

## Development of Objective Structured Practical Examination/OSPE System Based on Web and Mobile in the Faculty of Medicine

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**Abstract:** This study aims to 1) develop a web and mobile-based Objective Structured Practical Examination/OSPE exam system, and 2) determine the feasibility level of a web and mobile-based Objective Structured Practical Examination/OSPE exam system as a system that assists Faculty of Medicine administrators in managing exams, question bank management, analysis of questions, record of test results, management of scores and analysis of test results. This study uses a research and development method that adapts Sugiyono's development model. The development procedure is carried out through: (1) Preliminary study stages, including: literature studies and field studies. (2) The development stage is carried out by making model designs and system prototypes followed by validation of assessments by medical education assessment experts, media experts, learning experts and limited group trials and broad group trials to assess the feasibility of the exam system created. (3) The evaluation stage is the final stage of the development process related to the web and mobile-based Objective Structured Practical Examination/OSPE final exam system model. Collecting data in the study using an assessment instrument with a Likert scale. The results of the study show 1) Development Web-based and mobile-based Objective Structured Practical Examination/OSPE exam system with the Sugiyono model and 2) The results of the feasibility of the limited group trial included the category ..... (.....%), the broad group trial included the category ..... (.....%), medical education assessment experts belong to the category ..... (.....%), media experts belong to the category ..... (.....%), learning experts belong to the category ..... (.....%). Based on the results of the assessment of the five stages, then Web-based and mobile-based Objective Structured Practical Examination/OSPE exam system stated ..... (.....%) to be used as Objective Structured Practical Examination/OSPE exam system at the Faculty of Medicine, Gunadarma University.

**Keywords:** Exam system, Objective structured practical examination, Ope

### Preliminary

#### Background

The progress of science and technology today is increasingly felt so rapidly. For the medical field, this has implications for two things, namely on the side of medical service providers and on the side of users of medical services.

On the side of medical service providers, it must be defined as the provision of human resources for doctors who are professional, ethical and have the highest morals, rich with up-to-date knowledge and skills and capable of communicating in the form of good doctor-patient relationships.

On the other hand, the public has easier access to information, including knowledge of health-medical matters. People are increasingly aware of their rights as patients or individuals who use medical services.

The two things above are relentless challenges in the medical world, both in terms of the implementation of medical practice, and also on the upstream side, medical education, because this is where everything is prepared.

The Indonesian Medical Council as a regulator of the medical profession was born in accordance with the mandate of Law no. 29 of 2004 concerning Medical Practice, among others, has the duty and authority to ratify the Medical Professional Education Standards (SPPD) and the Indonesian Doctor Competency Standards (SKD) (Indonesia, 2012).

The Medical Professional Education Standard (SPPD) was approved by the Indonesian Medical Council (KKI) in 2006. The preparation of the SPPD at that time had taken into account the Global Standard for Medical Education compiled by the World Federation for Medical Education (WFME) (WF for M. Education, 1998; World Federation for Medical Education, 2007). The SPPD has been used by all medical education institutions to conduct self-evaluations and develop an internal quality assurance system.

Following global and local developments, this standard is regularly reviewed and revised in the parts needed in an effort to answer the community's need for quality assurance of medical education as the initial part of achieving patient safety in the implementation of medical practice.

Furthermore, the standards in the SPPD and SKD will be realized in the education and learning process at the Faculty of Medicine, starting from curriculum preparation, implementation of learning activities both theory, practicum, clinical skills to the implementation of exams as a form of evaluation of learning outcomes.

The curriculum model for the Faculty of Medicine used in Indonesia today is the Competency-Based Curriculum (KBK) which is integrated both horizontally and vertically with the curriculum content oriented to individual, family and community health problems in the context of primary health care with a family medicine approach, and has specific local content (RM Harden, Sowden, & Dunn, 1984; Zulharman, 2002).

To support the implementation of education at the Faculty of Medicine, technology, especially information technology plays an important role, especially in terms of education and learning management, content management, learning evaluation management including the analysis of the learning evaluation results (AI for IM Education, 2007; Khogali et al., 2011 ; Medical & Education, 2000; Sandars & Schroter, 2007).

Evaluation of learning outcomes at the Faculty of Medicine itself is very important because this evaluation consists of evaluation/value of the learning process which consists of assessment of tutorials, practicum, clinical skills and structured assignments as well as the final evaluation of learning outcomes consisting of block exams, general basic course exams, and exams featured courses.

