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Farihah
Universitas Negeri Medan, Indonesia

Samsidar Tanjung
Universitas Negeri Medan, Indonesia

Dina Ampera
Universitas Negeri Medan, Indonesia

Harun Sitompul
Universitas Negeri Medan, Indonesia

Ismail Jahidin
Universitas Negeri Islam Sultan Syarif Kasim Riau, Indonesia

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Development of 3D-based Learning Modules for University Students

Farihah, Samsidar Tanjung, Dina Ampera, Harun Sitompul, Ismail Jahidin

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Abstract

Some lecturers need suitable learning media and strategies in the learning process so that learning is effective. Previously, lecturers only used book media, *handouts*, and whiteboards as media, and only certain materials used media. It is also known that the obstacles in using media because there are still many lecturers who do not have the expertise to develop and use media and are not even familiar with computer technology, so learning strategies are implemented conventionally. The learning system is centered on lecturers delivering learning materials with lectures and further demonstrations of lecturers giving assignments or exercises to students. This research aims to know whether the development of 3D-based learning modules with direct learning strategies in Pattern Construction courses is worth using for students in the Department of Fashion Education at Universitas Negeri Medan and to find out whether module learning based on 3D with direct learning strategies in the Pattern Construction course is effectively used by the students.

Introduction

Education is an effort to realize future development through expanding potential and improving human resources quality. The concept of education will feel increasingly important when entering life in society and the world of work; therefore, every country seeks to advance its country by improving the quality of education as well as the Indonesian state, which participates in improving the quality of education, starting from the level of primary education to education in higher education. Improving the quality of education through vocational education can prepare graduates with advantages in the world of work and are expected to contribute a lot to society, nation, and country. The quality of Fashion graduates applies double sizes, namely quality according to school size or *in-school success standards* and quality according to community size or *out-of-school success standards*. The first criterion includes aspects of learner success in meeting curricular demands that have been oriented to the demands of the world of work. At the same time, the second criterion includes the success of skilled learners in the ability to show work by national or international learning outcome standards after they are in actual employment.

The success of increasing human resources through education is supported by a good learning process so that students acquire skills and values that meet national standards. According to Syah (2012), several factors can affect the learning of students who are divided into three kinds, namely: internal factors of the self in the student, external factors from outside the student self, the next factor is the approach *to learning (approach to learning*), namely the ethnicity of learning students who include strategies, models, media used and this, of course, requires lecturers who can teach. In this regard, Sanjaya (2013) stated that lecturers as educators have an essential role in the learning process, namely 1) as a learning resource, 2) as a facilitator, 3) as a manager, 4) as a demonstrator, 5) as a guide, 6) as a motivator. While learning is a conscious effort from a lecturer to direct students with good interaction and supported by learning resources delivered by lecturers professionally and effectively to achieve the expected goals.

Especially at this time, information technology has progressed rapidly. Teachers should be more open to mastering information technology to support the creation of an exciting learning process, efficiency, and the creation of learning goals. As for the media that is still often used by lecturers, namely print media (books, modules, and other teaching materials) and the use of *whiteboards* and markers as different media, but not all materials are adequately explained with print media, it would be better if lecturers have the motivation and innovate to move from lecturer habits. So far, which is too comfortable with the use of media soberly and increases creativity to create exciting learning by following the current technological developments, and it will be even better if learning with the use of media is supported by the right learning strategy so that what lecturers convey can be understood to the maximum.

Through the learning results, if students do not achieve maximum learning value, this does not mean that students cannot draw pattern constructions. It is suspected that many more factors cause low results of learning pattern construction, such as factors from within the students, including physiological factors, interests, talents, and motivations. Factors outside the student self are learning models, learning media, learning facilities and infrastructure, learning resources, approaches, techniques, tactics used during the teaching and learning process, and learning strategies. However, the low learning outcomes the researchers can get from the observations made are due to the lack of media utilization. It causes a less interested and communicative learning atmosphere, making students less motivated to learn and having difficulty understanding every step in the Pattern Construction course.

Pattern Construction course is ongoing learning of one complex unit in the learning process demands students can do work step by step so that learning goals are realized as an example for fashion pattern drawing materials, usually done with *handout* media and with demonstrations that only focus on lecturers. When learning takes place, students cannot understand clearly and cannot repeat the process properly and correctly. Therefore, this leads to researching to create learning media, making it easier and more motivating to learn independently and repeat.

Learning must be carried out optimally so that all indicators are achieved. It is not only supported by lecturers who can create learning conducive to students but also needs improvement so that students are more motivated and active in pattern construction learning. Students quickly understand the material and improve learning outcomes. One of the efforts that can be made is by using learning media. Learning media is expected to help lecturers deliver subject matter so that learning can run effectively and efficiently and students can understand pattern construction learning concepts more quickly.

Munadi (2012) states that learning media can be understood as everything that can convey and distribute messages from sources in a planned manner to create a conducive learning environment where the recipient can carry out the learning process efficiently and effectively. Thus, the purpose of media utilization in the learning process is to streamline and streamline it. Learning media allows students to adjust the speed of mastering learning. In contrast to direct learning, the speed of learning comprehension is generally determined by lecturers, so it is seen that learning media is very influential in the effectiveness and efficiency of learning.

Learning effectiveness is facilitated by developing computer technology, especially software that supports learning programs. As stated by Heinich, Molenda, and Russell (1996), *computer systems can deliver instruction by allowing them to interact with the lesson programmed into the system: this is referred to as computer-based instruction*. Computer systems can convey learning individually and directly to students by interacting with materials programmed into computer systems, which is called computer-based learning.

