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DEVELOPMENT A CONSTRUCTIVIST MODULE AND WEB ON CIRCLE AND SPHERE MATERIAL WITH WINGEOM SOFTWARE

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Abstract

This research aims to develop constructivist module and web on circle and sphere material with wingeom software are valid, practice and effective. The type of this research is development research. This research constitute development research utilize Plomp design that comprise of three phases: 1) the preliminary research, 2) prototyping phase, and 3) assessment phase. The research results obtained constructivist module and web on circle and sphere material with software wingeom are 1) valid in aspects of content, presentation, linguistic and kegrafikaan, 2) practice in the aspect of easy to use, efficient time and benefit, 3) effective based on the results of the final test student of mathematics education in STKIP PGRI West Sumatra on circle and the sphere material.

Keywords: constructivist module, the web, circle and sphere, software Wingeom

Abstrak

Penelitian ini bertujuan untuk mengembangkan modul kontruktivisme serta web untuk materi lingkaran dan bola dengan bantuan software wingeom yang valid, praktis dan efektif. Jenis penelitian ini adalah penelitian pengembangan dengan rancangan penelitian menurut Plomp, yang terdiri atas 3 fase yaitu 1). *preliminary research*, 2) *prototyping phase*, dan 3) *assessment phase*. Hasil penelitian ini diperoleh modul kontruktivisme dan web untuk materi lingkaran dan bola dengan bantuan software wingeom yang 1) valid dalam aspek penyajian, kelayakan isi, kebahasaan dan kegrafikaan, 2) praktis dalam aspek penggunaan, efisien waktu dan manfaat serta 3) efektif berdasarkan hasil belajar mahasiswa program studi pendidikan matematika di STKIP PGRI Sumatera Barat pada materi lingkaran dan bola.

Kata Kunci: modul kontruktivisme, web, lingkaran dan bola, software Wingeom

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Analytic Geometry is a compulsory subject for first year students in STKIP PGRI West Sumatra. Analytic geometry course is an combination of subjects analytical field and space that came into effect on study class of 2011. Circle and the sphere is part of the learning analytic geometry that is necessary for student STKIP PGRI West Sumatra. Based on interviews with several students and lecturer who teach courses analytic geometry known that student understanding of the concept is still low. This is marked with the number of students who scored less than 66 (category C).

Based on the observation showed that during the course still use the conventional method, so students only passive recipients and have not been able to construct knowledge well. Textbooks used by students still hard to understand, both in terms of the language that students use a foreign language as well as in terms of extend lesson does not match the characteristics of the students in STKIP PGRI West Sumatra. Consequently lecturers are difficult to complete the planned lesson, because the more time used to explain the lesson and gives many examples of questions. Sometimes the time to explain

the new material used to repeat material that has not been understood by the student. It is necessary for a teaching material that can train and improve their skills and understanding of student.

Other factors that cause students do not understand the concept of circle and the sphere well is the students ability to draw a circle in the field (dim-2) and the sphere in space (dim-3) is still very low. For that, the students need a tool that can help students in mastering the material, by using a software application program wingeom. Wingeom software is a computer application program that is designed to support the learning of geometry, both in dim-2 and dim-3. This program can be used as mind tools on learning geometry and students can use to develop a framework of geometry dimensions. Wingeom program is expected to help visualize a concept of geometry in particular the concept of circle and the sphere clearly so that students will more easily understand the concepts circle and the sphere.

Lecturers are people who have the ability in learning. As the demands of the times, lecturer should have the ability to utilize instructional media. Therefore, researchers are trying to highlight aspects of learning such as constructivist module and web with software wingeom, in the hope of learning more attractive the existence and development of constructivist module and web with wingeom software became one of problems solving in learning.

One learning approach that gives students the opportunity to construct their own understanding is constructivism approach. Constructivism approach is learning that requires students to participate actively, self-learning capability, actively develop their own knowledge, while the lecturer only acts as a facilitator and mediator in the learning process. Learning tools that can be developed with a constructivist approach is a module. Constructivism module not only contains a summary of the material and training, but also includes how students construct knowledge of earlier knowledge. This module is made gradually to train and improve the skills and knowledge of students completing the given problem. So this research aims to develop constructivist module and web on circle and sphere material with wingeom software are valid, practice and effective.

