



Application of Vending Machine-Based Certification Tools to Improve Professional Competence of Ototronic Engineering Vocational High School Teachers

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ABSTRACT

In competency standards and teacher certification, competency tests both theoretically and practically have very important benefits, especially in improving the quality of education through improving the quality of teachers. Every year, teachers, including automotive engineering, competency skills (komkal) of autotronic techniques, must be evaluated and uploaded a certificate of competence to SIMPKB (Management Information System for Sustainable Professional Development). Therefore, teachers as teaching implementers are required to improve competency mastery and fulfill the obligation to upload certificates through the technology applied by the proposer, namely "Vending Machine-Based Certification Tools". From the results of the situation analysis that includes the objectives and problem areas, the problem statements in this study are formulated, namely: 1) what is the process of developing a Vending Machine-Based Certification Tool for Teachers of SMK Autotronic Engineering Expertise Competencies? and 2) what are the results of the testing of the Vending Machine-Based Certification Tool for Vocational Teachers for Autotronic Engineering Skills Competence? This research was conducted using the Research and Development (R&D) Borg and Gall method which has been adapted by the proposer, namely: 1) analyzing the product to be developed, 2) developing the initial product, 3) expert validation and revision, 4) small-scale field trials and product revisions, and 5) large-scale field trials and final products, which will be completed for 8 months by a proposing team consisting of 3 lecturers, 1 foreign researcher, 2 students. Indicators of achievement/performance in this study are proven by producing outputs: Vending-based certification tools. The machine is equipped with: a) tool design, b) registration website, and c) grid and question bank.

Keywords: *Vending Machine, Certification, Autotronic.*

1. INTRODUCTION

Teacher professionalism is required to continue to develop in accordance with the times, the development of science and technology, and the needs of the community [1]. In making the teaching profession a dignified and professional profession, the government has set teacher competency standards in Law no. 14 of 2005 article 1 [2]. The competence of teachers determined by the government is basically a combination of personal, scientific, technological, social and spiritual abilities which literally form the standard competence of the teacher profession which includes mastery of the material, understanding of students, educational learning, personality development and professionalism [3]. Existing conditions and situations are the reason why each teacher has differences in mastering the required competencies [1]. Therefore, academic measurements need to be carried out regularly every year, namely by

holding a Teacher Competency Test through the technology applied by the proposer, namely "Vending Machine-Based Certification Tool" with the hope that teachers who pass the test will immediately receive a certificate so that they can meet the needs of teachers for competency improvement and certification.

Autotronic technique is one of the skill competencies that is oriented to material regarding automotive matters, especially in the latest automotive technology [4]-[6]. The scope of material on autotronic engineering competence is quite broad, including: 1) Electronic & Electric Fundamentals for Automotive (EEFA), 2) Fundamentals of Control System for Autotronic (FCSA), 3) Engine Control System (ECS), 4) Engine Scan Diagnosis (ESD), and 5) Engine Management System (EMS) [7]. Teachers are required to master these five competencies, through a competency test/test with an implementation system using a "Vending Machine-

Based Certification Tool" as a medium for conducting tests [8] and obtaining a certificate as an indicator that the teacher is competent in the autotronic engineering field. The problem statement in this study, namely how is the process of developing a "Vending Machine-Based Certification Tool" for SMK teachers with autotronic engineering competence?

The proposed solution to the problem study carried out is to develop a Vending Machine-Based Certification Tool for Vocational Teachers of Autotronic Engineering Skills Competence, with the following vending machine hardware specifications: 1) light sensor, 2) electromagnet, 3) machine database, 4) rejection channel, 5) sorting section, 6) minicomputer, 7) motor device, 8) spiral coil, 9) barrier, 10) release chamber, 11) pick-up point, 12) infrared ray, and 13) detection sensor. Operationally, the purpose of this research is to develop a Vending Machine-Based Certification Tool that is in accordance with the needs of vocational high school teachers for autotronic engineering skills and relevant to current automotive technology developments.