The block exam will consist of 4 types of exams, namely the Multiple Choice Question/MCQ exam which is carried out with the help of the Computer Base Test/CBT, the Objective Structured Clinical Examination/OSCE exam to evaluate clinical skills learning outcomes, Objective Structured Practical Examination/OSPE to evaluate practical learning outcomes. Student Oral Case Analysis/SOCA exams to evaluate students' understanding of a health problem (Baig, Ali, Ali, & Huda, 1969; Epstein, 2007). In its implementation, each type of exam will have a different management process, implementation method, instrument, assessment method, competency achievement and analysis, so that the role of information technology is felt to be very important to assist the process of administering the exam to analyzing the results of the exam.

### **Identification of problems**

To assist in the implementation of the Objective Structured Practical Examination/OSPE as a component of the block evaluation, research was carried out to design and develop an Objective Structured Practical Examination/OSPE exam system that can assist the management of the Faculty of Medicine in managing exam implementation, question bank management, question analysis, record keeping. test results, score management and analysis of individual test results for each subject and examinee.

### **Formulation of the problem**

Based on the description above, it can be formulated the formulation of the Objective Structured Practical Examination / OSPE exam system based on web and mobile as what is feasible and can be implemented so that it can assist the management of the Faculty of Medicine in managing the implementation of the exam, question bank management, question analysis, record exam results, management value and analysis of exam results effectively and efficiently ?

## **Theory Review**

Objective Structured Practical Examination/OSPE is an instrument for evaluating practicum learning outcomes at the Faculty of Medicine (Malhotra, Shah, & Patel, 2013). This evaluation activity will be carried out throughout the semester at the end of each block, which means the number of OSPE exams in one semester will depend on the number of blocks in that semester, so in each semester there may be a different number of OSPE exams.

This OSPE exam will evaluate the mastery of practicum material from the subject matter in each block. For example, for Basic Medical Sciences Block / IKD 3 in semester 1 which consists of Anatomy, Physiology, Histology and Biochemistry courses where from each of these courses there are practical activities, the component of the OSPE exam for Block IKD 2 will consist of questions anatomy, physiology, histology and biochemistry. So if in semester 1 there are 4 blocks, namely IKD 1, IKD 2, IKD 3 and IKD 4 blocks, then at the end of each block there will be an OSPE exam with a different number of questions and components depending on the courses in the block, which means In semester 1 there will be 4 OSPE exams.

The implementation of the OSPE exam is not only carried out on basic science blocks with basic medical science materials such as anatomy, physiology, histology, biochemistry, pharmacology etc. but also reaches clinical medicine blocks that have studied clinical diseases such as cardiovascular system blocks, reproductive system blocks, respiratory system block, immunohematological system block etc. So actually the OSPE exam is carried out throughout the medical undergraduate education process.

For the implementation process itself, it certainly requires a separate effort for the management of the Faculty of Medicine so that every step of the implementation up to the analysis of the results can be achieved in accordance with the standards set by the SPPD and SKD. The following is an overview of the steps for implementing the OSPE exam:

1. The block coordinator announces to the person in charge of the course/lecturer when the OSPE exam schedule will be held, how many exam questions must be prepared for each course and the level of competency achievement of the questions.
2. The person in charge of the course/lecturer prepares questions and preparations that will be used in the exam
3. Questions are collected to the block coordinator from all the person in charge/lecturer of the course to be put together and given the serial number of the questions in the question file
4. The block coordinator reports to the secretariat of the study program to prepare the exam venue, exam time and participants who will take the exam. The block coordinator will also submit a question file to the faculty evaluation/exam unit.
5. If the questions are appropriate and the place, time and participants have been determined, the exam is carried out.
6. The location for the exam is prepared on the morning of the implementation by attaching questions and placing practicum preparations related to the questions on the exam table in accordance with the sequence of questions that have been previously determined. In this case, the preparations meant when anatomy are preparations/parts of cadaver/corpse and mannequins, when histology is a slide of body tissue pieces placed in a microscope, as well as other subjects the preparations are adjusted to what is needed.
7. In the morning on the day of the exam, students are ready at the exam location 30 minutes before the exam
8. After being called into the exam location, students enter the exam venue by standing directly at one of the existing exam tables.
9. After all students are ready in the exam room through the instructions of the exam supervisor, the student takes the exam answer sheet that is already on the exam table in front of him then fills in personal data (name and NIM), exam date, exam code and the exam table number in front of him which is the number the first question of the student's examination concerned.
10. After everything is ready, the exam supervisor will give a sign that the exam starts and students work on the first exam questions according to the exam table number in front of them.
11. After 1 minute, a sign will be given for students to move to the next exam table, and so on until all exam questions are completed with a 1 minute interval for each question.
12. After the exam is over, the student leaves the exam answer sheet on the exam table in front of him which is the final exam table for the student and leaves the exam room.
13. If there are several groups on one day, the same test cycle will be carried out the same as the first group with the record that the previous groups will be quarantined until the last group enters the exam room.

