachers develop outcomes (e.g., content knowledge, pedagogical skills) and how different types of reflection, observation, design, planning, engagement, and assessment activities affect these outcomes. Based on this synthesis, it is also recommended that interested researchers expand the data corpus on mobile learning and establish its relationship to desired teacher outcomes, such as technological pedagogical content knowledge (TPACK) within mobile learning contexts and address issues endemic to teacher development and education in the teacher preparation phase.

#### **2.4.5. *Using varied research methodologies with diverse and larger samples and reports on trustworthiness***

The majority of the research conducted on mobile learning and teacher education presents best practices and case studies conducted within contexts with limited scope and small sample size. While these best practices reveal critical findings, future empirical research must follow other methodological routes such as design-based research to develop theories within practice and ethnography to understand how mobile learning interacts with social and cultural dynamics in teacher education contexts. The field also calls for studies with diverse and larger samples with rich descriptions of context and trustworthiness to make the findings transferable.

#### **2.4.6. *Developing new models for teachers' professional development using mobile learning***

Research on mobile learning and teacher education technology has mostly investigated teachers learning about mobile technologies rather than learning with them. While a limited number of studies have looked at learning with mobile devices [10] more research is needed to understand how teachers and teacher educators' professional development can be supported with mobile learning. Additional research may also consider how the immersion of teacher educators into CoPs or PLCs helps them engage in a professional conversation about the integration of mobile learning within teacher education contexts, such as sharing stories and best practices, engaging in collaborative resource creation, and helping each other through a mentor or peer support system [11].

#### **2.4.7. *A systemic investigation of mobile learning in pre-service teacher education***

Greater insight into research on mobile learning in specific teacher education contexts has potential to support more system-wide adoptions of mobile learning, where more research is needed. While the research on pre-service teacher education and mobile learning mainly included the investigation of mobile learning as an approach within individual teacher education courses, further research continues to be needed on the systemic investigations of mobile learning within entire teacher education programs. Different ways for mobile learning integration into teacher education can be examined, such as the infusion in practical, special courses (e.g., methods or classroom management), and throughout the teacher education program. Understanding the potential impact of mobile learning that is integrated into the entire teacher education programs and associated challenges and benefits are critical to gaining greater insight into the purposes of various phases of teacher education and the role of mobile learning in each.

#### **2.4.8. *Changes in the m-Learning Configuration of a Secondary School***

Mathematics Service: The Case of Microsoft Math (South Africa)

This paper puts forward a refined theoretical framework for describing the m-learning configurations of mathematics related interventions. The use of this framework is exemplified by describing changes in the Microsoft Math service over time.

The Microsoft Math service adapted its m-learning configurations from services being fully integrate into the formal environment of school learning; to a service designed for independent and voluntary use by individual learners. By continuously designing, evaluating and reflecting on the uptake, use and impact of the service; the offering has changed substantially over time. The m-learning configurations framework has provided a way of describing these changes, allowing for comparison between different versions of same service. It is expected that further revisions or adaptations of the theoretical framework for use in other contexts and outside of secondary mathematics would be necessary. As such this framework is made available for critical review.

### **3. Research Methods**

#### **3.1. Types of research**

This type of research is research and development (R & D). This research is intended to produce a valid product as well as test the practicality and effectiveness of the product. Therefore, the researchers applied needs analysis [3]. This study was used to develop the software learning tool concerning 4-D model (Four-D) [12]. This model consists of 4 development stages namely: define, design, development, and disseminate [13].

#### **3.2. Location and Subject of Research**

This research was conducted in Makassar City in private colleges, namely College of Management Informatics and Computer or STMIK Dipanegara Makassar in the Department of Informatics Engineering. The research subject is software learning tool in the form of teaching materials, semester implementation plan, lecturing unit, and student worksheet. They were then developed according to the 4-D model [12].

#### **3.3. Research Instruments**

To measure the validity and effectiveness of the developed software, a research instrument should also be well developed. The instruments used in this research consist of validation sheet of learning tools software and response questionnaire sheet.

#### **3.4. Data Analysis Technique**

Data that have been obtained from the assessment of expert and practitioner validator, validation sheet of learning tools software, and student questionnaire sheet against learning tools software were analyzed.

#### 4. Results

Based on the research problem which is previously stated, the level of validity of the developed learning tools software at Informatics Engineering department will be described in this section. To answer the problem needs analysis is done in accordance with the model of development of Four D (4-D) development model [12]. Learning tools software in this research is developed based on the 4-D model proposed by Thiagarajan which consists of four stages namely define, design, develop, and disseminate.

##### 4.1. Expert Analysis Results

Expert validation is performed to see the content validity of the draft instrument that has been developed. The steps are taken before the validation is to do the guidance to the promoter and co-promotor. The instrument that has been examined is then validated by one of the trusted validation agencies in South Sulawesi namely the Association of Indonesian Education Evaluation. This agency uses 2 (two) experts who validate the instrument of learning tool software.