This research developed Pattern Construction Learning Media using *3D* (*Three-Dimensional*) Software that serves to overcome weaknesses in learning media. The advantages of media that will be developed are media using *3D software* that is packaged multimedia. Handoyo and Suharto (2003) said multimedia is the presentation of information in the form of text, images, and sounds together (*integrated*) to become effective and efficient. Multimedia can stimulate the human senses and affect learning outcomes. Munir (2008) revealed that approximately 90% of a person's learning results are obtained through sight, 5% through hearing, and 5% through other senses.

Thus, the appearance of learning media for students that are packaged multimedia will be more interesting because there are animations and examples of videos, sounds, and images, so it is assumed that the presence of these media can improve the lack of media that has been used. Through learning media using *software* (*Three-Dimensional*), it is hoped that students' interest in learning will be increased and motivated to follow pattern construction learning.

Based on this fact, the author realized the importance of developing learning media for pattern construction courses. With the development of this media, it is expected to help lecturers present better and more attractive materials so that lecturers and students do not depend only on lecturers. This research is an effort to develop a 3D-based learning module (*Three-Dimensional*) and direct learning strategies in its application to the Pattern Construction study program for the Fashion Study program of Medan State University.

Literature Review

The Essence of Pattern Construction Courses

Patterns are pieces of paper that are prototypes of clothing parts or sewing-sewing products. Pratiwi (2001) states that patterns are pieces of cloth or paper that follow a specific size or body shape. It is supported by the opinion of Muliawan (2002), who defines patterns or patterns in the field of sewing as a piece of cloth or piece of paper used as an example to make clothes when materials are rolled. The pattern is an example, so there are no errors when cutting the fabric. In addition to wearing homemade patterns, people can sew at home using ready-made patterns (finished patterns) published by women's magazines.

The pattern is initially in the form of muslin cloth or paper completed on the sewing doll. For the flat material to follow the body's shape, some pleated must be made. A pleated shape is called pulpit kup or pleated fast or pleated knit. Then in places of the sleeve cage, the neck cage and waistline are shaken precisely according to the shape. The joints on the shoulders and sides are called the shoulder lines and sidelines. Trace body shape becomes the clothing archetype, and this method is often referred to as disallowing, or many call it draping (Muliawan, 2002).

Optitex PDS-10 Computer Pattern (Pattern Design System)

A computer pattern system is a process of creating patterns using software programs on the computer in various predetermined ways. The software used in the fashion design process is comprehensive and diverse because computer design provides various image processing programs and layouts.
Some software is used to create computerized patterns, including Richpeace, Optitex, Gerber, Lectra, and GGT. A clothing pattern (pattern) is the shape or image of the clothes' components or parts based on the determined size (measurement). The pattern image (pattern) consists of a straight line (line), curved line (curve), and other signs or images, such as button marks (buttons), kupnat marks (darts), pleated marks (pleats), and fiber direction (baseline). The patterns that need to be considered are the grading point and curve point (Miyoto, 2011).

Computer patterns also have their advantages and disadvantages. The advantages of computer patterns namely: (1) The time required to make patterns is faster than construction patterns, (2) Can create a large number of patterns at a time because patterns can be directly copied on the computer, (3) To enlarge or reduce the size can be quickly done, because there is a grading menu that can be operated according to the instructions, (4) The size on the pattern is more precise, and (5) The process of arranging patterns can be done quickly on top of the material, so you can know how many materials are needed in the manufacture of fashion. The shortcomings of computer patterns, namely: (1) Expensive software, resulting in not everyone being able to make patterns using computer patterns, (2) Patterns made tend to use standard patterns so that the resulting fashion does not match the wearer's body, (3) To break patterns or on curved parts, the level of flexibility of the curve tends to be stiff or less flexible.

Optitex is software that has been designed to create computerized patterns that have been programmed on a computer. Optitex has several main programs, including Pattern Design System (System Design Pattern), Marker (Material Design), Grade (Class), Modulate (Modulation), and others. However, in this study, the program used from Optitex is PDS version 10 (Pattern Design System). The process of creating computerized patterns can use PDS (Pattern Design System) by opening the menu facilities and toolbars provided on the computer screen. Afterward, the pattern creation process can be carried out according to predetermined instructions. PDS, used as the software to design and develop this pattern, has an advantage in its creation, where the pattern can be efficiently designed from scribbles or by changing/modifying the style that has existed before. Optitex PDS-10 displays on the computer screen in the form of menus, toolbars, pieces, and working areas (see Figure 1).

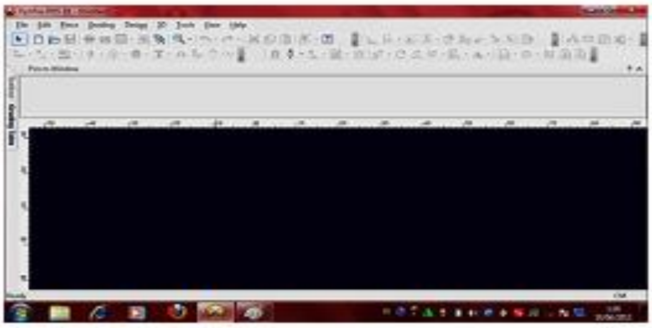

Figure 1. Optitex Display (Miyoto, 2011)

Computer Pattern Creation Steps (Optitex PDS-10)

PDS-10 (Pattern Design System) is the creation of patterns using a computer through pre-programmed software, namely Optitex PDS-10. For making patterns using a computer, several stages must be done with Optitex after defining working units that can only be used to create patterns.

