Development of "Image Processing" Practical Learning Model On Diploma Program Informatics Engineering Department

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Abstract. This research was conducted by students of Informatics Engineering diploma program at the Teachers' Training College in Central Java. This study uses a research model for the development of a 4D model learning system. Before the research was carried out the initial needs analysis on the Practical Image Processing learning that took place so far in the Informatics Engineering diploma program. This research aims to find out the suitability of the practice learning model needed by the industrial world. The results of the initial needs analysis show that the practical learning model is needed by students in improving the ability and skills of the Image Processing field. The stages in developing practical learning use 4D as follows: 1) defining; 2) design; 3) development; 4) dissemination. The four stages include: a) lecturer and student observation; b) designing teaching materials; c) design of practicum modules; d) designing practicum instructions; e) designing practicum tools; f) validation of teaching materials experts, practice modules, media practice tools; g) limited trial. In this study is still in the development stage, for the dissemination phase in further research. In the desimanation stage is a wide dissemination stage of the results of the design of practical learning models

1. Introduction
Education and the industrial world today has become an inseparable relationship with one another. The dependence of the industrial world on the real world of education as well as vice versa. The industrial world requires educated workers who have the skills, abilities and skills in running the industry. The output of educational institutions is needed by the industrial world, in other words graduates from educational institutions as workers in the industry. The role of educational institutions as a place for the educational process in building human resources is very important. The use of appropriate learning methods in printing ready-to-use power is also very influential. Learning model is a pattern or structure of learning that is structured and designed, determined, and systematically evaluated to achieve the learning objectives desired by educators. The term model itself can be interpreted as a form of imitation of the actual object. Models can also be interpreted as a conceptual or procedural example of a program, system, or process that can be used as a reference or creative guidance in meeting the needs of students.
The diversity of forms of educational institutions will harmonize educational goals and the needs of the industrial world. The diversity of forms of higher education level institutions makes it easy for prospective students to choose the type of education that suits their wishes. The selection of educational institutions is strongly influenced by the trends and prospects of the workforce.

The education that is the prospect of the world of work today is bringing together Technical Education and Vocational Education, known as TVE (Technical and Vocational Education), while TVE itself is a type of formal education that provides work provision at school and campus. As time passes for the provision of working provisions cannot be done through formal education alone, it is necessary to provide work supplies also need to be facilitated through non-formal and informal training. Therefore, the concept of education and technical and vocational training and the name Technical and Vocational Education Training (TVET) emerged. For educational institutions that cover the above, it is available in educational institutions called Polytechnics and Academics in accordance with the forms of implementation in Indonesia [1].

2. Research Method

Models can be interpreted as an object or concept in the form of a graphic display, regular and systematic work procedures, and contain explanatory thoughts. The development model is the basis used for product development to be produced. An effective development model demands conformity between the approaches used with the products to be produced. The development model that will be planned in this study follows the flow of the Four D development model [2]. The main stage of Model D is: Define, Design, Develop, and Disseminate, which is defining, designing, developing, and disseminating. The application of the main steps in research not only traces the original version but is adapted to the characteristics of the subject and place of origin to examine. In addition, the model will be followed and adapted to the development needs in the field. The development model that will be planned in this study follows the explanation flow of each stage below [2].

2.1 Development with 4D Model

2.1.1 Stage I: Define

The researcher observes the lecturers of Image Processing practice through interviews and defining in this case, among others, to define and define the needs in the learning process of the Image Processing course. In this case the researcher conducted a preliminary study by observing lecturers through interviews and students through questionnaires. Students undertaking the Informatics Engineering Education Study Program are involved as key information because the most competent to reveal the real conditions of the impact to know the real problems in the field [2].

2.1.2 Stage II: Design

The purpose of this phase is to design teaching materials or teaching materials, practice instructions, practice modules and Image Processing practice tools so that prototypes of teaching materials, practice instructions, practice modules and Image Processing practice tools are developed. Activities at this stage are media selection, format selection, and initial design [3].

2.1.3 Stage III: Development

The development phase aims to produce a final draft that is good in the form of teaching materials, practice instructions, practice modules and a revised Image Processing practice tool based on expert input and data obtained from field trials. This stage includes the validation of teaching materials by experts.
followed by revisions, and then the implementation of the trial. The results of validation and trial will be used as a basis for revision [6].

2.1.4 Stage IV: Disseminate
At this stage the product in the form of teaching materials, practice instructions, practice modules and Image Processing practice tools are tested in real class on a larger scale or referred to as field trials. The actual product trial was carried out to find out the effectiveness of the model developed using the product in the form of learning devices [2].

