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Developing a Competency Assessment Model for Graduates in the Field of Information and Communication Technology of Vocational High School Expertise in North Sulawesi Province

Olivia E S Liando[1*], Herry Sumual[1], Mozes M. Wullur[1], Jeffry S J Lengkong[1], Ruth Umbase[1], Harol R. Lumapouw[1], Ronny Palilingan[1], Mario T. Parinsi[1]

[1]Doctoral Program in Educational Management, Graduate School, Universitas Negeri Manado, Indonesia

*Corresponding author: olivialiando@unima.ac.id

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ABSTRACT

This study aims to develop a system-based assessment model for SMK graduates in ICT that is adjusted to the industrial occupation map. Specific objectives include: (1) designing a system-based assessment model, (2) determining the level of model feasibility, and (3) testing the usability of the assessment model. This study uses a development method (research and development) with the Design Science Research Methodology (DSRM) approach. The research procedure consists of four stages: needs analysis, system design, system creation, and evaluation and testing of the assessment model. Data collection techniques are carried out through observation, interviews, documentation studies, and the distribution of USE questionnaires for usability testing. The study results indicate that the developed assessment model has met the feasibility aspects based on expert assessment and has a high level of usability, ease of use, and user satisfaction, as indicated by the test results using the USE Questionnaire. This model is also able to map graduate competencies based on industry needs more accurately and objectively. In conclusion, the developed system-based competency assessment model has proven to be feasible and effective in measuring and mapping the competencies of vocational high school

graduates in the field of ICT according to the needs of the world of work. The implementation of this model is expected to increase the competitiveness of vocational high school graduates and strengthen the quality of vocational education in Indonesia.

Keywords: competency assessment, information and communication technology, system-based assessment model

INTRODUCTION

Rapid technological developments towards the Industry 4.0 and Society 5.0 eras require graduates of Vocational High Schools (SMK), especially in the field of Information and Communication Technology (ICT), to have adaptive competencies that are relevant to the needs of the world of work. However, data shows that vocational high school graduates in North Sulawesi Province still face serious challenges in terms of absorption in the business and industrial world (DU/DI). One of the main causes is the mismatch between graduate competencies and industry demands, as well as the limitations of the assessment system used to measure and map these competencies accurately.

Vocational schools as providers of skilled labor are required to be able to produce graduates who are ready to work. However, the Open Unemployment Rate (TPT) of vocational school graduates is still relatively high compared to other levels of education. In August 2024, the TPT of vocational school graduates reached 9.01%, higher than diploma graduates (4.83%) and bachelor's degree graduates (5.25%). This indicates a gap between the education curriculum and industry needs, as well as the ineffectiveness of the assessment system in ensuring graduate competencies following DU/DI standards.

ICT expertise fields, such as Software Engineering (RPL), Computer and Network Engineering (TKJ), and Multimedia, have great potential in supporting digital transformation. However, in North Sulawesi, these expertise programs are still not evenly developed. For example, only 8 vocational schools have RPL majors, while TKJ is more dominant with 107 schools. The lack of innovation in the development of ICT expertise programs also contributes to the low competitiveness of graduates in the job market.

The current competency assessment system is also considered suboptimal. The implementation of the assessment is still limited to conventional approaches, such as theory, practice, and portfolio tests, without adequate technology integration. In addition, the absence of spatial data visualization of assessment results makes it difficult for stakeholders to monitor the distribution of graduate competencies by region. Therefore, it is necessary to develop a system-based assessment model that is integrated with the industrial occupation map to improve the accuracy, efficiency, and relevance of competency assessments.

Based on this background, this study aims to:

1. Designing a competency assessment model for vocational school graduates in the field of ICT based on a system integrated with interactive map features.
2. Evaluate the level of feasibility of the assessment model.
3. Testing the usability of the assessment model from the user perspective.

The results of this study are expected to provide practical solutions in improving the quality of competency assessments, strengthening the alignment between vocational education and industry, and supporting link and match policies to reduce the competency gap of vocational school graduates.

METHOD

Research Model

The research model used in this study is Design Science Research Methods (DSRM). DSRM is a standard guideline for research related to the design of a service in the form of an information system. DSRM will guide researchers through six stages to design, design, test, demonstrate to users, and create documentation for an information system service (Gregor & Hevner, 2013). The emphasis on the DSRM methodology is not only developing. DSRM implements and works on solutions in the form of software that is created, but also demonstrates it to users (consumers). Demos and testing on the user side are important to determine the extent to which the proposed solution can solve the problem well (Onwuegbuzie & Collins, 2007).