Determining Working Units

Before creating a computerized pattern, every pattern maker must know the working units in the Optitex PDS-10 software. Working units are units of measure of work in pattern making. The working units consist of: Millimeters, Centimeters, Meters, Inches, Feet, and Yards (Miyoto, 2011). Here are the steps to determine working units:

a. Click Tools from the menu and then Preference (see Figure 2).

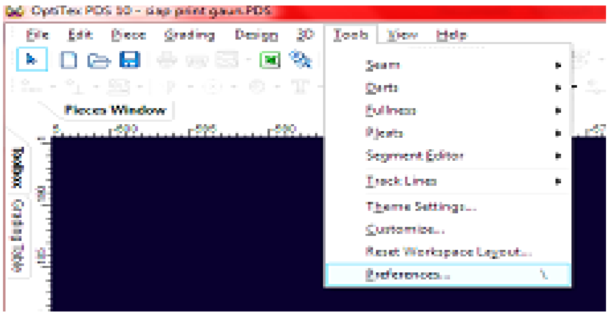

Figure 2. Steps to Define Working Units (Miyoto, 2011)

b. Click Main and then highlight the Working Units menu (see Figure 3).

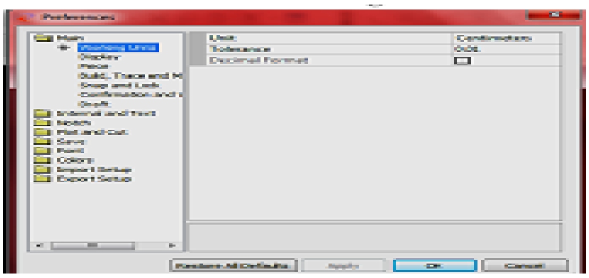

Figure 3. Steps to Define Working Units (Miyoto, 2011)

c. Fill in the work unit on the Unit line by selecting the available work units. Then click centimeters and fill in the tolerance, how many digits behind the comma, on the Tolerance line (see Figure 4).

Figure 4. Steps to Define Working Units (Miyoto, 2011)

d. Make sure the working units are filled, click Apply, and click Ok (Miyoto, 2011) (see Figure 5).

Figure 5. Working Units Display (Miyoto, 2011)

Creating Computer Patterns

After determining working units, the next in computerized pattern creation is to determine the piece. Here are the steps to create a computer pattern:

a. Click piece on the Highlight menu or block on the New Piece, and then click on the Create a Rectangular Piece icon (for rectangular shapes). Once clicked will appear as follows (see Figure 6):

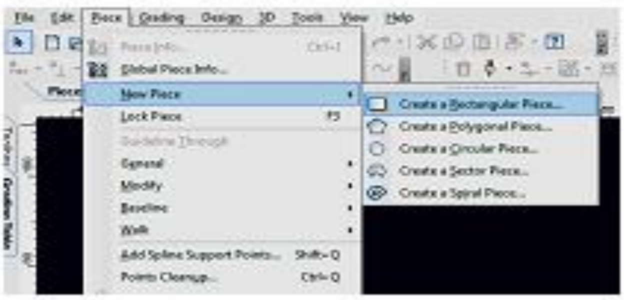

Figure 6. Step View Creates Pattern (Miyoto, 2011)

b. Write the pattern's name to be created on the Piece Name line. Write the length on the Length line and the width on the Width line (see Figure 7).

Figure 7. Step View Creates Pattern (Miyoto, 2011)

c. After that will appear the following image: (Miyoto, 2011) (see Figure 8).

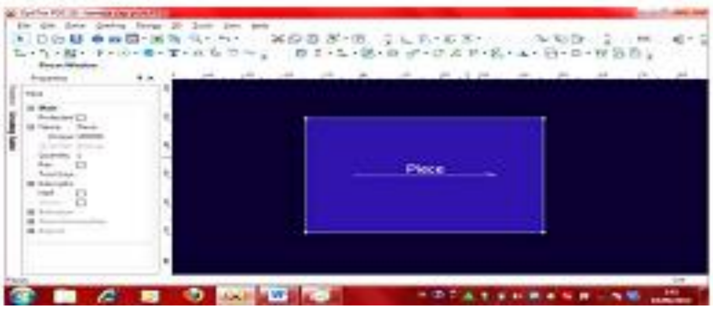

Figure 8. Step View Creates Pattern (Miyoto, 2011)

In computerized pattern making, two kinds of points must be considered: curve points (curve points) and Grading points (value points). The grading point is a point when developed (made into several sizes) that must be given a value. Most grading points are located at the corner or angle of the image, and they can also be in the middle of the line, both in a straight line and a curved line. Below is an example of a grading point and curve point (see Figure 9):

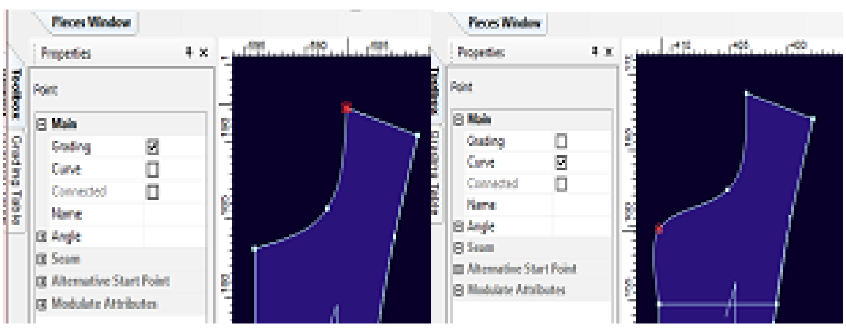

Figure 9. Grading Points and Curve Points (Miyoto, 2011)