14. After all groups have finished the exam, the test answer sheet is submitted to the evaluation unit/faculty corrector for correction using a scanned answer sheet in accordance with the answer key that has been given by the person in charge/course lecturer.
15. After the correction is complete, the score will be issued as the OSPE test score for the block without any explanation of the value per course in the block and a description of competency achievement.

Looking at the sequence of exam steps above, it can be seen that there are many steps that can be assisted in their implementation with information technology including the question collection process, centralized question bank management, question analysis, record exam results and analysis of student exam results per-course as well as analysis of student exam results in the OSPE exam individually.

OSPE as an instrument for evaluating practicum learning outcomes at the Faculty of Medicine, it is applied both during preclinical education and clinical education (Ronald M. Harden & Cairncross, 1980).

In general, compared to traditional practicum exam methods, OSPE is a valuable instrument that can see the depth of understanding of a material (Hasan S, Malik S, Hamad A, Khan H, 2009; Rahman, Ferdousi, Hoq, Amin, & Kabir, 2007).

Feedback on the use of OSPE at the Melaka Manikal Indian School of Medicine indicates that the OSPE exam method is more challenging for students than the traditional exam method (Abraham, Raghavendra, Surekha, & Asha, 2009). The implementation of OSPE will run effectively if the questions tested in one exam session can be interconnected and supported by an integrated question bank (Mahajan, Shankar, & Tandon, 2004).

In systems-based anatomy, biochemistry and pathology courses, this test method is believed to be the most efficient evaluation method and triggers an increase in student grades because it integrates basic knowledge with clinical applications (Kundu et al., 2013; Manjula, Shashikala, & Nagaraj, 2013; Yaqinuddin, Zafar, Ikram, & Ganguly, 2013).

In physiology courses, OSPE can efficiently distinguish between students with good exam preparation and those who are not well prepared (Sandila, Ahad, & Khani, 2001).

The OSPE test method can also be carried out in pharmacology courses as an instrument to assess the depth of student understanding of the material being taught, with a note that students need more intensive skills training (Deshpande et al., 2013).

The use of OSPE in the evaluation of surgical residents is also considered very precise and reliable (Cohen, Reznick, Taylor, Provan, & Rothma, 1990).

In forensic science courses, OSPE is considered a better method because it covers a wider range of knowledge, but it will cause stress for students if there are many questions tested (Pramod Kumar, Sentitoshi, Nath, Menezes, & Kanchan, 2015). For a good OSPE implementation, it is also important to determine the pass limit value using the modified Angoff method (Ganesh Kamath et al., 2016).

## **Research Methodology**

### **Research Purposes**

This research aims to:

- 1) Develop web and mobile-based Objective Structured Practical Examination/OSPE exam system
- 2) Knowing the feasibility level of the Objective Structured Practical Examination/OSPE exam system based on web and mobile as a system that helps the management of the Faculty of Medicine in managing exam implementation, question bank management, question analysis, record exam results, score management and analysis of exam results.

### **Research Time and Place**

This research was conducted at the Faculty of Medicine, Gunadarma University and lasted approximately ... (.....) months, starting in ..... 2019 until ..... 2019

### Research Methods

The research will be carried out using the Research and Development method with the Sugiyono model, which is described in Figure 1 below:

