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A Practicum Learning Management Model for Productive Materials Based on the Needs of Industry 4.0 in Vocational School

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The purpose of this study is to assess the implementation of a practicum learning management model for productive material based on the needs of industry 4.0. This study employed research and development. From the results of the study, development was carried out to produce a practicum learning management model called MOMANTIKPROIN 4.0. Suggestions were conveyed to the heads of vocational schools to strengthen the partnership of vocational schools and industry, especially to conduct analysis of workforce competency requirements according to needs of industry 4.0.

Keywords: *Development, Management model, Material, Productive practice, Vocational school.*

Introduction

Vocational education is designed to provide prospective graduates with the theoretical knowledge and professional skills required by certain occupations (Kotsikis, 2007). The core of vocational education is to teach the habit of thinking and working through repeated training. There are three habits taught in vocational school: (1) adaptation to an occupational environment; (2) habits in the work implementation process and (3) thinking habits in occupation (Prosser & Quigley, 1949).

Efforts by the Indonesian government have been conducted to improve the ability of vocational school graduates based on market demands, such as, 'SMK bisa' [vocational education can do it] and revitalisation of vocational education (Presidential Decree No. 9 of

2016). Notwithstanding, these efforts have not been fully able to overcome problems in terms of the quality of graduates. Total number of vocational school graduates in 2016 was still not able to meet the needs of the workforce. Vocational education graduates only account for 1,296,247 of the total workforce, which is 5,759,787. Therefore, the remaining number of 4,463,541 is still unabsorbed in industry. Therefore, there is a gap between the number of graduates, those who are employed, and those who are unemployed. This condition indicates that there is a gap between the quality of graduates and the need for employment in industry.

The incompatibility of the skills of vocational school graduates has been significantly reported by employers in many countries, especially in transition countries in the Eastern European environment. The level of skills mismatch has been identified using the results of the EBRD/World Bank 'BEEPS' 2 survey. The BEEPS 2010 survey covers 21,000 companies in 29 transition countries. The survey shows that many companies have employed a workforce with inadequate competences, and this becomes a major obstacle to their business. In Ukraine and Moldova, more than two fifths of companies have problems with workforce education (Bartlett, 2013). It could be suspected that the low employment of vocational school graduates and the high open unemployment figure of vocational school graduates are caused by the incompatibility of practicum learning management models for productive material in vocational schools. DeShields, Kara & Kaynak (2005) argue that university management must apply the same principles and market-oriented strategies used in companies. This policy will of course apply not only at university but also at vocational schools.

Complex competency and skills must be developed by using integrated learning instead of a standalone learning process (Saavedra & Opfer, 2012). Therefore, the authors were interested in reviewing the development of a practicum learning management model for productive material based on the industrial needs of industry 4.0.

Research Purposes

This current study aims to (1) describe assessment of teachers and students regarding the implementation of a practicum learning management model for productive material based on the needs of industry 4.0. It will focus on technical competency in automotive maintenance management in vocational high schools. (2) It also aims to develop a model of practicum learning management for productive material based on the needs of industry 4.0 (regarding technical competency in automotive maintenance management). The implementation of this study was limited to (1) a management model of practicum learning on productive material, (2) a management model of practicum learning on productive material based on the needs of the era of industrial revolution 4.0, and (3) the location of the study was limited to Semarang, Indonesia.

Literature Review

Callan (2003), and Clarke (2008) indicate that there are differences in goals between industry and the education. Schools are required to produce graduates who have high grades in a short period of time. On the other hand, industry requires technical competencies and good attitudes from graduates (Callan, 2003; Field, 1991). The goal difference could have an impact on the low employment figure of graduates of vocational education (Shevchuk, Strebkov & Davis, 2019). The low quality of graduates is inseparable from the quality of learning management in the theoretical and practicum learning material in vocational high schools, which is not aligned to market needs (Hadromi, Rachman, Soesanto & Kartana, 2015; Widowati at all., 2020). If those two factors are not aligned, it could increasingly widen the gaps between the quality of vocational school graduates and competencies required by industry. Vocational schools are not fully ready to produce graduates according to industry needs.

The rapid development of technology, especially information technology, has influenced the industry in four main ways: cyber physical systems, the internet, clouds and cognitive computing (Lee, Bagheri & Kao, 2015). If it is associated with the era of industrial revolution 4.0, the quality of vocational school graduates is increasingly demanded to change and be oriented towards the needs of the industry market. The World Economic Forum (2016) estimates that until 2020, the current core skills will be lost because the field of work does not need them anymore. At the same time, The Economist, Intelligence Unit (2015) reveals that distinctive skills will emerge for new types of work that require skills that are different from those currently available. Experts predict that changes in work patterns will be faster, and vocational education faces severe challenges in the industrial age 4.0 (Clifton, 2016; Nguyen & Nguyen, 2018).

Learning management contributes to producing graduates according to market needs. Hadromi, Rachman, Soesanto & Kartana (2015) corroborate and find that the implementation of an integrated management model of productive skill practicum (Momantikproter) contributes to improving the quality of students' learning. In the era of industry 4.0, the improvement of a learning management model in vocational school is compulsory to produce qualified graduates who are oriented with the needs of industry 4.0. This can be achieved by using a model of professional development that includes collegial dialogue, such as mentoring and communities of practice, as well as the implementation and enforcement of professional learning.

Research Design

This study employed a research and development (R&D) design in the field of education developed by Borg and Gall (1983), modified into 3 steps: (1) preliminary study, (2) model development, and (3) model testing.