2. METHOD

This research was conducted using the product development method. Product development is an implementation method in the field of production, in the form of a series of product design works for Vending Machine-Based Certification Tools, including: 1) data collection: a) design concepts, b) product specifications, c) material planning, and d) product working principles ; 2) design making/adjusting; 3) planning elements, namely breaking down raw materials in product manufacturing; and 4) function testing in the lab./workshop.

3. RESULT AND DISCUSSION

3.1. Data Collection

Data collection includes: 1) design concepts, 2) product specifications, 3) material planning, and 4) product working principles. The design concept of a vending machine is a machine that can dispense items such as snacks, soft drinks such as soda, alcohol, cigarettes, lottery tickets, consumer products and even gold and gems to customers automatically. Like the original seller, this machine will issue the item we want after we pay for it by inserting a number of coins or paper money. In this study, the proposer uses a more interactive user experience feature to make the vending machine a certification tool for vocational teachers of autotronic engineering competence.

The product specifications of the vending machine in this study include: 1) light sensors, 2) electromagnets, 3)

machine databases, 4) rejection channels, 5) sorting parts, 6) mini computers, 7) motor tools, 8) spiral coils, 9) barrier, 10) release chamber, 11) pick-up point, 12) infrared beam, and 13) detection sensor.

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The working principle of the vending machine product in this study, namely: using a light sensor to identify the size of the coin. This machine also uses electromagnets to detect the type of paper from which the money is inserted. Then the information on the size and type of money is used by the machine to determine the value of the money entered, where each amount of money is Rp. have unique size and type characteristics. If the machine database is not found the value of Rp. that match the identified size and type, the money will be rejected and issued back to the customer through the rejection channel. Meanwhile, when the money is identified correctly, the money will go to the sorting section, where the money will be sorted and placed based on its size. The machine will also enter the idle state, he waits for the customer to make a choice by pressing the button on the product they want.

There is a mini computer inside the vending machine that functions as the brain of the machine. This computer can track payments, the value of money entered will be used as a reference, then services that are more expensive than the money entered cannot be accessed by customers. When the customer has selected the service, and passes the test, the computer instructs 1 of 32 very small motor devices, the size of a matchbox, to turn the spiral coil 360 degrees and open the barrier. The certificate will drop into the printing room, then the customer can take their certificate of test results from that room.

When the certificate is about to go out to the pick-up point, the certificate must pass through the infrared light installed in the channel to the machine pick-up point as a detection sensor. If after the product is selected but the infrared does not detect any object passing through it, then the machine concludes that the certificate has not been sent. Then the computer will tell it to the motor to turn back 360 degrees so that the barrier valve opens. The signal continues to be sent until the infrared detects something.

3.2. Design Making

The following is the design of the Vending Machine-Based Certification Tool designed by the proposer (Fig. 1).

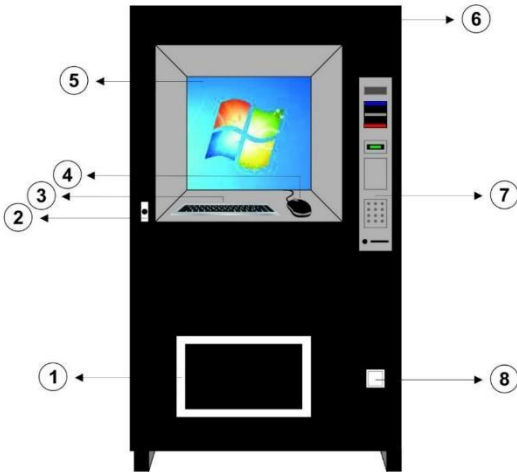


Figure 1. Science and Technology Overview of Vending Machine Based Certification Tools.

Vending Machine-Based Certification Equipment is equipped with components whose functions are interconnected so that the product can run, including: 1) certificate retrieval place, 2) detection sensor, 3) keyboard, 4) mouse, 5) mini computer screen, 6) vending frame machine, 7) engine database, sort & reject section, and 8) motor tool.

