Advances in Social Science, Education and Humanities Research, volume 299
5th UPI International Conference on Technical and Vocational Education and Training (ICTVET 2018)

Competency Based Learning Model for Programmer Certification

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***Abstract*—The emergence of workers and graduates with the skills needed to meet the needs of the workforce. In contrast to the old paradigm that has been practiced so far, the system of preparing workers in the new paradigm format is based on two principles, namely: first, the preparation of the workforce is based on the needs of the users (the demand is driven). ; And secondly, the training process is performed as a vehicle for personnel preparation with a competency-based training approach. Competence tests are needed to determine the level of competence of employees and graduates. A model is being developed to prepare potential competence test participants. This study will create a learning model that can be used as a reference for instructors / practitioners / managers of competency test points in conducting online learning to increase the willingness of potential competency test participants. The resulting model is used in the learning process for people preparing for competence tests. The resulting model syntax can be used for learning to prepare for the programmer competency test. In addition to the programmer's test, this model can also be used in learning other field competence tests. The resulting syntax is the result of the evolution of existing models. With this model, it will be able to increase the willingness of participants in the proficiency test, and it is also expected to increase participants' competency value.**

Keywords—competency based learning models; e-learning; programmer; certification

I. INTRODUCTION

Press release Ministry of Communications and Information No. 93 / HM / KOMINFO / 07/2017, on the introduction of the ICT fieldwork map on 27 July 2017 (Minister of Communications and Information, 2017), states that management and improvement of the human around the to improve the competitiveness and negotiating position of Indonesian workers, resources or the competence of the workforce as well as the equality of qualifications with other countries or foreign workers must be ensured [1]. In this case, competence certification, which is carried out systematically and objectively, is to be dealt with through competence tests related to the Indonesian national labor standards (SKKNI) and / or international standards.

On July 27, 2017, the Minister of Communications and Information announced that the quality of education in the field of ICT in Indonesia is ranked 8th in Southeast Asia. This leads to a shortage of competent staff in the ICT industry [1]. There is a lack of staff in Indonesia, so large companies like Gojek and Tokopedia have to import Indian services. They even started a research and development center in Bengaluru, India.

The small number of competent workers is a national problem according to the work requirements. A measure of the work competence is a competence certificate issued by BNSP.

Specifically for computer programmer certification, based on data obtained from the Competency Test Institute, 80% of test participants receive "incompetent" results as programmers.

A solution to overcome low competency test results by providing material from competency units that are tested for programmer certification. However, the learning model used in learning must be representative of the circumstances and needs of potential participants for potential test participants. For this reason, existing learning models have to be analyzed and developed further. From the first studies that have been conducted, it is believed that the use of competency-based learning models in learning can be applied to potential competence test participants. However, the syntax of the existing learning model needs to be reviewed and adapted to needs and needs. In this study, the new syntax for competence-based learning models is developed.

II. RESEARCH METHODS

In this study, a systematic literature review method was used. There are three main phases of this method, namely planning, implementation and reporting.

- Planning: Formulate research questions: Population (P): learning model, competence-based learning, competence-based learning model; Intervention (I): learning model for dealing with professional competences and certification tests, especially programmer certification; Comparison (C): N / A; Results (O): predictions or estimates of accuracy; Context (C): Competence Test Center or Professional Certification Body. Develop a review log; Background; Research questions; Search term; Selection criteria; Checklist and quality procedures; Data extraction strategies; Data synthesis strategy.
- Do: Identification of relevant literature; Conduct a selection of primary studies; Perform a data extraction;

Evaluate the quality of the research; Execution of Evidence Synthesis.

- Reporting.

III. RESULTS

Learning is a change experienced by individuals based on experience [2]. Learning is not a passive acceptance of knowledge that is "out there," but learning involves students who are connected to the world [3]. Learning will build meaning, any meaning we build will allow us to give meaning to other sensations that can match similar patterns [4]. In learning, it is necessary to offer activities that affect the mind and the hands [5]. Learning in language, language and learning is closely related [6]. Conversation, interaction with others and the application of knowledge is an essential aspect of learning [7]. Learning cannot be separated from our lives [8]. If you need the knowledge to learn, learning must provide a pathway to the topic for students based on the student's prior knowledge [4].

Mastery Learning is a learning strategy where students have to master the topic before moving on to more advanced topics. An important aspect of mastery learning is the mastery criterion, which is the rule of whether a student has achieved mastery [5]. Mastery Criteria was studied 40 years ago [9, 10], but at the time, only for static testing and small applications. Mastery Learning is a framework for planning learning sequences [11, 12]. Mastery of Learning offers a level of achievement in school subjects. Recent work has sharpened their idea, and modern teaching technology has made it possible [13]. That the models of Tyler, Bloom and Carroll, which found an echo in the world of education 1949-1964, were strongly influenced by the mastery of the learning model [14]. The naming of this theory is "learning in school".