Making Party Shirts and Dresses using Patterns

Computer PDS-10 (Pattern Design System) Pattern-making computerized PDS-10 (Pattern Design System) is the creation of patterns using a computer through software programmed on the computer, namely Optitex PDS-10. Below is the basic pattern of computerized party shirts and dresses. The pattern system used is the same as the construction pattern system or manual that distinguishes the working process of making the pattern and its media.

1) Shirt Archetype

The first step in creating a shirt pattern is determining working units and pieces (see Figure 10).

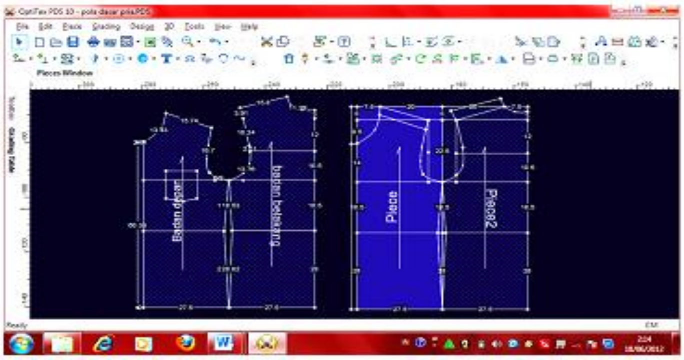

Figure 10. The Base of the Shirt Body

2) Party Dress Archetype

To create a party dress pattern, working units and pieces should be determined (see Figure 11).

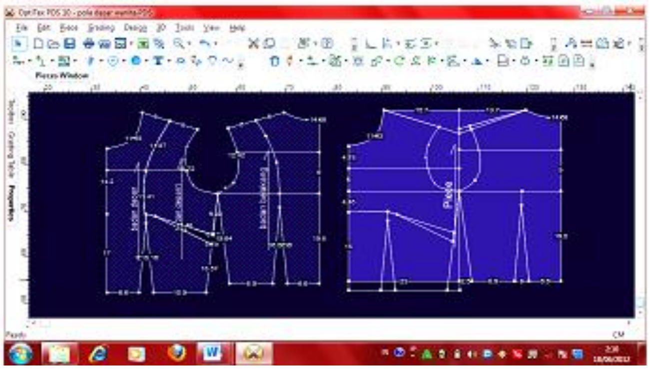

Figure 11. An Archetype of the Female Body

Methodology

This study was carried out in the Pattern Construction Course of the Department of Fashion Education, namely using the development of Dick and Carry Models in the Pattern Construction course. The stages of development are as follows:

1. Conduct preliminary research, including (a) identification of learning needs and determining the competency standards of courses, (b) conduct a learning analysis, (c) identify the initial characteristics of the student, (d) write essential competencies and their indicators (e) write benchmark reference tests, (f) devise learning strategies realized in the form of syllabuses and Learning Plans related to, and (g) develop learning materials.
2. Collection of materials which include: (a) collection of materials /materials, (b) the manufacture and collection of images and animations, and (c) recording and collecting audio.
3. Creating software design which includes (a) creating software design, (b) scripting, (c) *creating a storyboard, and* (d) creating *flowcharts.*
4. Developing and creating learning media includes: (a) learning instructions (opening), (b) brief descriptions, (c) essential competencies, (d) material descriptions, (e) summaries and bibliography, and (f) questions about exercises and returns.
5. Review and trial of products phase I, phase II, phase III.

Furthermore, the data collected from product trials determine the feasibility and attractiveness of products developed before use in the field by the development design used. The data types unearthed are (1) aspects of learning and truth of content obtained from expert materials and design of learning models, (2) learning attraction obtained from student activities and responses during learning trials with three-dimensional modules using the Optitex application on Pattern Construction courses.

Data collection instruments in this development are in the form of assessment instruments to assess products that have been developed. The main instrument used to collect data in this development is questionnaire sheets on pattern construction competencies. The instruments used are (1) questionnaire sheets for lecturers and students, (2) questionnaire sheets for material experts; used to obtain quality data on learning materials and development of aspects of the learning delivery system, (3) questionnaire sheets for learning design experts; used to obtain data on the quality of learning and technical design from products in the form of Pattern Construction learning development design by learning design experts, and (4) observation test sheets; which are used to obtain data on Pattern Construction learning outcomes.

Findings

The development of 3D (Three dimensions)-Based Pattern Construction Modules in the Department of Fashion Education in the Pattern Construction course is carried out gradually. The initial process in this research and development is conducting a needs analysis and collecting data. The activity is carried out to obtain data on the teaching and learning process, students' characteristics and learning needs, problems that exist in learning, and media development needed during the learning and teaching process.

The needs analysis stage is carried out in the Fashion Education Department by researchers distributing questionnaires to research subjects, namely students and lecturers of pattern Construction courses. The results of the needs questionnaire research distributed to 3 lecturers of pattern Construction courses said that 100% of learning media in three-dimensional-based modules had never been used in pattern construction courses.