This Design Science Research Methodology (DSRM) model focuses on the creation and evaluation of technological artifacts as solutions to practical problems. DSRM was chosen because it follows the research objectives, namely to develop a web-based design model for assessing the competency of SMK ICT graduates in North Sulawesi.

The stages of the Design Science Research Methods (DSRM) method used in this research can be seen in the following diagram.

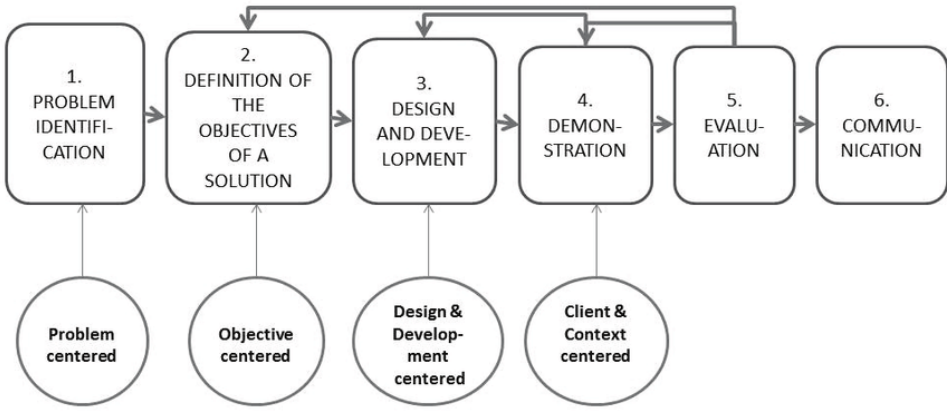

Figure 1. DSRM Design Method

Figure 1 explains the stages of the DSRM method used to develop the design of the competency assessment model for graduates of ICT expertise in vocational schools in North Sulawesi.

1. Problem Identification (Problem Identification)

Problem identification is the first step and is the main foundation of the entire research process. This stage serves to understand, describe, and formulate real and significant problems from the real world (real-world problems), so that they can be used as a strong basis for designing relevant solutions or artifacts.

The main objective of the problem identification stage is to identify real problems that occur in a particular environment (in this case, the assessment process in vocational schools), understand who are the parties affected by the problem and how it impacts graduate competencies and the needs of DU/DI, explain the urgency of solving the problem and the reasons why it is important to develop a technology-based solution.

2. Definition: The Objectives of a Solution (Identification of the objects of a Solution)

The next stage is the object identification stage of the solution, which is an important part that appears after identifying the problem. This stage focuses on formulating the characteristics or criteria of the solution that are expected to solve the problems identified in the previous stage. Here, the researcher describes what features, functions, or qualities the artifact (technology/innovation solution) should have so that it truly fits the user's needs and the context of the problem.

3. Design and Development (Design and Development)

The design and development stages are carried out by compiling a system design based on the results of the needs analysis obtained in the previous stage. This design serves as a bridge between user needs and the technical implementation of the system, intending to describe the structure and

functionality of the system more clearly and systematically. In this process, a visual and structured approach is used so that system development becomes more focused and efficient. To model various important elements in the system, including objects, entities, relationships between components, attributes, and their interactions, the Unified Modeling Language (UML) is used. UML is a set of standard notations that help in describing system design through various types of diagrams, thus facilitating communication between development teams and ensuring that the system being built follows the specified needs.

4. Demonstration

After the system design stage is completed, the next step is to conduct a demonstration or initial implementation of the system as a form of validation of the design that has been created.

Demonstration is an important stage in DSRM that serves to show how the artifact or system that has been designed and developed can solve the problems that have been identified in the early stages. In this phase, the system is implemented in the form of a prototype or initial version that can be tested directly in a real context or a limited simulation. The goal is to verify whether the system works according to the design and meets user needs. This demonstration aims to see to what extent the developed system has been following user needs and specifications set at the analysis stage.

5. Evaluation

The evaluation stage is the fifth stage in the Design Science Research Methodology (DSRM) framework. This stage has an important role in assessing the quality, effectiveness, efficiency, and usefulness of the artifacts that have been developed to solve the problems that have been identified in the initial stage. Evaluation is carried out to ensure that the artifacts are not only technically functional but also relevant and useful in the context of their use.

Thus, evaluation in DSRM is not only aimed at technical testing, but also at assessing the utility, feasibility, and scientific contribution aspects of the resulting artifact. This stage is an important foundation before moving on to the final stage, namely, communication of research results. System testing consists of 2 tests, namely system feasibility level testing and usability testing. System feasibility level testing is validated by system experts and construct experts, while usability testing uses the USE Questionnaire model.