Competence-based learning, as opposed to competence-based education, focuses on students and their experiences in the learning environment [15]. CBL is a set of integrated data base, adaptive, performance-oriented processes that express, measure, record and validate within the framework of flexible time parameters, known demonstrations, expressly stated, and agreed to facilitate learning outcomes that reflects the success of the function in the role of life [16].

CBL builds a teaching-learning system that further develops student autonomy, learning and learning. This approach loses its importance and materiality when incorporated as a methodology for lecturers [17].

Online competency-based education is revolutionary because it identifies the critical convergence of different vectors: the right learning model, the right technology, the right customer, and the right business model. Every student is different, needs different mastering skills [18]. Competence is based on the role that students can fulfill after graduation [19]. Using an online application makes learning easier for students [20]. Learning is no longer limited by space and time. The dividing wall between school and society needs to be removed, because good learning is not enough at school alone [21]. E-learning is explained as a computer-based learning tool or system that allows learning anywhere, anytime [22]. eLearning is when we use computers and networks that connect in different ways to support the learning process [23]. With eLearning, students can develop their knowledge. Knowledge is not something that already exists, but a process that is constantly evolving [24]. ELearning students get freedom. Freedom and learning are required for students to have freedom of thought [25].

Carrol said that giving each student the time they need to gain a degree of mastery and spending the time they spend is likely to bring students to a certain level of competence [12]. US Department of Education. One way to improve the learning outcomes of students is to consider competency-based learning [26]. DoE describes competency-based learning as "a structure that creates flexibility, allows students to progress." The competence-based curriculum became part of a college-based course program that began in 1977 [27]. Competence-Based Learning Outcomes and Outcomes Students are encouraged to learn in a way that enables them to use reproducible skills to achieve tangible results [28]. The definition of competence in the workplace is the application of Knowledge, Skills, Attitudes, and Values and Behaviors [29]. The process by which knowledge emerges through the transformation of experience and knowledge [30]. Basically, competence involves three important aspects, namely knowledge (cognitive), attitudes (affective) and abilities (psychomotor), which are combined to perform certain tasks. Competency-based learning is also referred to as results-based learning that is different from traditional educational approaches. Results-based learning is not about session time, but what learners know and what they can do [31]. Outcome-based education (OBE), mastery learning, performance-based learning and performance-based education are other names of competency-based or identical approaches [32]. Department of Education in the USA. That is, competence is "a combination of the skills, abilities and knowledge needed to perform a particular task" [33]. The characteristics of teaching and learning are explained with the control model as follows: teaching is based on predetermined educational goals, paying attention to individual differences, the evaluation is carried out continuously based on criteria, the programs repair and enrichment programs use the principle of active learning students.

Some of the models underlying the competency-based e-learning model are:

Personal education system. Keller developed a Personalized System of Instruction (PSI) in the late 1960s to help students in Brazil learn the subject without teachers at their side [34]. Keller suggests five basic components that are important for PSI teaching: mastery of the subject matter, use of proctors / tutors, own experiments, emphasis on written words, and use of lectures and demonstrations, especially for motivational purposes [35]. Keller divides the PSI creation process into four steps: Determine the material to be discussed in the course so that the material is a stand-alone module (segment). Create a method to assess students' ability to master the material in the given module this allows students to move from module to module at their own pace.

Mastery learning and programmed lessons. Mastery of learning is a mindset in the design of instruction circuits

formulated by John B. Carrol and Benjamin Bloom [13]. Talent is the time students need to study specific material. This mastering learning design includes the following steps: mastering the topic, dividing the material in its broad scope into smaller subchapters, material identification and selection of teaching strategies, conducting tests (evaluation) for each material, additional guidance given by students [36].

Some existing competency-based learning models:

Fuchs model of learning control, the steps of which are described as follows [37]: The curriculum is broken down into a number of sub-competences and arranged according to the hierarchy of learning objectives. For each level in the learning hierarchy, the teacher designs a criterion-related test and determines the performance criteria that indicate completeness for each sub-skill; Precede learning activities by performing a pre-test; the teacher starts learning from the lowest level in the hierarchy to achieve the learning goals set for each level of the hierarchy. Give feedback on learning material; If the results of the post-test students are incomplete, the teacher uses corrective strategies until completeness is achieved; then the teacher takes the students to the next level in the hierarchy, which is a more difficult phase.