3.3. Element Planning

The Vending Machine-Based Certification Tool in this study uses machine elements, namely parts of a construction that have their own form and function, such as: 1) connection elements: a) glue joints, b) solder joints, c) rivet connections, d) welded joints, and d) threaded joints; 2) transmission elements: a) shaft and key, b) clutch, c) drive belt and chain, d) gears, and e) brakes; and 3) supporting elements: a) springs and b) bearings [9].

Details of machine elements as fastening elements, shifting or transmission elements, support elements, lubricating elements, and protective elements; in this study is described in table 1 below.

Table 1. Identification of Machine Elements Certification Tool Based Vending Machine.

Elemental Group	Implementation	Volume
Glue Joint	Installing the money reader into the vending machine drawer	3 rods @ 150 mm

Elemental Group	Implementation	Volume
	Coating welded joints using sealant	1 bottle
Solder Connection	Installing the money reader cable wiring on the vending machine wiring	30-50 dots
	Soldering the printer cable connection to the wiring vending machine	30-50 dots
Rivet Connection	-	-
Welding Connection	Connecting frame parts from hollow metal pieces	> 24 dots
	Installation of plate body vending machine	750 mm, 4 points; 600 mm, 4 points; 450 mm, 4 points
Thread Connection	Installation of door hinges and locks	> 20 pieces
	Rotating wheel installation	> 16 pieces
	Drawer handle installation	> 4 pieces
	Money reader installation	> 6 pieces
Shaft and Stake	Spinning axle	4 pieces
	Lower drawer hinge axle	2 pieces
	Money reader shaft	2 pieces
	hinge pegs	2 pieces
Clutch	Money reader	1 unit
Drive Belt and Chain	Printer	1 unit
Gears	Printer	1 unit
Brake	Spinning wheel	4 pieces
Spring	-	-
Bearing	-	-

3.4. Element Planning

Test the functionality of the Vending Machine Based Certification Tool in the lab. This is done to see the performance produced by the Vending Machine-Based Certification Tool before being sent to the field trial location and socialized to teachers. The performance of the Vending Machine-Based Certification Tool tested includes the functions of: 1) the performance of the light sensor to identify the size of the money, 2) the performance of the electromagnet to detect the type of paper from which the money is inserted, 3) the performance of the vending machine in determining the value of the money entered, 4) rejection channel performance, 5) sorting section performance, 6) vending machine performance in idle state, waiting for the teacher to make a choice by pressing a button on the test to be run, 7) minicomputer performance as the brain of the machine, 8) motor and barrier performance, 9) the performance of the printing room, and 10) the performance of the infrared ray installed in the channel

leading to the pick-up point of the machine as a detection sensor.

The vending machine product in this study works well and is useful for the user. Researchers developed a vending machine by using a more interactive user experience feature to make the vending machine a certification tool for vocational teachers of autronic engineering competence. The results of this study are in line with and/or modifications of previous studies, including the implementation of vending machines for: 1) pet bottle shredder [10], 2) healthier food/snacks and drinks [11]-[16], and 3) managing plastic waste [17].

After the product is tested and the results are functioning, in accordance with the purpose of this study, the next stage of work is to send the product to the field trial location and socialize it to teachers, namely vocational high school teachers with autronic engineering expertise, and students/alumni who participate in the socialization of product use in the field. field test locations.

4. CONCLUSION

The conclusions from the development of this Vending Machine-Based Certification Tool are: 1) the product is developed based on an assessment of the teacher's need for competency improvement and certification, 2) a series of product design works, including: a) data collection (design concepts, product specifications, material planning and principles product work); b) design making, including assembly design and component parts design; c) planning elements, namely breaking down raw materials in product manufacturing; and d) function testing in the product development lab/workshop; 3) the product has been tested and the results work, in accordance with the objectives of this study.