Table 1. The Names of the Validators

No	The names of the validators	Positions
1.	Prof. Dr. Alimuddin Mahmud, M.Pd	Professor at Universitas Negeri Makassar
2.	Dr. Pattaufi, M.Pd	Lecturer at Universitas Negeri Makassar

The results of the expert assessment of software learning tools are in the form of Display Software learning tools, teaching materials, semester implementation plan, lecturing unit, and student activity sheet. Description of the results of the expert assessment of the learning tools is described in the table as follows.

Table 2. Description of the results of Expert Assessment of Learning tools software

Learning tools	Indicators	Assessment	Categories
Learning Tool Software	1. Display	3.75	SV
	2. Colour	3.83	SV
	3. Program	4.00	SV
	4. Time	4.00	SV
	5. Material	4.00	SV
	6. Language	4.00	SV
	Average	3.93	SV
Teaching	1. Teaching	3.75	SV

Material	2. material Construct	3.90	SV
	3. Language	3.75	SV
	Average	3.80	SV
semester implementation plan	1. semester implemen tation plan	3.57	SV
	2. Construct	3.50	V
	3. Language	3.57	SV
	Average	3.55	SV
Lecturing Unit	1. SAP	3.50	V
	2. Construct	3.25	V
	3. Language	3.87	SV
	Average	3.54	SV
Students' Worksheet	1. Students' Worksheet	3.66	SV
	2. Construct	3.33	V
	3. Language	4.00	SV
	Average	3.66	SV
Average/total		3.67	SV

Table 2. shows that the display of learning tools software, instructional materials, semester implementation plan, lecturing unit, student activity sheet viewed from the indicators are in "valid" and "very valid" categories. The average score for the display of learning tools software, instructional materials, semester implementation plan, lecturing unit, student activity sheet is invalid category. Both validators conclude that the learning tools that have been developed can be used with little revision.

Based on the results of the analysis of the validity of learning tools, it can be concluded that the learning tools software consisting of the display of the learning tools software, teaching materials, semester implementation plan, lecturing unit, student activity, according to expert assessment has met the criteria of validity, with valid category.

##### 4.2. The Results of Field Test Analysis

The data of the practicality of learning tools software were found through observation sheet of learning tools implementation. The results of observation of the feasibility of the learning tools were analyzed to see the practicality level of the learning tools that have been prepared. Descriptions of each aspect of the feasibility of the learning tools are described as follows.

The average observation of the feasibility of the learning tools regarding the syntax component lies in the fully implemented category ( $1.5 \leq x \leq 2.0$ ). As explained earlier, learning tools are said to be effective if they meet the following criteria. First, the achievement of learners achievement is 80% (minimum score 70 for the range of the score 0 -

100). Second, more than 50% of learners give positive response to learning tools software.

40 students fill results of data analysis of students' response to the implementation of learning. Description of the response results of the students is shown in Table 3. Based on Table 3., it can be seen that the average percentage of learners' response to the implementation of the evaluation using the learning tool software on the Algorithm and programming material as a whole has a value which is greater than 70%. From the overall aspects, the average percentage of learners' response is 93.75%. Based on the results of the analysis, all aspects that are asked in the implementation of learning activities using learning tools software on the learning materials of Algorithm the positive response from students.

Table 3. Description of the Results of Students' Response on the Implementation of Learning Tools Software in Algorithm and Programming Materials

No	Aspects of Students' Responses	Students' Responses (%)	
1	Are you happy or unhappy about the appearance of software learning tools you have used?	<u>S</u> 90	<u>TS</u> 10
Average percentage		90	10
2	Is the appearance in your learning tool software new?	<u>B</u> 100	<u>TB</u> 0
Average percentage		100	0
4	Can you understand clearly or not the appearance of learning tools software?	<u>J</u> 90	<u>TJ</u> 10
Average percentage		90	10
5	Can you understand the appearance of learning tool software?	<u>M</u> 97,5	<u>TM</u> 2,5
Average percentage		97,5	2,5
6	Are you interested with the appearance of learning tools software?	<u>T</u> 92,5	<u>TT</u> 7,5
Average percentage		92,5	7,5
Average		94,43	5,56

Notes:

- S = happy                      TS = unhappy
- B = new                        TB = old
- B = Interested                TB = Not interested
- J = clear                        TJ = unclear
- M = understand                TM = not understand
- T = fascinated                 TT = not fascinated

## 5. Discussion

This section discusses the results of research that includes three things: (1) the achievement of research objectives, (2) special findings, and (3) constraints experienced during the study.

### 5.1. The Achievement of Research Objectives

#### 5.1.1. The Development Process of Learning Tools Software

The software development process of this learning tools used development model (Four-D) which consists of 4 development stages namely: define, design, development, and disseminate (Thiagarajan, 1974).

#### 5.1.2. The Validity of Learning Tools Software

The word "valid" is often interpreted with correct, authentic, and legitimacy. Valid means the instrument (in research development of learning media) which can be used to measure what should be measured [3]. Analysis of suggestions and validation sheets from experts and practitioners is used as a basis for refinement or revision of the initial design of instructional media. It aims to get a valid product. Validity tested in product development is the validity of the completeness of the media, the validity of the content, the validity of the interpretation, the validity of the language, and the validity of the media gradability. A product is said to meet the validity of the content in accordance with the demands of the curriculum. A learning tool is said to meet the validity of the construct when the components of the product are consistent with each other. The validity of the commentary is valid if the relevance of the verse is in accordance with the material. While the validity of the language associated with the use of language in accordance with EYD.