6. Communication

Communication in Design Science Research Methodology (DSRM) is a very important final stage in the research cycle. In this phase, the results of the research, including the artifacts that have been developed, the design process, evaluation, and the findings obtained, are systematically compiled and delivered to the scientific community and practical stakeholders. The main objective of the communication stage is to disseminate the knowledge that has been obtained so that it can be utilized, criticized, and further developed by others. In addition, effective communication also allows validation

and replication of research by other researchers and opens up opportunities for the utilization of artifacts in different contexts.

Samples and Procedures

The sample in this study consisted of 24 Vocational High Schools (SMK) spread across North Sulawesi Province. The sampling technique used was purposive sampling, which is a sampling technique intentionally based on certain considerations or criteria that follow the objectives of the study. The criteria used in selecting the sample are schools that have certain expertise programs or majors that are considered relevant to the focus of this research study, such as the Computer Network Engineering and Telecommunications / Computer and Network Engineering (TJKT / TKJ) major, the Visual Communication Design / Multimedia (DKV) major, and the Software Engineering (RPL) major. This selection is intended to ensure that the data obtained truly reflects the conditions and needs that are relevant to the topic being studied.

This study outline consists of three stages of implementation. Stage First is the study introduction, where done assessment to theories that form the basis of the development process assessment model design web based. At this stage, this is also done, deepening theory learning to be a runway for implementation, and assessment of competence. In addition, it is are carried out various surveys related to vocational school students' implementation assessment as well as to the party industry as users and stakeholders, to get a description of existing needs and challenges. Stage second covering planning and development system assessment, web-based, designed to become applications that can be used practically by vocational school students. System This is built based on the results analysis needs that are obtained from the study introduction, and development process done with the following methods that have been set so that the resulting system can fulfill need user optimally. The final stage is evaluating the system, which is carried out comprehensively, from a technical aspect and also from the side of users, which involves students, teachers, and mentors. This evaluation uses instrument testing specially designed to measure the performance system, as well as satisfaction and effectiveness of use system assessment in support of the learning and assessment process competence.

RESULTS AND DISCUSSION

Assessment Model Design Competence Based on System with Interactive Map Feature

Designing assessment models for competence. This is motivated by the need for answer mismatch competence of vocational school graduates in the field of Technology Information and Communication (ICT), with the needs of the industrial world. The assessment model developed carries a digital-based approach system, information, and technology, as well as named OLIVIA (Optimal Learning & Innovation Validation for IT Assessments). The main objective development of this model is to provide

a system accurate, objective, adaptive assessment to meet industry needs, and support taking decision data based.

The model consists of two main components, namely the system assessment web and map map-based interactive GIS (System Information Geographical). This component forms a unified system that not only evaluates the results study students, but also visualizes the results in a spatial format based on school area.

a. Assessment Section

System assessment developed for support management questions digitally by the teacher/admin, implementation exams by students, and assessments are automatically administered by the system. Every process, from login, selection assessment, workmanship question, to acquisition results value, is documented systematically and efficiently. The exam results in a way automatic processed and stored in the database, later used by the module map interactive for visualization.

Assessment features are designed to evaluate three domains of competence: cognitive, affective, and psychomotor in accordance standard competence national (SKKNI) and the needs of the business world / industrial world. The assessment results not only become a tool for evaluating education, but also input for system management and quality education.

b. Interactive Map Section

Map features play a role in the spatial visualization of the collected assessment data. Each school is visualized as a point coordinate on a digital map, accompanied by information about profile school, the achievement competence of students, and relevance to need local occupational industry. With this approach, the stakeholders' interests, such as the Department of Education, schools, and the industrial world, can:

1) See distribution competence in a geographical way
2) Identifying areas with high mismatch between competence graduates and needs for Work
3) Determining policy strategy, education, vocation, and partnership industry in a more precise way

Map integration also allows analysis of spatial disparity in equalization education, as well as supports the concept of link and match between SMK and DU/DI based on local. Utilizing technology visualization spatial systems, this pushes an evidence-based decision-making approach in the field of vocational education.

c. Structure and System Flow

Model designed with program hierarchy and interactive flowcharts depicting the entire interaction process for users: from user login, data entry, online assessment, validation documents, up to visualization results on an interactive map. Every element system is designed to put forward efficiency, convenient access, and data security.

d. Function Strategic Model

In general, this system supports function evaluation quality, planning data-based, reporting results, and studying in real-time. The system also provides a database for mapping useful talents (talent mapping). For the industrial world for look for graduates following needs. In other words, the system brings together assessment data with opportunity Work based on region, which strengthens the connection between education, vocation, and the world of work.