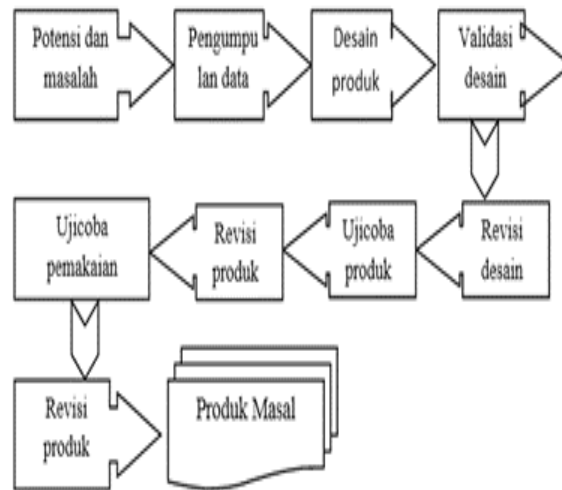


Figure 1. Research Stages Research and Development

The design of this research activity only reached the feasibility test of the web and mobile-based Objective Structured Practical Examination/OSPE examination system, which was followed by an evaluation of the final model. Thus, the three steps of simplifying research methods carried out by researchers are by dividing the research into three parts, namely: the preliminary study stage, the system development stage, the evaluation stage which is described in Figure 2 as follows:

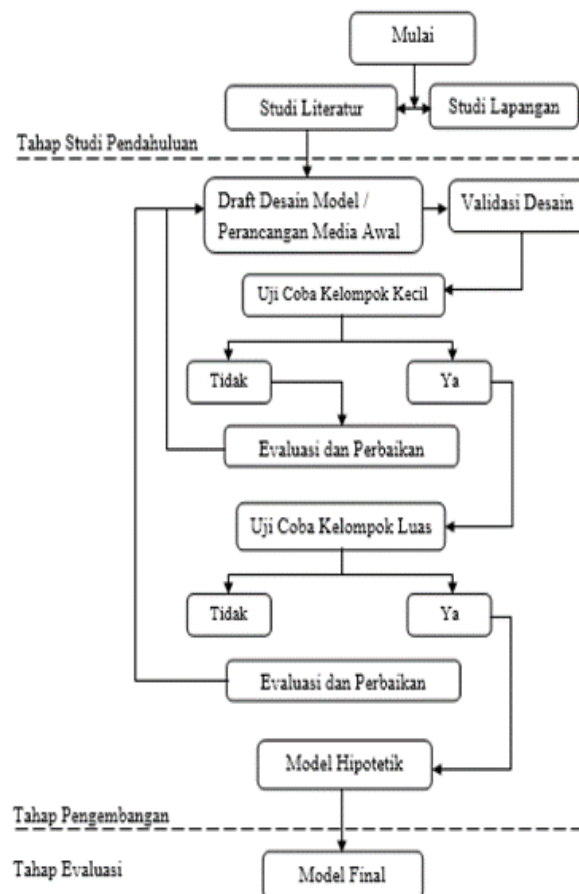


Figure 2. Development Procedure Flow

The research instrument is a tool used to measure natural phenomena and to measure observed social phenomena.

Web and mobile-based Objective Structured Practical Examination/OSPE assessment system is provided to medical education assessment experts, media experts and learning experts.

To assess the feasibility of the exam system that has been created, a measurement scale is used using a Likert scale. The variables to be measured are translated into variable indicators. Then the variable indicator is used as a starting point for compiling instrument items which can be in the form of statements or questions. The answer to each instrument item using a Likert scale has a gradation from very positive to very negative.

The Likert scale is described in tables 1 and 2 as follows:

Table 1. Criteria Eligibility Assessment

Kategori Penilaian	Skor
Sangat Layak	5
Layak	4
Cukup Layak	3
Tidak Layak	2
Sangat Tidak Layak	1

Table 2. Interpretation of Research Results Criteria

Kategori Penelitian	Intepretasi
Sangat Layak	Ahli assessment pendidikan kedokteran, ahli media, ahli pembelajaran menyatakan bahwa sistem ujian Objective Structured Practical Examination/OSPE berbasis web dan mobile sangat layak digunakan sebagai sistem ujian OSPE
Layak	Ahli assessment pendidikan kedokteran, ahli media, ahli pembelajaran menyatakan bahwa sistem ujian Objective Structured Practical Examination/OSPE berbasis web dan mobile layak digunakan sebagai sistem ujian OSPE
Cukup Layak	Ahli assessment pendidikan kedokteran, ahli media, ahli pembelajaran menyatakan bahwa sistem ujian Objective Structured Practical Examination/OSPE berbasis web dan mobile cukup layak digunakan sebagai sistem ujian OSPE
Tidak Layak	Ahli assessment pendidikan kedokteran, ahli media, ahli pembelajaran menyatakan bahwa sistem ujian Objective Structured Practical Examination/OSPE berbasis web dan mobile tidak layak digunakan sebagai sistem ujian OSPE
Sangat Tidak Layak	Ahli assessment pendidikan kedokteran, ahli media, ahli pembelajaran menyatakan bahwa sistem ujian Objective Structured Practical Examination/OSPE berbasis web dan mobile sangat tidak layak digunakan sebagai sistem ujian OSPE