METHOD

The type of this research using design research and development. In this research development product is a constructivist module and web on circle and sphere material with software wingeom for student of mathematics education in STKP PGRI West Sumatra. This research constitute development research utilize Plomp (2013) design that comprise of three phases: 1) the preliminary research, 2) prototyping phase, and 3) assessment phase.

Formative evaluation, that is evaluation aimed at improvement, takes place in all phases and iterative cycles of design research. As illustrated in Table 1, formative evaluation serves different function, or-in other words-is aimed at different quality criteria (or combination of these) in the various development cycles, each being a micro cycle of research with its specific research/ evaluation question and related research/ evaluation design. One may say that formative evaluation has various layers in a design research project which is illustrated in figure 1, taken from Tessmer (1993): from more informal

in the early stages of a project (self evaluation, one-to-one evaluation, expert review) to small group evaluation aimed at testing the practicality and effectiveness, to a full field test (if possible).

Table 1. Evaluation criteria related to phases in design research

Phase	Criteria	Short description of activities
Preliminary research	Emphasis mainly on content validity, not much on consistency and practicality	Review of the literature and of (past and/or present) projects addressing questions similar to the ones in this study. This results in (guidelines for) a framework and first blueprint for the intervention.
Prototyping phase	Initially: consistency (construct validity) and practicality. Later on, mainly practicality and gradually attention for effectiveness	Development of a sequence of prototypes that will be tried out and revised on the basis of formative evaluation. Early prototypes can be just paper-based for which the formative evaluation takes place via expert judgments resulting in expected practicality.
Assessment phase	Practicality and effectiveness	Evaluate whether target users can work with intervention (actual practicality) and are willing to apply it in their teaching (relevance & sustainability).

(Taken from Plomp, 2013)

Figure 1 also illustrates that many possible methods of formative evaluation can be chosen, such as:

1. Expert review and/or focus groups (important to consider 'experts in what')
2. Self evaluation or screening (using check list of important characteristics or design specifications)
3. On-to-one evaluation or walk through (with a representative of target audience)
4. Small group or micro evaluation
5. Field test or try out

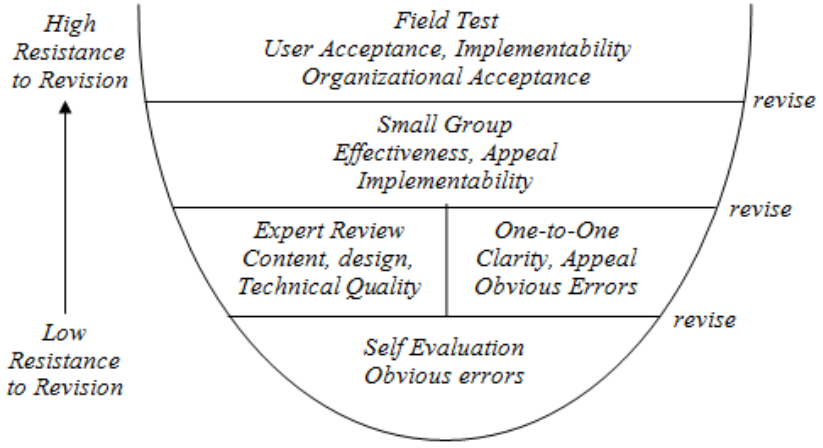


Figure 1. Layers of formative evaluation (Tessmer, 1993; Zulkardi, 2002)

Validity of data collected through the sheet validation and quantitatively analyzed descriptively. The practicalities of data collected through filling a questionnaire and interviews with students and observation of the implementation of the course. A questionnaire, interviews and observation were

analyzed with descriptive qualitative techniques. Effectivity of data collected through tests. Test data were analyzed descriptively by using a quantities calculation of the percentage of students who meet the assessment criteria specified. For the development of this module, said to be effective if more than 70% of students had increased the value of the initial test to final test.