Assessment Model Feasibility Level Competence

The level of feasibility of the assessment model competence is based on the developed system in the study. This was evaluated comprehensively through two approaches: validation by experts (expert judgment) and functionality testing system. This evaluation aims to ensure that the model is not only worthy in a technical way, but also substantial and relevant to the need for vocational education in school field of Technology Information and Communication (ICT).

a. Model Validation Procedure

Validation was done on two main aspects, namely:

1) System validation by experts, system information, which includes eligibility functionality, performance, security, and user interface;
2) Construct validation by experts in vocational education, which focuses on substance content assessment, suitability with the national curriculum, as well as its relevance with standard competence industry (SKKNI and KKNI).

Activity validation is done in a structured way with the use of instrument evaluation based on a rubric. Experts evaluate how far the OLIVIA system has come in fulfilling indicator eligibility technical and substantial requirements required in the context of vocational education.

b. Validation Results

Results of the expert assessment system show that the model obtains an average score of 88.6 % (very decent category). Aspects assessed include:

1) Convenience navigation system,
2) Speed response and stable application,
3) User data security and validation,
4) Availability feature for management questions, implementation exams, and recapitulation results assessment in an automatic way.

Temporary, validation by experts constructed produces the average score was 86.5% (a very decent category), which reflects:

1) Relevance indicator assessment of the standard competence national,
2) Compliance material assessment with the profile occupation industry in the field of ICT,

3) The ability system assesses competency domains in a holistic way (knowledge, skills, and attitudes).

Second results show that system OLIVIA's assessment has fulfilled standard eligibility, Good from the technical side and also academic. Evaluation of eligibility. This becomes a strong foothold for the state that the model developed is worthy of use in context learning and assessment in vocational schools in the ICT sector.

c. Feedback and Revisions

The validation process also produces valuable inputs, especially related:

1) Additions feature tracking progress of individual assessments.
2) Improving the appearance of spatial data visualization on interactive maps;
3) System integration assessment with the database needs Work from the industry.

Input the then made into base to perfect the system before user testing end done. This shows that the validation process is not only a nature verification, but also participatory in iteratively increasing the quality artifact system.

d. Implications from Model Feasibility

A high level of feasibility in the assessment model has its impact on the strategic context in education vocation. The OLIVIA system cannot only be used by schools as an instrument for evaluating students, but also becomes a tool helpful for:

1) Department of Education for mapping and planning the development of data-based vocational schools;
2) business world / industrial world (DU/DI) for access graduates in accordance required competencies;
3) Teachers and students for to obtain bait come back accurately in repair learning and preparation Work.

Thus, validation is carried out not only functioning as testing technical test, but also confirms the position of this model as a solution for contextual and transformative education in supporting the link and match of education and the world of work.

Usability Testing Assessment Model

Usability testing is performed to evaluate how far the system assessment competence based on the developed system (OLIVIA) can be accepted, used, and felt useful by users. This evaluation is important to ensure that the model that has been designed is not only functional and feasible, but also provides an experience effective, efficient, and enjoyable.

a. Testing Methods

Testing was done using the USE Questionnaire (Usefulness, Satisfaction, Ease of Use, Ease of Learning), developed by Lund (2001). The questionnaire This given to 30 respondents, consisting of teachers and students from several vocational schools in the field of ICT in North Sulawesi. The purpose of testing is to measure the perception users have of the utility system, convenience learning, comfort usage, and satisfaction in a way overall.

b. USE Questionnaire Test Results

Test results show a very good score for all aspects measured as displayed in Table 12, Assessment highest achieved in the Ease of Learning aspect (4.7), which indicates that the system is easy to study for new users. This shows an intuitive interface system and approach friendly to navigation for users. High scores on the Usefulness (4.5) and Satisfaction (4.6) aspects show that the system felt relevant to the needs of users and had a positive impact on the assessment process.

c. User Feedback

Respondents disclose that the system:

1) Practically used and not needed. Lots of Instructions written;
2) Own channel, simple and consistent use;
3) Give experience, flexible, and efficient assessment;
4) Help in visualizing achievement competence and its relationship with the world of work.

Users also stated that the system gives a mark plus through feature map interaction, which allows understanding contextual information about the position competence of students in the regional landscape industry.

d. Implications of Test Results

The height usability score confirms that the OLIVIA system has potential for implementation in a wide in context vocational education contexts. Testing This strengthens validity artifact in Design Science Research Methodology (DSRM) approach, because it measures the usefulness real from the system in the context of use in the field. Experience positive user is an important indicator success system, in particular in the transition process of digitalization assessment in vocational schools.