The Learning Model with a Thorough Learning Approach consists of four steps: classroom teaching and then subdividing students into learning groups; Provide a test to check students' learning outcomes at the end of each lesson; Conduct assessments to see how the students master the whole topic; Depending on the needs of students offer enrichment activities or corrective actions; and give a second test to measure the completeness [38].

Bloom's thorough learning model can be described as follows [11]: topics are subdivided into a number of smaller learning units (e.g., biweekly teaching), and the purpose of each unit is determined, the completeness of which is very important to complete the main purpose; The teacher teaches each unit to use group learning methods, but has simple feedback / correction procedures to ensure that the teaching of each unit is of optimal quality. The feedback tool is a short (formative) diagnostic test at the end of each unit [39]. Each test includes all the audience-specific goals so that they can show what each student has learned or not learned from the group learning activities in that unit; Providing summative tests to verify the completeness of student learning for all subjects; Additional supplemental instruction connectors are then provided to help students overcome learning difficulties in the unit before group instruction continues.

The steps that the teacher needs to take to complete the learning are: subdividing the subjects into a number of smaller lessons (e.g., teaching twice a week), setting learning goals for each lesson, and sorting the lessons units Lesson based on difficulty level (starting with the simplest one); give a preliminary test for the study unit to be submitted; Division of students into small learning groups; Students learn the first lesson in their respective study groups; Conducting individual tutorials for students who have difficulties; Conducting formative tests at the end of each lesson; provide additional learning guidance to help students overcome learning difficulties in the learning unit before continuing with group learning in the next lesson; Enrichment for students who have achieved full mastery of this learning unit; Providing summative tests to verify the completeness of student learning for all subjects; If the summative test results are not exhaustive, the teacher uses corrective strategies until completeness is achieved [40].

IV. Discussion

Competency Based Learning (CBL) is a very strong foundation for developing eLearning solutions. CBL targets important skills and practices that directly contribute to the company's goals and drivers. CBL recognizes human capital in the form of competence models and creates training programs, individual development plans, performance management and measurement systems for this competency model.

Competency-based learning models are used through e-learning because they allow organizations to send content or learning objects to individuals.

From the literature that has been studied, steps can be determined from the competency-based learning model, namely:

A. Create competency models or competence standards

They provide tools to determine what skills are needed to meet current needs and the potential for a different future. In this developed syntax, the competency model used must refer to the Indonesian National Labor Competence Standard (SKKNI), which is defined by the Minister of Labor of the Republic of Indonesia.

B. Skills Standards

Once the skills and knowledge that make up the competency model have been developed, the number of skills or knowledge required for success must be determined. Management and problem experts determine these levels or standards and this is the level of performance goals for all individuals.

It has been developed by the SKKNI Committee on Skills Standards, which consists of several elements, including the Ministry, the Technology Assessment and Application Agency (BPPT), professional associations and organizations, and universities for the preparation of Indonesian national labor standards.

C. Rating

An independent professional certification body has been set up to perform the work ability certification. The National Vocational Certification Body is an independent body responsible to the President, who has the authority to certify and certify the workforce as a Personnel Certification Authority. The Agency will prepare a qualification program for the national work qualification. All schemas are packed with work packages (occupational titles) and see SKKNI. Each scheme has several competence units. Each competence unit has the unit code, the unit title and the unit description. Each competency unit has arranged work items and performance criteria in a table. Each competency unit has limited variables

and rating guidelines. Variable variables consisting of variable context, equipment and inventory, required regulations and norms and standards. The evaluation guide consists of the context of assessment, competence requirements, required knowledge and skills, the necessary work settings and important aspects.

D. Training

1) Teaching design: Competence models inform the instruction design. The competency model, which is well structured, contains a complete list of the skills and knowledge required to successfully complete the task. The competence model serves as a template for instructional designers. Instructional designers use competency models to create learning goals and control training development.

2) Develop learning objects: The competency model also serves as a template for the identification of learning objects that can be building blocks for e-learning.

E. Performance Improvement

Competency-based learning is a component of a strong strategy for improving the competency model and maximizing the impact of assessment, training, program, and delivery resources.

V. CONCLUSION

From the results of the literature study, 5 syntaxes can be formulated in competence-based learning models for the certification of programmers. The syntax compiled in this learning model can be used to prepare a competency test to obtain a programmer's certificate or other competency test fields.

This learning model is implemented by developing eLearning applications as learning media. In the eLearning application, learners can customize and select material they do not master or master. The use of e-learning offers participants the opportunity to learn according to their time and ability.

ACKNOWLEDGMENTS

Thanks to the promoter, the leader of UNP Padang, the leader of Unilak and all friends of S3 UNP and Fasilkom Unilak. Especially for the whole family.

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