The percentage calculation process is done by comparing the obtained frequency with the expected frequency. The percentage is calculated using the following formula:

$$\text{Persentase} = \frac{\text{Frekuensi yang diperoleh} \times 100\%}{\text{Frekuensi yang diharapkan}}$$

## Research Result

In the implementation of the research carried out with 3 main stages, namely:

### Preliminary Study Stage



This stage consists of 2 parts, namely: literature study and field study. The literature study was conducted by looking for references and literature related to evaluation and assessment in the medical faculty and the Objective Structured Practical Examination/OSPE as an instrument for assessing practicum learning outcomes. While the field study is to make observations in the field by digging up information, seeing firsthand the OSPE exam process, exploring problems and identifying problems.

### Development Stage

This stage consists of 8 parts including:

1) Model design design.

The data obtained from the field survey and supported by theoretical foundations from the results of the literature study, the researchers then designed the design of the test system model which consisted of 3 stages, including:

- a. Design modeling and system analysis using the Unified Modeling Language (UML) which will describe the algorithms, architecture, logic, functions and procedures that will run in the OSPE exam system using ArgoUML software.
- b. Making a mockup/prototype of the exam system that will describe the navigation system, menus and system usage using the Balsamiq Mockup software.
- c. Creating a web-based exam system using the Javascript programming language and a mobile application using React native. For the database used is Postgresql.

2) Validation of the expert team (expert judgment)

The validity of the assessment in this study refers to the opinion of Sugiyono (2013: 168) which states that a valid instrument means that the measuring instrument used to obtain data (measures) is valid. Valid means that the instrument can be used to measure what it is supposed to measure. The assessment of the OSPE exam system is carried out by experts or experts through assessment instruments based on existing theories and then used as indicators in the assessment by experts. Experts or experts include three experts, including: medical education assessment expert, media expert and learning expert.

The medical education assessment expert who assesses the feasibility of the examination system is the head of the medical education unit ..... The presentation of the test system assessment data by the medical education assessment expert is described in Figure 3 as follows:

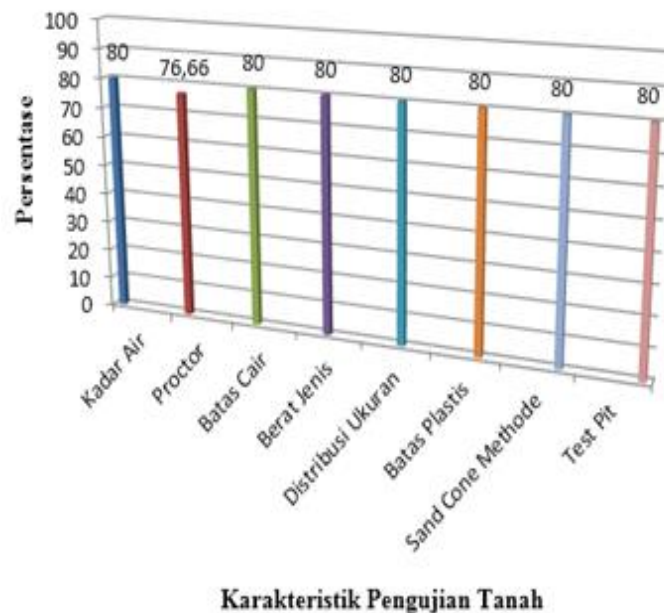


Figure 3. Diagram of Medical Education Assessment Expert Assessment (currently only an example)

Calculation of the percentage of medical education assessment experts in terms of relevance to the process and analysis of test results including, , , and: management of the implementation of the assessment percentage of

.....%, question bank management of .....%, analysis of questions of .....%, record the test results are ..... %, the score management is ..... % and the analysis of the test results is ..... %, if the average is ..... %. Media experts who assess the feasibility of media are postgraduate lecturers of Educational Technology UIKA Bogor ..... The percentage of data resulting from the assessment of media experts is described in Figure 4 as follows:

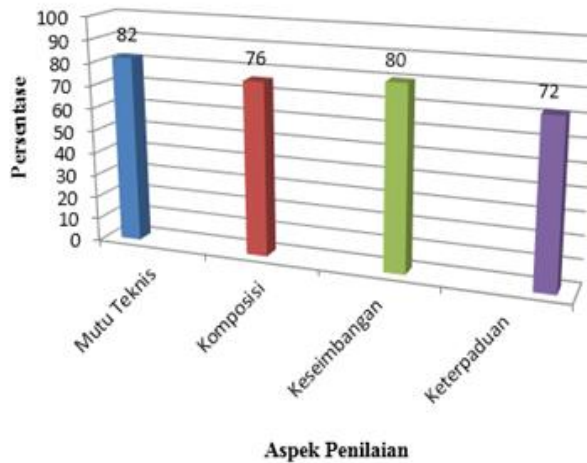


Figure 4. Media Expert Assessment Diagram (currently only an example)

The validation of the assessment by media experts contains 23 questions with indicators including: technical quality, composition, balance and cohesiveness to assess the feasibility of the Objective Structured Practical Examination/OSPE exam system. With the percentage of assessment as follows: technical quality aspect of .....%, compositional aspect of .....%, balance aspect of .....%, integration of .....%, if the average level of feasibility of the Objective Structured Practical Examination/OSPE examination system is averaged according to media expert assessment of .....%.

Learning experts who assess the feasibility of the Objective Structured Practical Examination/OSPE are postgraduate lecturers of Educational Technology UIKA Bogor ..... The percentage of assessment results by learning experts is described in Figure 5 as follows:

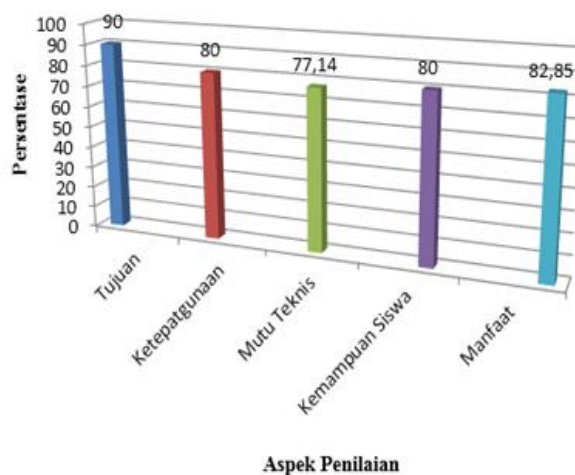


Figure 5. Learning Expert Assessment Diagram (currently only an example)

The feasibility assessment by learning experts through the validation of learning expert assessments contains 25 questions. Question indicators include: purpose, effectiveness, technical quality, level of student ability and benefits. With the percentage of assessment results as follows: the aspect of the objective is .....%, the aspect of usability is .....%, the technical quality aspect is .....%, the aspect of the student's ability level is .....% and the benefit aspect is .....%. If the average assessment of learning experts is .....%.



3) Group trial assessment.

The trial assessment is in the form of assessment validation carried out by system users, namely the medical faculty assessment unit personnel and students. The assessment sheet is prepared based on indicators for selecting learning media.

a. Limited group trial

The limited group trial was conducted with 1 respondent from the 2nd semester assessment unit of the Faculty of Medicine, Gunadarma University (FK UG) and 3 respondents from the 2nd semester students of the UG Faculty of Medicine who are currently taking the basic medical science block V to assess the exam system that has been designed and has gone through validation from experts. The assessment data is described in Figure 6 as follows:

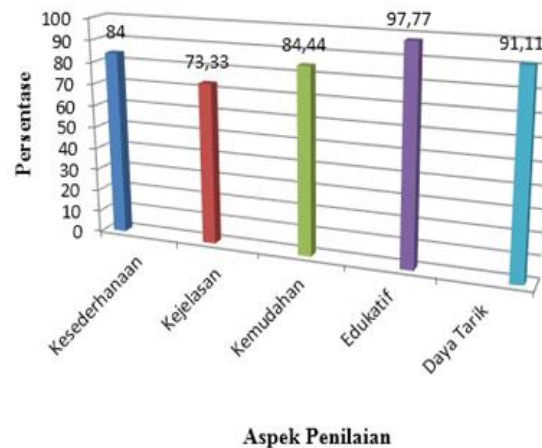


Figure 6. Diagram of a Limited Group Trial Assessment (currently only an example)