In addition, the success of usability testing supports the achievement of objective third-party research, namely testing the assessment model competence from the aspect of convenience usage, efficiency interactions, as well as user satisfaction.

Based on the matter mentioned, the Design of the assessment model competence web-based on vocational high school fields Technology Information and Communication (ICT) in North Sulawesi is a strategic step in support of digital transformation in vocational education. System This not only functions as a tool for evaluating the results of students, but also as a device for integrated management. For support efficiency, accuracy, and retrieval, decision data-based.

System assessment web-based developed. This not only plays a role as a tool for evaluating the results of studying students in a way objective and comprehensive way, but also a very strategic managerial tool in the framework management modern educational management. In the context of management education, this system supports all over functional management, from planning, organizing, implementing, to controlling and making decisions, with a valid and accurate database. Approach This in line with theory management education that emphasizes the importance of controlling quality as part of the managerial cycle for reaching the objective education that has been determined (Hamalik, 2012).

In general, the system assessment is web-based and integrates principal management quality, technology visualization, spatial, and theory management. This Fullan change is capable of increasing quality management education in vocational schools, especially in support of equity and relevance, competence graduates with the needs of the business world and the industrial world. The system strengthens efficiency, accountability, transparency, and capacity to make decisions based on evidence, so that it becomes an important instrument in the development of source Man Power excels in North Sulawesi during the revolution, the industry 4.0 era. One of the advantages of the assessment model is the integration map interactive based on spatially displays the Distribution of ICT Vocational High Schools in North Sulawesi and competency data for graduates available in each region. This map is designed to support decision-making in strategic planning for education, vocation, and collaboration between schools and the industrial world. This map not only displays the position geographical school, but also connects competent students with the needed occupations in the business world / industrial world (DU/DI) based on the region.

This feature makes it easier for stakeholders' interests, including the Department of Education, other parties, schools, and industry sectors, to see potential and inequality inter-regional. For example, the area with amount graduates of highly competent but minimal partnership with industry can be identified as a priority area for link-and-match programs or strengthening the Work in the same industry. Through the map interactive and results digital assessment, found that there is a significant competency gap between educational outputs and vocation, and the needs real industry in several regions. The digital industry is growing rapidly. However, complaints about skill mismatch are high enough. Many graduates have not yet mastered the latest technology, such as cloud computing, cybersecurity, or mobile application development, according to the industry. Findings This is in line with the World Bank report (2020), which states that the main challenge education vocational education in Indonesia is a skills gap, where graduates do not yet fully own the competencies required by the job market.

Thus, the development of assessment models for competence graduates of web-based with support map interactive is an innovative solution and applicable to answer the challenge of quality vocational school graduates in the digital era, at the same time, strengthening the role of education and vocation in the development source Power man empowered areas to compete.

CONCLUSION

This study's success develops assessment model design competence. Vocational school graduates in North Sulawesi Province, especially in the field of skill technology information. The assessment model is designed based on the system This aiming to answer industrial world needs as well as support achievement standard competence graduates following the scheme occupation, national, and KKNI. Based on objective research, the following conclusion was obtained: 1. Assessment model design competence graduate of field skill technology Web-based information and communication for vocational schools in North Sulawesi, which is called the OLIVIA (Optimal Learning & Innovation Validation for IT Assessments) system, has succeeded. developed with integrated industrial world needs as well as standard competence, national, referring to the scheme occupation, national, and KKNI. System This is integration between assessment formats competence skill ICT field of vocational schools with map interactive based on spatial displaying distribution of vocational schools in the ICT sector in North Sulawesi, competency data graduates available at each school as well as connect competence student with need occupation in the business world / industrial world (DU/DI) based on region. 2. The level of feasibility of the assessment model competencies developed shows satisfactory results based on the evaluation of experts and end users. This model is rated as worthy for use in the vocational school context of field technology information in North Sulawesi Province, both in terms of content, features, and mechanisms of its operations. 3. System OLIVIA (Optimal Learning & Innovation Validation for IT Assessments) information as representation from the developed model has been tested through a series of trials and declared to fulfill the standard in terms of functionality, performance, security, convenience, and Usability. Testing the model of usability aspect shows that the assessment model based on the system This own level of convenience, high usage, good interactivity, and gives a positive experience to users. This shows that the system is Ready to support vocational school graduates in obtaining a suitable job with their competence. Thus, the assessment model competence based on the system can become an innovative solution to increase the quality and relevance of education vocation field technology information at SMK, as well as strengthen connectedness between the world of education and the world of work in North Sulawesi Province.

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