Therefore, media development is needed in the form of three-dimensional modules with Optitex applications in Pattern Construction courses to improve more effective and exciting learning.

The media program developed as a whole discusses how to change fashion patterns according to design. The target of this learning media product is students taking pattern construction courses. Three-dimensional module learning media products using Optitex software programs can be operated on computers with minimum specifications without installing programs. The learning media production process uses Optitex software programs and other supporting programs that help in creating backgrounds, backgrounds, effect sounds, text animations, or image animations. The use of three-dimensional-based modules with the Optitex application program on pattern-making learning media aims to create interactive and exciting learning conditions, motivation, and students' learning interests and improve learning outcomes on pattern construction learning. Hopefully, with this media, students can change fashion patterns according to design.

Results of Media Expert Validation

As shown in Table 1, materials experts assess the development of three-dimensional (3D) modules with Optitex applications in pattern construction courses based on the three aspects above, namely the aspect of program display with an average percentage of 90%, efficiency aspects with an average percentage of 80%, and technical quality aspects, program effectiveness with average (90%). Overall, all three aspects are in the "Excellent" criteria with a percentage (of 86.67%).

Table 1. Results of Average Percentage Assessment of the Development of Three-dimensional (3D) Modules with the Application of Optitex Pattern Construction Courses by Media Experts

No	Indicators	Average Percentage (%)	Criterion
1.	Aspects of program appearance	90	Excellent
2.	Efficiency aspects	80	Good
3.	Aspects of technical quality, the effectiveness of the program	90	Excellent
Average		**86.67**	**Excellent**

The results of the percentage of media expert research can be seen in Figure 12. Based on the assessment of media experts, the development of three-dimensional (3D) Modules with Optitex applications in pattern construction courses is "excellent" and worthy of use in the learning process. However, there are some suggestions and inputs to improve the feasibility of learning media products. The results of the analysis of suggestions and inputs submitted by media experts are as follows:

1. Image selection should be high resolution.
2. It is necessary to add a button to the Optitex application.
3. The use of animation in Optitex software is obvious.
4. Adjust the layout of images, letters, and arrangements on learning media products.

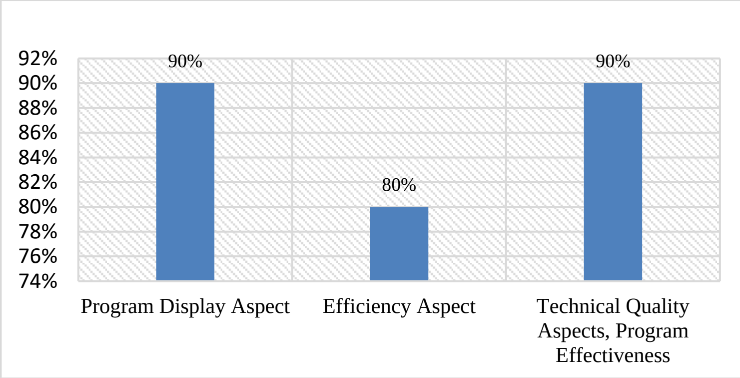

Figure 12. Empirical Score Development of Three-dimensional Modules (3D) with Optitex Application on Pattern Construction Courses by Media Experts

Results of Material Expert Validation

The development of three-dimensional (3D) modules with Optitex applications in Pattern Construction courses has two aspects: the educational aspect with an average percentage of 94%, and the aspect of material accuracy with an average percentage of 85%. Overall, both aspects are included in the "excellent" criteria with a percentage of 89.5%. The average results of the percentage of assessments by material experts can be seen in Figure 13.

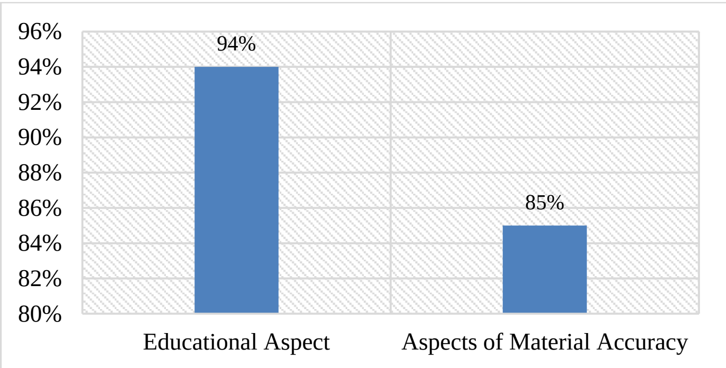

Figure 13. Empirical Score of Three-dimensional (3D) Module Development with Optitex Application on Pattern Construction Course by Materials Expert

Based on the assessment of the material, the development of three-dimensional (3D) modules with Optitex applications in the Pattern Construction course was considered "excellent" and worthy of use in the learning process. However, there were some suggestions and inputs to improve the feasibility of learning media products. As for the analysis of suggestions and inputs put forward by learning material experts as follows:

1. Pattern lines are less clearly visible in pattern applications.
2. The way to make patterns is good, but the Optitex application is too fast, so students should be given more opportunities to follow the application. Then, the teacher should add a *pause* button to the application to reward students for trying.
3. Before the pattern creation application is displayed, the design analysis is first explained.