Validity in a development study includes content validity and constructs validity. The validity refers to the extent that the design of the intervention is based on state-of-the-art knowledge (content validity) and that the various components of the intervention are consistently linked to each other (construct validity) [14].

Aspects of validity can be seen from whether the curriculum or learning model developed is based on state-of-the-art knowledge. It also can be seen from whether the various components of the learning tool are consistently related to each other.

The aspect of practicality can be seen concerning the user in which whether experts and practitioners believe that what is developed can be used under normal conditions. It also can be seen from whether the reality shows that what is developed can be applied by teachers and students.

### 5.1.3. *The Validity of Learning Outcomes in Software Learning Tools*

In general, the average score based on the results of the expert assessment of learning tool software according to the results of expert assessment is 3.67. Based on the previously mentioned criteria of validity this value belongs to a very valid category ( $3.5 \leq M \leq 4.0$ ). Therefore, regarding overall aspects of learning tools, the learning outcomes otherwise meet the criteria of validity. Based on the average value of the total assessment or the results of the validation of experts on the developed software is in the very valid category ( $3.5 \leq M \leq 4.0$ ). This means that the learning tool software has been feasible to be tested.

### 5.1.4. *Teaching materials*

Based on the results of the expert assessment in Table 2., the average value of 3.80 is obtained. Based on the previously mentioned criteria of validity, this value falls within a very valid category ( $2.5 \leq M \leq 3.5$ ). Therefore, regarding the overall aspect of teaching materials, it meets the criteria of validity.

### 5.1.5. *Student Activity Sheet*

The average value of expert assessments to student activity sheet is seen from the constructed aspect, the language used and the material or content. The average score is 3.66. Based on the previously mentioned criteria of validity, this value falls within a very valid category ( $2.5 \leq M \leq 3.5$ ). Therefore, concerning the overall student activity sheet, it is stated that it meets the criteria of validity. The overall aspect, as well as each aspect, has met the criteria of validity. However, some expert suggestions need to be considered for the perfection of Student Activity Sheet.

### 5.1.6. *Lesson Plan*

The average score of expert assessment of the lesson plan is seen from the aspect of the constructed format or the presented content, the used language, in the learning. The average score is 3.55. Based on the validity criteria mentioned before, this score falls into a very valid category ( $2.5 \leq M \leq 3.5$ ). Therefore, the overall lesson plan is stated to meet the criteria of validity. Although the overall aspect and each aspect have met the criteria of validity, there is experts' advice that needs to be considered for the perfection of the lesson plan.

### 5.1.7. *Lecturing Unit*

The average total value of expert judgment on the lecturing unit is seen from the aspect of the constructed format or the presented content, the used language. The average score is 3.54. Based on the previously mentioned criteria of validity, this value falls within a very valid category ( $2.5 \leq M \leq 3.5$ ). Therefore, the overall lesson plan is stated to meet the criteria of validity. However, some expert suggestions need to be considered for the perfection of the lesson plan.

Based on the average value of the total assessment or validation results of the experts on learning tools developed which include software learning tools, teaching materials, student worksheet, lesson plan and lecturing unit are in the category of "Very Valid." It means the learning tool has been eligible to be tested.

## 5.2. *Special Findings*

This research was conducted to develop the learning device software on the subject matter of Algorithm and programming to be used in the learning so that the students can receive the lesson well and can improve the students' motivation and learning outcomes with the learning paradigm that gives dominance to the students to construct their knowledge. This makes a difference with other learning devices.

The learning tool software which is successfully designed by using E-learning software program based on Android is expected to solve the problem in learning. The distinguishing feature of learning tools software is designed based on teaching materials, lecturing unit, and semester implementation plan, Student Worksheet, and value assignment to students. Moreover, there is a scoring system conducted by lecturers which can facilitate manual system appraisal.

## 5.3. *Constraints Experienced During Research*

There are several constraints experienced during the development activities, especially in the trial activities of learning tools software. The intended constraints are as follows.

1. Time management that has been allocated still feels challenging to achieve maximally in operating learning tool software. Therefore, it so takes time to provide guidance before the implementation of teaching and learning process.
2. At the beginning of the trial, students are sometimes confused with what to do. This is because students are not used to using learning tool software.

3. At the time the learning process takes place, there are often errors, especially connections on wifi or data packets used to connect to a smartphone or tablet.

## 6. Conclusion

The learning tool software at STMIK Dipanegara Makassar has been developed by using 4-D model Thiagarajan consisting of four stages, namely define, design, develop, and disseminate. The defining stage consists of curriculum analysis, learner analysis, and concept analysis. The designing stage consists of preparation on the subject matter of algorithms and programming, media setting, initial design. Developing stage consists of validation of experts and practitioners, field trials using learning tools software. Disseminating stage means that learning tools software that has been revised then performed a limited stage of dissemination to the Department of informatics engineering STMIK Dipanegara Makassar at the first semester.

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