RESULTS AND DISCUSSION

Analyzes were conducted to identify the problems and needs in the implementation of analytic geometry lesson on circle and sphere material in mathematics education courses STKIP PGRI West Sumatra, particularly associated with the constructivist module and web on circle and the sphere material with software wingeom. Based on interviews with the lectures obtained information that student need considerable time to find a concept and understand the material contained in textbook student have, lectures had never made teaching materials, teaching practices have not been able to make students active and independent. One material that is difficult to understand by the students is a circle and the sphere material, because the student must be able to analyze the form of equation of the circle and sphere by first describes the shape and determine the location of the circle and sphere. Syllabus analysis results, one of which must be achieved student competencies that students are be able to apply analytic geometry using a computer program, using by wingeom software. Thus, necessary teaching materials to help students understand the material and helps the student to draw a circle and sphere with help of a computer, so that student no longer confused in illustrating an object in the field and in space.

Prototyping constructivist module and web with wingeom software starts with designing the systematic and structure of the module discussion. Systematic modules that are designed consists of three learning activities, namely 1) the equation of circle and the sphere, 2) equation of tangent to power, and 3) the sphere and the field average. Module is designed to be intuitive expected to motivate students to learn. Formative evaluation was instrumental during the creation of this module. The result of the development at this stage is self evaluation by the developer and then analyzed and revised based on the results of the self evaluation. Data from the initial development stage constructivist module aspects of the presentation of the material presented is based on constructivism, feasibility of the content, language and kegrafikaan.

Language on the module should be clear and easy to understand by students, the size of the module that are designed is 29.7 x 21 cm (A4) with 3 left edge, right 3, top 3 and bottom 3. The font of paper used is Plantagenet Cherokee with the size 12 pt, and a print view one page per sheet. Layout cover and content section designed with the dominant color of yellow. This module is equipped with core competencies, instructions for use modules that can be used by students as a guide in learning independently and the final destination after students using the module. The main competence describes the material held by students after attending a lesson. Material begins with illustrations that exist in their daily lives, followed by giving the problem to be solved by doing, then proceed with the exercises, summary, formative test and feedback along with an answer key.

Sepeda merupakan salah satu alat yang memanfaatkan bentuk lingkaran untuk bergerak. Lingkaran-lingkaran pada sepeda di antaranya roda depan, roda belakang, serta roda-roda gigi depan dan belakang. Perhatikan gambar sepeda di bawah ini.

Gambar 8.1 sepeda balap

Kegiatan 8.1. Persamaan lingkaran dengan pusat (a,b)

1. Gambarkan sebuah lingkaran dengan mengambil titik pusat disebarang titik selain titik $O(0,0)$ dan beri nama titik tersebut yaitu titik $P(a,b)$ dan jari-jarinya r.
2. Kemudian buatlah sebarang titik pada lingkaran tersebut, misalkan $T(x,y)$. Sehingga jarak antara titik T dan titik P adalah $\sqrt{(x-a)^2+(y-b)^2}$.

Figure 2. Give problems on the constructivist module

Web creation continued after the module is completed. Website framework consist of a header, menu, content, sidebar, and footer. Component of website is a domain and hosting website. A process that will be done on making the web is as follows:

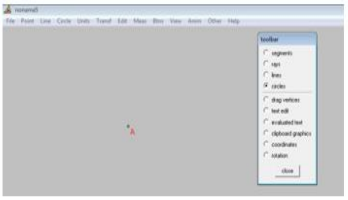
1. Hosting domain redirect to the address that had been prepared
2. Installation CMS Word press in hosting place
3. Plug-in installation required
4. Create web based design that has been design

Web interface that was developed containing the home menu, news, contents, evaluation, guidance, download, about, chat and registers.

Figure 3. Web front

After a self-evaluation phase is completed, proceed continued to the validation a constructivist module and web with wingeom software. The following are suggestions from validators on constructivist module and web on circle and sphere material with software wingeom on the content, the presentation, linguistic and kegrafikaan aspect. Advice validator is at every start-up activities do not need to use software wingeom to construct knowledge of student, so the learning activities using software wingeom separated into an activity outside the learning on constructivist module.