Flowchart of the development of learning tools 4D, can be described in full as follows:

![Flowchart of the Four D Model implementation](image)

**Figure 1.** Flowchart of the Four D Model implementation [2].

3. Results and discussion
3.1 Results Phase I: Define
In this preparation stage, observations were made with recap of the results of observations of Image Processing practice conducted by Informatics Engineering lecturers as many as 10 people and the level of understanding of students with a total of 30 students is as follows:

| No | Learning Method                           | User Lecturer Presentation | Student understanding points |
|----|------------------------------------------|----------------------------|------------------------------|
| 1  | Lecture-based learning (theory)          | 55%                        | 20%                          |
| 2  | Practice-based learning                  | 13 %                       | 55%                          |
| 3  | Theory and practice based learning       | 12%                        | 65%                          |
| 4  | Learning by discussion method            | 8%                         | 20%                          |
| 5  | Problem-based learning                   | 10%                        | 12%                          |
| 6  | Experience-based learning                | 2 %                        | 6%                           |

Table 1. Recapitulation of the results of Observations on lecturers of Image Processing Course
3.2 Phase II Results: Design

The purpose of this phase is to design teaching materials, teaching materials, practice instructions, practice modules and Image processing practice tools. Draft teaching materials designed contain [3]: 1) Image management in Matlab; 2) basic operation of digital image processing; 3) Boolean operations; 4) Operation of Convolution geometry; 5) Filter and restoration; 6) Image segmentation; 7) Image morphology; 8) Color processing; 9) Image acquisition Image transformation; 10) Discrete wavelet transforms; 11) Image watermark. The draft lab manual contains: 1) Laboratory rules and regulations; 2) Rules of practicum Image Processing in a multimedia computer laboratory; 3) Guide to report writing; 4) Matlab Program; 5) Basics of Matlab; 6) Adventure in Matlab. The Draft Practice Module [5] Image Processing is as follows: 1) Image management in Matlab; 2) basic operations of digital image processing; 3) Boolean operations; 4) Operation of Convolution geometry; 5) Filter and restoration; 6) Image segmentation; 7) Image morphology; 8) Color processing; 9) Image acquisition Image transformation; 10) Discrete wavelet transforms; 11) Image watermark. For the design while the media practicum tools use personal computers with specifications: Processor Cor i3, 8 GB RAM, Hard disk: 500 GB, USB Microscope.

3.3 Results Phase III: Development

The development phase aims to produce a final draft that is good in the form of teaching materials, practice instructions, practice modules and Image Processing practice tools that have been revised based on Validation and expert input, based on the rating scale criteria [5]: 1 (not good), 2 (less good), 3 (good enough) and 4 (very good).

| Table 2. Recapitulation of the Validation Results of Teaching Materials Experts |
|-----------------------------|----------------|----------------|------------------|
| Validator                  | Score category obtained | Total number of scores | Expert Revision Note |
| User Lecturer Presentation |                               |                      |                   |
| Student understanding points |                               |                      |                   |
The results of expert validation of the material carried out by two material experts contained several notes for improvement from the draft material supporting the learning of Image Processing practices.

**Table 3. Recapitulation of Practice Module Expert Validation Results**

| Validator | Score category obtained | Total number of scores earned | Expert Revision Note |
|-----------|--------------------------|-------------------------------|---------------------|
| First     | - - 7 33 165            |                               | More varied assignments, Addition to practice variations |
| Second    | - 1 5 34 170            |                               |                     |
| Jumlah Skor Maksimum | 200 |                               |                     |

The results of the validation of the practice module and practicum instructions by two experts have some improvement notes from the validator. The assignment of the lab module draft is still limited to the introduction of image processing and the variety of practices that are carried out need to be added to the development of student skills and expertise.

**Table 4. Recapitulation of Media Practices Tool Validation Results**

| Validator | Score category obtained | Total number of scores earned | Expert Revision Note |
|-----------|--------------------------|-------------------------------|---------------------|
| First     | - - 2 38 190            |                               | Media retrieval is more varied |
| Second    | - - 4 36 180            |                               | The Matlab program is always updated |
| Jumlah Skor Maksimum | 200 |                               |                     |

The results of the media expert validation of the practical tool by two experts, there was an improvement of the previous form of media practice tools. Using a USB Microscope can be replaced with a digital camera or web cam. For supporting software must always be updated according to the development of science and technology.

**Table 5. Limited trial results (30 students)**

| Aspect   | Activity | Enhancement |
|----------|----------|-------------|
|          | Trial I  | Trial 2     |             |
| Cognitive| 30%      | 48%         | 98%         |
| Skills   | 25%      | 45%         | 95%         |
| Creativity| 15%      | 29%         | 98%         |
| Activeness| 25%      | 47%         | 96%         |
| Average  | 24%      | 42%         | 97%         |
The average increase in each aspect of the trial conducted can be seen in the graph below:

![Graph showing the comparison of trials 1 and 2](image)

**Figure 4.** Comparison of the results of Trials 1 and 2

From the graph above, the improvement of each aspect shows the increase experienced by students in mastering the image processing expertise. Limited testing done before extensive testing, to see the feasibility of practical learning models.

### 3.4 Results Phase IV: Disimination

At this stage, testing of teaching materials, practice instructions, practice modules and Image Processing practice tools in the real class is carried out. The trial was conducted on students of the Informatics Education Study Program of the Central Java Veterans Teachers' Training College. This trial is still ongoing, so that the effectiveness of practical learning models that have been developed by using products in the form of learning devices is not yet known.

### 4. Conclusion

- Teaching Materials, Modules of practice, practice guidelines, and modified media practice tools greatly influence the improvement of the ability and skills of student image processing expertise
- The response of students to positive teaching materials for almost all aspects with the lowest percentage in trial I was 15% for the category of creativity. Furthermore, the lowest percentage in trial II was 29% still for the category of sensitivity.
- The model of practical learning development can be developed by combining the field of artificial neural network expertise for industrial automation needs.

### 5. Reference

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