Results of Small Group Trial

The analysis of small group trial data on each aspect of the overall assessment was determined from the average score in their respective categories. The results were then analyzed to determine the shortcomings of three-dimensional (3D) module products with the Optitex application in the Pattern Construction course. The average results of the percentage of small group trials conducted by five students include the attraction aspect, the difficulty level aspect, the display aspect, and the benefit aspect, showing the average results of the small group trial response assessment based on four aspects, namely the attraction aspect with a percentage of 61.33%, the difficulty level aspect with a percentage of 62%, the display aspect with a percentage of 61.6%, and the benefit aspect with a percentage of 66% (see Figure 14). Overall, in the "Enough" criteria with an average percentage of 63%.

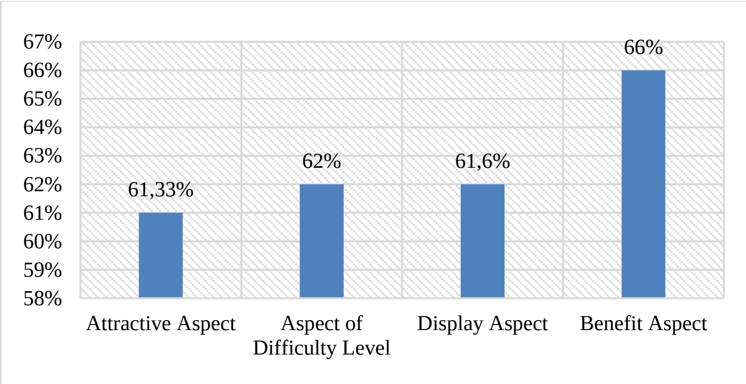

Figure 14. Empirical Score of Three-dimensional (3D) Module Development with Optitec Application on Pattern Construction Course in Small Group Trials

Results of Medium Group Trial

The results of the percentage assessment of medium group trial responses in 15 Fashion students were based on four aspects, namely the attractiveness aspect with a percentage of 76%, the difficulty level aspect with a percentage of 70.67%, the display aspect with a percentage of 74.66% and the benefit aspect with a percentage of 76.66% (see Figure 15). Overall, the "Agree" criteria had an average of 74.49%.

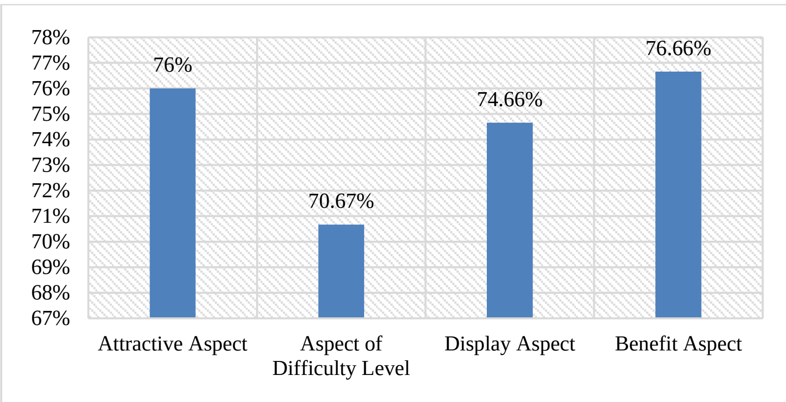

Figure 15. Empirical Score on the Development of Three-dimensional (3D) Modules with Optitex Applications on Pattern Construction Courses in Medium Group Trials

The results of the assessment of the development of three-dimensional (3D) modules with the application of Optitex in the Pattern Construction course are expressed "agree" and can be continued in large group /field trials.

Results of Large Group/Field Trial

The results of the percentage assessment of large group trial responses in 31 Fashion Education students based on four aspects, namely the attractiveness aspect with a percentage of 92.67%, the difficulty level aspect with a percentage of 87.5%, the display aspect with a percentage of 91% and the benefit aspect with a percentage of 91% (see Figure 16). Overall, the criteria "Strongly Agree" with an average percentage of 90.54%. The percentage of large group/field trials can be seen in the figure.

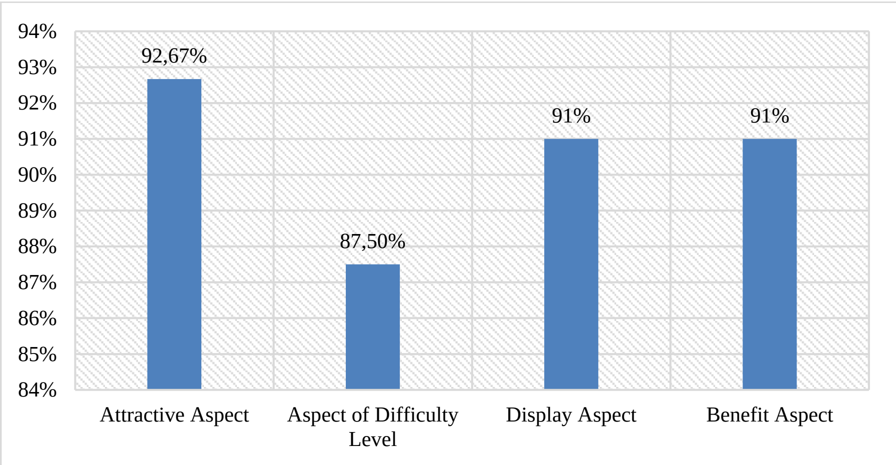

Figure 16. Score against the Development of Three-dimensional (3D) Modules with Optitex Applications in Pattern Construction Courses in Large Group/field Trials

In the assessment of the development of three-dimensional (3D) modules with the application of Optitex in the Pattern Construction course, in general, the response value of students is considered very agreeable, so no more revisions are carried out. This result can be seen in small, medium, and large group trials from the student responses (see Figure 17).