Table 2. Result the validation module with software wingeom

Before revision	After revision
Kegiatan 8.1. Persamaan lingkaran dengan pusat (0,0) 1. Gambarkan 1 titik pada program wingeom 2-dim dengan mengklik kanan file wg2. 	Langkah membuka program wingeom 1. Double klik shortcut wingeom yang ada di layar depat komputer Anda, 2. Setelah muncul layar utama wingeom, klik satu kali window Window yang berada di kiri atas layar utama wingeom, 3. Klik 2-dim pada window atau F2 untuk membuat gambar 2 dimensi dan Klik 3-dim pada window atau F3 untuk membuat gambar 3

The next suggestion of the validator is the addition of a spherical suffice, determine the equation of circle and sphere equation by means of substitution and elimination, properties of the roots of a quadratic equation and translation principle. One of the suggestion of the validator regarding the presentation of the picture that the shape of a circle and sphere should be appropriate, since the module there is a circle that is elliptical due to the layout module. The next suggestion is on exercises that are presented. Validator suggestion to add the matter of applications to the circle quadrant I to IV and on the sphere of octane III to VIII. One of the suggestion for improvement of language expert is numbering at the beginning of each activity on the constructivist module.

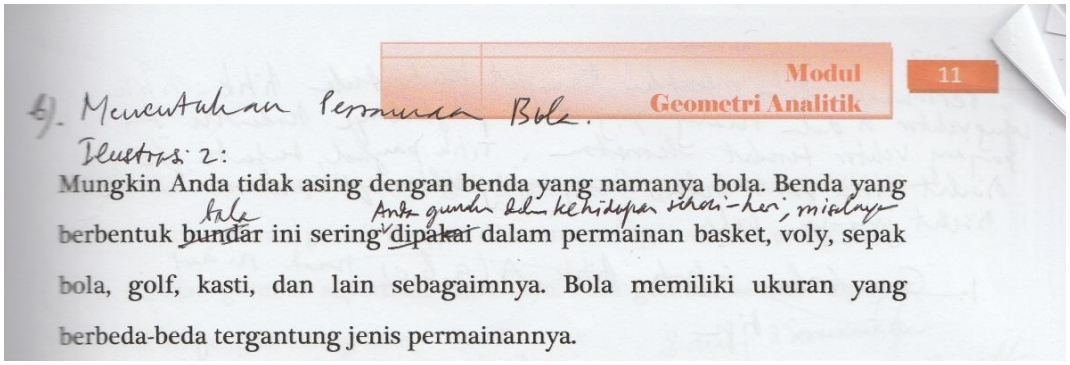


Figure 4. Suggestion from language expert

The validity of the data obtained through the sheet validation constructivist module and web on circle and sphere lesson with wingeom. Assessment given cover aspects of content, presentation, language and kegrafikaan. The validity of each aspect can be seen in the table 3.

Table 3. Validity of constructivist module and web with software wingeom based on aspect of assessment

No	Assessment Component	Validator			Quantity	Percentage Validity (%)	Criteria
		1	2	3			
1	Content	36	37	35	108	90	Very valid
2	Presentation	50	52	51	153	91,1	Very valid
3	linguistic	33	33	32	98	81,7	Very valid
4	kegrafikaan	65	69	66	200	92,6	Very valid
	Totality					355,4	Very valid
	Average					88,85	Very valid

Based on the validation results of the experts can be seen that the constructivist module and web on circle and sphere lesson with software wingeom developed are valid in terms of the content, presentation, linguistic and kegrafikaan.

Small group discussion results obtained some student comments. One of the comments came from NH students who say that the design of the module interesting and interested to learn its contents, but when to understand the module, students constrained in the absence of sample question given. So that the module was revised and given examples of questions in the form of activities that were completed by some students.

The practicalities of constructivist module and web on circle and sphere lesson with software wingeom try out on ten students STKIP PGRI West Sumatra who took a course on analytic geometry. Try out conducted 4 times, giving a questionnaire practicality and interviews of 4 students who have participated in try outs of constructivist module and web on circle and sphere lesson with software wingeom. Questionnaire of ten students showed that most students agreed to the ease of use of the constructivist module, the time devoted to understanding the content was appropriate, and the benefits derived after studying the constructivist module very much. Student questionnaire data of the contents can be seen in the table 4.