ACKNOWLEDGEMENTS

Researchers from the S1 Automotive Engineering Education study program, State University of Malang (UM) express their deepest gratitude to: 1) The Head of LPPM UM who has funded this research activity through non-State Budget UM funding sources, 2) Bhirawa Car Workshop, Jl. Raya Tlekung No.49, Tlekung, Kec. Junrejo, Batu City, East Java 65327; 3) Committee International Mechanical and Industrial Engineering Conference 2022, Mechanical Engineering Department, State University of Malang (UM).

REFERENCES

- [1] Y. Yuniati, Competence of Kindergarten Teachers in Sikka Regency in terms of academic qualifications and tenure, S2 thesis, Indonesian University of Education, Indonesia, 2019.
- [2] Law 14 of 2005: Teachers and Lecturers, <https://luk.staff.ugm.ac.id/atur/UU14-2005GuruDosen.pdf>, last accessed 2022/11/05
- [3] Mulyasa: Development and Implementation of Curriculum Thought, Rosdakarya, Bandung Indonesia, 2013.
- [4] I.M. Said, E. Sutadji, M. Sugandi, Development of Cooperative Learning-Based Teaching Materials with a Scientific Approach for SMK Students in Malang City Autronic Engineering Expertise Program, *Journal of Education: Theory, Research, and Development*, 1(2), 2016, pp. 99–110.
- [5] R.B. Limianto, The Effect of Playing Online Games on Student Learning Discipline, *COUNSELING: Scientific Journal of Research and Its Application*, 1(2), 2019, pp. 99–110.
- [6] I. Hamdani, Efforts to Improve Ability to Understand Sensor Characteristics in Gasoline Engines Through Group Work Models with Jigsaw Techniques for Autronic Class XI Students at SMK Negeri 6 Malang, *VOCATIONAL: Journal of Vocational Education Innovation*, 1(3), 2021, pp. 99–110.
- [7] VEDC Autronic Department Training Program Malang, 2022.
- [8] Anonymous, What is CBT? Computer Based Test with Many Benefits, 2022.
- [9] Anonymous, Machine Element, Jakarta, 2022.
- [10] N. H. A. Rahim, A. N. H. M. Khatib, Development of PET Bottle Shredder Reverse Vending Machine, *International Journal of Advanced Technology and Engineering Exploration*, 8(74), 2021, pp. 24-33.
- [11] M. Whatnall, A. J. Patterson, M. Hutchesson, Effectiveness of Nutrition Interventions in Vending Machines to Encourage the Purchase and Consumption of Healthier Food and Drinks in the University Setting: A Systematic Review, *Nutrients*, 12(3), 2020, p. 876.
- [12] U. Rozman, I. Pravst, U. P. Kupirovic, U. Blaznik, P. Kocbek, S.S. Turk, Sweet, Fat and Salty: Snacks in Vending Machines in Health and Social Care Institutions in Slovenia, *International Journal of Environmental Research and Public Health*, 17(19), 2020, p. 7059.
- [13] C. Bos, I. Lands, E.V. Kleef, H.C.M. Trijp, Promoting healthy choices from vending machines: Effectiveness and consumer evaluations of four types of interventions, *Food Policy*, 79, 2018.

- [14] A. Carrad, J. C. Y. Louie, M. Milosavljevic, B. Kelly, V. Flood, Consumer support for healthy food and drink vending machines in public places, *Australian and New Zealand Journal of Public Health*, 39(4), 2015, pp. 355-357.
- [15] Parada, D. X. M. Gonzalez, M. L. J. Geromini, M.A.M., Artalejo, F.R., Royo, M.A.: Adherence to nutritional recommendations in vending machines at secondary schools in Madrid (Spain), 2014-2015, *Gaceta Sanitaria*, 32(5), 2017.
- [16] A.J. Rovner, T. Nansel, J. Wang, R. J. Iannotti, R.J.: Food Sold in School Vending Machines Is Associated With Overall Student Dietary Intake, *Journal of Adolescent Health*, 48(1), 2011, 13-9.
- [17] S. Sambhi, P. Dahiya, Reverse vending machine for managing plastic waste, *International Journal of Systems Assurance Engineering and Management* 11(10), 2020.

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