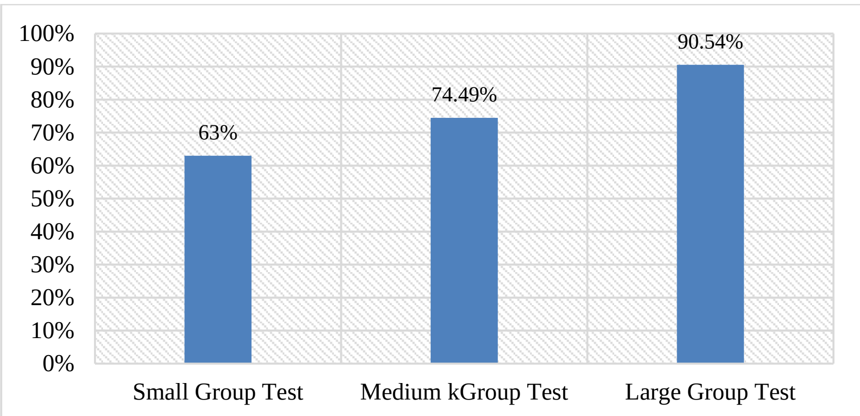

Figure 17. Small Group Test, Medium Group Test, and Large Group Test

Based on the results of the effectiveness of the development of three-dimensional Modules with the Optitex application in pattern construction courses, which were distributed to 3 lecturers of Pattern Construction courses, it was concluded that the three-dimensional module with the Optitex application on the pattern construction course increased students' learning interest in pattern making learning, the lecturer stated 100% "strongly agree ."Based on the analysis of effectiveness test data in students and lecturers, it can be concluded that the development of three-dimensional Modules with the Optitex application in the pattern construction course is effectively used in learning activities to motivate students in learning, which will lead to increased learning outcomes.

Three-dimensional Module products with Optitex applications in the developed pattern construction courses supplement pattern construction teaching materials with the competence to change patterns according to design. The development of this learning media is carried out in several stages using the development model developed by Borg and Gall. The stages carried out in this development research include: identifying potentials and problems, data collection, media design, media validation, small group trials, media revisions, medium group trials, media revisions, large group trials, and media production.

At the stage of identifying potentials and problems, researchers conduct a needs analysis to lecturers who study pattern construction courses by providing questionnaires of needs and making observations to lecturers of course holders to find out the implementation of pattern construction learning, the curriculum used, the use of learning media in pattern construction learning, and determining the material in the media to be developed. In developing the three-dimensional module with this Optitex application, the material explained is used to change the pattern with competence, namely, changing the patterns of the blouse, the shirt, and the skirt according to the design. The overall competency is a competency that must be achieved in one semester.

The next stage of development is designing and producing the initial product in the form of three-dimensional Modules with Optitex applications with pattern-making materials. Before media products are produced, the pre-production stage needs to be done, including compiling an outline of the media program and *flowchart*. In the development of three-dimensional modules, the outline of the media program serves to determine the title, objectives, and subjects of the material to be poured into the learning media product. One of the psychological principles in creating media is the organization of content (Arsyad, 2013). So, the development of interactive multimedia will be arranged and organized in several sequences outlined in *the flowchart* (flowchart). The order of presentation of learning materials starts from core competencies, essential competencies, indicators, goals, tools, and materials for pattern making, material from each sub-competency, namely shirt, skirt, and blouse materials, how to make patterns, evaluations, and summaries.

The interactive multimedia production stage follows the pre-production stage. Creating patterns using software programs on the computer in various predetermined ways. Software used in the fashion design process is very diverse because computer design provides various image processing programs and layouts. The software experienced very rapid development until, in a matter of months, there was an increase in the version of the existing series or the emergence of a new series. Some software is used to create computerized patterns, including

Richpeace, Optitex, Gerber, Lectra, and GGT. Files resulting from the development of this three-dimensional module are made in *exe* format so that they can be used on any computer or laptop with different specifications.

A clothing pattern (pattern) is the shape or image of the clothes' components or parts based on the determined size (measurement). The pattern image (pattern) consists of a straight line (line), curved line (curve), and other signs or images, such as button marks (buttons), kupnat marks (darts), pleated marks (pleats), and fiber direction (baseline). The pattern that needs to be considered is the grading point and curve point (Ampera, 2018; Miyoto, 2011. Pourii, 2001).

Computer patterns are applied processes of creating patterns from manual patterns. A computer must first determine what components or things are in the process of manually creating patterns. Computer patterns are often used in the pattern-making process in the garment industry, whose production is in large quantities. Computer patterns also have their advantages and disadvantages. The advantages of computer patterns namely: (1) The time required to make patterns is faster than construction patterns, (2) Can create a large number of patterns at a time because patterns can be directly copied on the computer, (3) To enlarge or reduce the size can be quickly done, because there is a grading menu that can be operated according to the instructions, (4) The size on the pattern is more precise, and (5) The process of arranging patterns can be done quickly on top of materials, so you can immediately find out how many materials are needed in fashion making. The shortcomings of computer patterns, namely: (1) Expensive relative software, resulting in not everyone being able to make patterns using computer patterns, (2) Patterns made tend to use standard patterns, so that the resulting fashion does not match the wearer's body, and (3) To break patterns or on curved parts, the level of flexibility of the curve tends to be stiff or less flexible. Optitex is software that has been designed to create computerized patterns that have been programmed on a computer. Optitex has several main programs, including Pattern Design System (System Design Pattern), Marker (Material Design), Grade (Class), Modulate (Modulation), and others. However, in this study, the program used from Optitex is PDS version 10 (Pattern Design System). The process of creating computerized patterns can use PDS (Pattern Design System) by opening the menu facilities and toolbars provided on the computer screen. Afterward, the pattern creation process can be carried out according to predetermined instructions. PDS, used as the software to design and develop this pattern, has an advantage in its creation, where the pattern can be efficiently designed from scribbles or by changing/modifying the style that has existed before. Optitex PDS-10 displays on the computer screen in the form of menus, toolbars, pieces, and working areas.