Table 4. Practicalities of constructivist module and web with software wingeom based the average score of the questionnaire evaluation stage small groups

No	Assessment Component	quantity	Percentage (%)	Criteria
1	Easy to use	326	74,1	Practice
2	Time efficiency	57	71,25	Practice
3	Benefit	97	80,83	Very practice
Average			75	Practice

Based on the table 4 can be seen that constructivist module and web on circle and sphere lesson with software wingeom is practice in easy to use, time efficiency, and benefit aspect, with practicality value is 75 %. Interviews with students showed that the presentation of the activities of contents and activities to helps students in developing an understanding of concepts, instructions and commands in activity and exercise clearly and easy understood, and has been using the Indonesian language was good and right. The used of the constructivist module and web in the learning process can make students active listening, active speaking, active reading and encourage students to actively think in resolving question and encourage students to devote more time to do exercise.

The effectiveness of a constructivist module and web seen from the final test of students in analytic geometry lesson on circle and the sphere material. Final test are compared against two classes, namely the experiment class and control class. The experiment class, student were given treatment that is given a constructivist module and constructivist approach in the learning, but in control class, student are not given a constructivist module and use a conventional methods. Based on the final test in circle and the sphere material obtained average for the experiment class was 63, 55 from 39 students and

average final test in the control class was 58,91 from 40 students. Seen from the average of final test in circle and the sphere material can be concluded that a constructivist module and web with software wingeom is better than conventional learning.

CONCLUSION

Based on data analysis and discussion that has been done, we concluded that the validation results showed that the expert review indicates that the constructivist module and web on circle and the sphere material with software wingeom is valid. The result of evaluation in small groups involving 10 students in STKIP PGRI West Sumatra who have taken courses analytic geometry shows that the prototype constructivist module and web on circle and the sphere material with software wingeom has practice. The effectiveness of students learning outcomes after using the constructivist module and web on circle and the sphere material with software wingeom indicates that the module is effective. Based on the result of the development is done, it is recommended to develop constructivist module and web with wingeom for other materials on analytic geometry lesson.

REFERENCES

Arikunto, S. (1999). *Prosedur Penelitian: Suatu Pendekatan Praktek.* Yogyakarta: Rineka Citra.

Muliyardi. (2006). Pengembangan Model Pembelajaran Matematika dengan Menggunakan Komik di Kelas I Sekolah Dasar. *Unpublished Dissertation.* Surabaya: Pasca Sarjana UNESA.

Santyasa, I.W. (2010). *Model-model Pembelajaran Inovatif*.

Sardiman, A.M. (2007). *Interaksi dan Motivasi Belajar Mengajar*. Jakarta: PT Raja Grafindo Persada.

Setiawan, D. (2007). *Pengembangan Bahan Ajar*. Jakarta: Universitas Terbuka.

Sukardi. (2008). *Evaluasi Pendidikan*. Jakarta: PT. Bumi Aksara.

Sudjana. (2009). *Penilaian Hasil Belajar*. Bandung: Remaja Rosda Karya.

Sugiyono. (2012). *Metode Penelitian Pendidikan*. Bandung: CV Alfabeta.

Plomp, T. (1997). *Educational and Training System Design.* Enschede: University of Twente.

Plomp, T. (2013). *Educational Design Research an Introduction,* in Tjeerd Plomp and Nienke Nieveen (Eds). Enschede: SLO.

Purwanto, S.K., & Suharyadi. (2004). *Metodologi Penelitian.* Jakarta: Gramedia Pustaka Utama.

Tessmer, M. (1993). *Planing and Conducting - Formative Evaluations.* London: Kogan Page.

Trianto. (2010). *Model Pembelajaran Terpadu: Konsep, Startegi, dan Implementasinya dalam Kurikulum Tingkat Satuan Pendidikan (KTSP)*. Jakarta: Bumi Aksara.

Zulkardi. (2002). *Developing a Learning Environment on Realistic Mathematics Education for Indonesian Student Teachers.* Published Dissertation. University of Twente, Enschede, The Netherlands.