The indicators of the limited trial include: simplicity, clarity, convenience, educativeness, and attractiveness with 23 questions asked. The percentage of assessment results is as follows: simplicity aspect is ...%, clarity aspect is ....%, convenience aspect is ....%, educative aspect is ....% and attractiveness aspect is ....%. The limited trial of the Objective Structured Practical Examination/OSPE test system was averaged so that the result was .....%.

b. Wide group trial

After that, the Objective Structured Practical Examination/OSPE test system was conducted in a broad group trial with 4 respondents from the assessment unit in semester 1 and 2, Faculty of Medicine, Gunadarma University (FK UG) and 27 respondents from semester 2 students at FK UG who are currently taking the medical science block. V basis for assessing the exam system that has been designed and has been validated by experts. The percentage of eligibility data is obtained in the form of a diagram described in Figure 7 as follows:

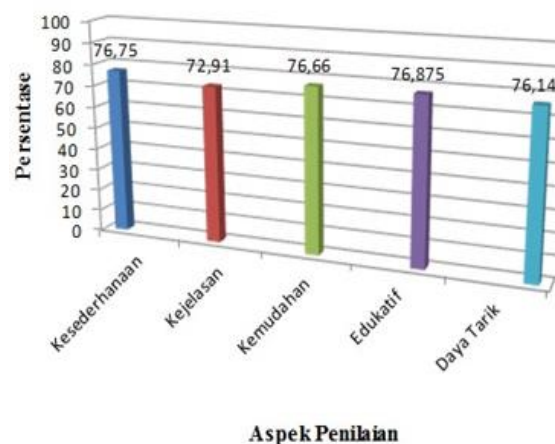


Figure 7. The Broad Group Trial Assessment Diagram (currently only an example)

Based on indicators in the form of simplicity, clarity, convenience, educative, and attractiveness with 23 questions. The percentage of assessments include: simplicity aspect of ....., clarity aspect of ....., convenience aspect of ....., educative aspect of ....., attractiveness aspect of ..%. The average assessment in the broad group trial is ..%.

The feasibility of the Objective Structured Practical Examination/OSPE examination system which is reviewed by medical education assessment experts, media experts, learning experts, medical faculty assessment unit personnel and students as users of the exam system through validation of assessment in the form of instruments, referring to the opinion of Sugiyono (2013: 136) , can be seen in table 3 below:

Table 3 Eligibility Based on Assessment Instruments

No	Penilai	Hasil (%)	Kelayakan
1	Ahli Assessment Pendidikan Kedokteran	.....	.....
2	Ahli Media	.....	.....
3	Ahli Pembelajaran	.....	.....
4	Kelompok Terbatas	.....	.....
5	Kelompok Luas	.....	.....

#### Evaluation Stage

The final model is part of the evaluation stage of the Objective Structured Practical Examination/OSPE examination system, which is validated by assessment experts in medical education, media experts and learning experts.

## Conclusions and Suggestions

### Conclusion

Based on the data from the research and discussion that have been described previously, the following conclusions can be drawn:

1. Web-based and mobile-based Objective Structured Practical Examination/OSPE exam system was created.
2. The feasibility of the Objective Structured Practical Examination/OSPE examination system is known based on the validation of the assessment of medical education assessment experts, media experts, learning experts, limited group trials and broad group trials.
  - a. Medical education assessment expert.

Appropriateness examination system based on medical education assessment experts with a percentage of ..... % including the category of .....

- b. Media expert.

The feasibility of the examination system based on media experts with a percentage of ..... % belongs to the ..... category.

- c. Learning expert.

The feasibility of the exam system based on learning experts with a percentage of ..... % including the category .....

- d. Limited group trial.

The feasibility of the exam system is based on the opinion of 1 respondent from the 2nd semester assessment unit of the Faculty of Medicine, Gunadarma University (FK UG) and 3 respondents from the 2nd semester students of FK UG who are currently taking the basic medical science block V obtained a percentage of ..... % including the ..... category.

e. Broad group trial.

The feasibility of the exam system is based on the opinions of 4 respondents from the assessment unit in semester 1 and 2 of the Faculty of Medicine, Gunadarma University (FK UG) and 27 respondents from semester 2 students of FK UG who are currently taking the basic medical science block V obtained a percentage of ..... % including the category ... ..

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