On the results of the validation sheet assessed by two media experts, media experts assessed with an average of 86.67% with the criteria "very good," that the media is worth using because the media display is good images, it is good and, on the menu, attracts the attention of students to create interactive learning. Then the material expert assessed with an average of 89.5% with "excellent" criteria that the three-dimensional module is feasible to use in the learning process because the material in the three-dimensional module is by the curriculum, syllabus, Learning Implementation Plan, Core Competencies, Basic Competencies, indicators and learning objectives. Based on the results of the data analysis conducted, it was stated that the three-dimensional module with Optitex application on the pattern construction course is included in the good classification, which means it is worthy of use as a learning medium. The feasibility in question is that three-dimensional module products with Optitex applications have met the characteristics of interactive multimedia. One of the characteristics of three-dimensional modules with Optitex applications is *self-instructional* or self-study (Susilana & Cepi, 2009). In meeting self-instructional characters, three-dimensional module products with Optitex applications meet the criteria for computerized pattern creation PDS-10 (Pattern Design System).

PDS-10 (Pattern Design System) is the creation of patterns using a computer through pre-programmed software, namely Optitex PDS-10. Software Optitex is then programmed on a computer to make it easier in pattern making and valuable for shortening the production process time. Computerized pattern-making systems are widely used in the garment industry rather than manual (Kang & Kim, 2000; Mullet, 2015) because computerized pattern-making is very supportive in realizing production and efficiency targets that the garment industry must meet to get maximum profits.

Using patterns with different systems will affect the efficiency and results of each fashion creation. The accuracy of the pattern will also affect the results of products in the manufacture of fashion. The resulting fashion will be uncomfortable if the pattern used in making clothes is incorrect. In computerized pattern making, two kinds of points must be considered: curve points (curve points) and Grading points (value points). The grading point is a point when developed (made into several sizes) that must be given a value. Most grading points are located at a corner drawing, but they can also be in the middle of a line, both in a straight line and a curved line.

Based on the explanation above, it can be concluded that the three-dimensional module with Optitex is suitable for the learning process of fashion student pattern construction. This finding is in line with research conducted by Ampera (2017) and Taya, Shibuya, and Nakajima (1995), where the study developed a *blazer pattern-making* learning media based on *Adobe Flash CS6* for students of class Fashion. The research stated that learning media based on *Adobe Flash CS6* could be used as a learning medium.

The last stage of developing three-dimensional modules with this Optitex application is socializing three-dimensional module products on pattern construction courses. This stage is carried out after the product of this three-dimensional module is declared feasible. This three-dimensional module product is socialized by distributing 3-dimensional module product results with Optitex application to lecturers of pattern construction courses and students so that they can be used as a learning medium in pattern making.

Conclusion

1. This research developed a 3-dimensional module with Optitex application. The material in the 3-dimensional module with Optitex application is a pattern-making material with the competence to change patterns according to the design. From the results of validation by two media experts, overall obtained an assessment of 86.67% in the criteria of good sangar. Meanwhile, from the results of validation by two material experts, overall obtained, an 89.5% rating in the criteria is very good.
2. Based on the results about 3-dimensional modules with Optitex application in the Pattern Construction course, 90.54% of the students in the criteria strongly agreed that the three-dimensional module using

the Optitex application attracted attention, increased learning interest, motivated students, and looked attractive so that the media was declared effective as a learning medium for pattern construction learning for Fashion students.

Suggestions

1. It is hoped that lecturers should have willing to create learning media that can attract students' learning interests, create a teaching and learning process that is more interesting and interactive, and can improve student learning outcomes.
2. The development of 3-dimensional modules with Optitex application in pattern construction courses has shown an excellent tendency toward optimizing the facilities and infrastructure of the Department of Fashion Education to improve the quality of learning.
3. Three-Dimensional modules with Optitex application in Pattern Construction courses are utilized in the learning process intended to increase learning effectiveness and deficiency of learning and increase student learning interest.
4. 3-dimensional module products with the Optitex application are expected to be used as well as possible to add insight into pattern-making materials both for lecturers and students.
5. The results can be used by the researchers who will research pattern-making learning to produce better learning media and interactive multimedia.

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Author Information

Farihah

https://orcid.org/0000-0002-5998-9402

Universitas Negeri Medan

Indonesia

Contact e-mail: *farihah@unimed.ac.id*

Harun Sitompul

https://orcid.org/0000-0003-4322-5317

Universitas Negeri Medan

Indonesia

Dina Ampera

https://orcid.org/0000-0003-3252-2551

Universitas Negeri Medan

Indonesia

Samsidar Tanjung

https://orcid.org/0000-0001-8036-6640

Universitas Negeri Medan

Indonesia

Ismail Jahidin

https://orcid.org/0000-0002-6201-039X

Universitas Negeri Islam Sultan Syarif Kasim Riau

Indonesia