Preliminary Study

Preliminary study was performed by conducting a field survey and literature studies. The field survey was conducted to obtain data on the condition and empirical situations of the existing management of productive skill practicum. Data from survey and literature studies was processed using the focus group discussion (FGD) technique by involving experts in productive learning material (lecturers, teachers and industry practitioners). The results of the FGD were as follows: (1) the existing model, (2) issues in the implementation of a productive skill practicum management model based on industry 4.0, and (3) identification and definition of knowledge and skills that must be possessed by students based on the needs of industry 4.0.

Model Development

The development of the productive practicum management model was carried out in the following steps: (a) summarising the results of the preliminary study; (b) developing a model framework of productive skill practicum management based on the needs of industry 4.0; (c) developing a learning instrument from preparation of tools and materials (the basics of learning strategy) as a guide regarding the learning strategy for teachers and students, a validation sheet, and assessment sheets; (d) setting of learning and learning organisation. Furthermore, the result of this model development was called a conceptual model of management of productive practicum based on the needs of industry 4.0. The conceptual model was further validated by involving experts in productive skill practicum and teachers of productive subjects at the vocational schools. The validation was performed by using the Delphi method used to organise ideas and opinions to find common themes. It is summarised as the model of productive practicum management based on industry 4.0.

The Testing of the Model of Productive Practicum Management

The testing of the hypothetical model of productive practicum management was conducted in these following stages: (a) establishing the test location, class settings and organisation; (b) socialisation and training of the productive practicum management model as the result of the development of technical competency in automotive maintenance management in vocational schools; (c) implementation of productive practice management models resulting from the

development of technical competency in automotive maintenance management in vocational schools (in a limited scope); (d) revision of the management model of the development of productive practicum regarding technical competency in automotive maintenance management based on the study of the trial; (e) implementation of the management model of the productive skill practicum as a result of the development of the technical competency in automotive maintenance management in vocational schools in the extended scope; (f) revision of the management model of the productive skill practicum as a result of the development of technical competency in automotive maintenance management based on testing; (g) assessment on the effectiveness of the management model of the productive skill practicum as a result of the development of technical competency in automotive maintenance management with a quasi-experimental group.

Location and Subjects of the Study

The study was conducted in six state vocational schools in Semarang. Based on the method of the study, it consisted of four location groups: (1) pre-survey, (2) limited model testing, (3) extended model testing, and (4) for the validation test and the effectiveness of the model. Overall, the number of subjects in the study at each stage of research and development is shown on table 1.

Table 1: Number of subjects based on skill competency and stages of research and development

Stages of R & D	Information	Location	Number of class X	The number of students	Total number of teachers
Preliminary study	Pre-Survey	Vocational School 1	3	@ 36	8
		Vocational School 3	2	@ 36	6
		Vocational School 4	2	@ 36	8
		Vocational School 5	2	@ 36	7
		Vocational School 7	2	@ 36	6
		Vocational School 10	3	@ 36	8
Model development	Modelling	Engineering Faculty, UNNES	-	-	-
	Limited Model Testing	Vocational School 7	2	@ 36	6
	Expanded Model Testing	Vocational School 1	3	@ 36	8
		Vocational School 4	2	@ 36	8
		Vocational School 5	2	@ 36	7
Model Validation Test	Experimental group	Vocational School 3	2	@ 36	6
		Vocational School 7	2	@ 36	6
	Control group	Vocational School 5	2	@ 36	7
		Vocational School 10	3	@ 36	8

Instrument of the Study

The development of instruments of the study consisted of (1) the development of questionnaire instruments, interviews, and observations; (2) the development of instrument specification; and (3) the validation and reliability of the test instrument. The data was collected by using questionnaires, interviews, observations, tests, and detailed documentation in table 2.

Data Analysis

After the stages of model development, a limited model testing and the extended model testing, observational data and questionnaires were obtained and analysed by using descriptive analysis. Furthermore, in the expanded model testing, the analysis of the effectiveness of the model was conducted to reveal the quality of students' learning outcomes before and after the implementation of the model by using descriptive techniques. The overall quantitative analysis process was carried out by using the SPSS version 16 program.

Table 2: The use of data collection techniques in R&D: The development of a productive practicum model

Stage of R & D	Activity	Data source	Data collection technique				
			Questionnaire	Interview	Observation	Test	Document
Preliminary study	Survey	Students	v	-	v	-	-
		Teacher	v	v	v	-	-
		Document	-	-	-		v
		Structural officer	-	v	-	-	-
Model development	Modelling	Teachers, lecturers, industry practitioners	-	v	-	-	-
	Limited model testing	students	v	-	v	-	-
		Teacher	-	v	v	-	-
	Extended model testing	students	v	-	v	v	-
		Teacher	-	v	v	-	-
Model validation test	Experiment	students	v	-	v	v	-
		Teacher	-	v	v	-	-

Research Results

Preliminary Study

The preliminary study was conducted by carrying out field observation in six vocational schools in Semarang: Vocational School 1, Vocational School 3, Vocational School 5, Vocational School 7, and Vocational School 10. The reason for choosing these vocational schools was because were ready with various forms of equipment and materials to support the needs of industry 4.0.

Table 3: Teachers and students' perceptions of the quality of the study and implementation of the management of productive skill practicum based on the needs of industry 4.0

No.	Statement	N	Mean	Std Dev	Max	Min	Criteria
1	Teacher assessment of students' learning outcomes in the competency of the technical competency in the automotive maintenance management in vocational schools based on the needs of industry 4.0	30	2.70	0.33	3.30	2.33	excellent
2	Student assessment of students' learning outcomes in the competency of the technical competency in the automotive maintenance management in vocational schools based on the needs of industry 4.0	36	2.59	0.31	3.33	2.73	poor
	Average Score	2.6 5					poor
2	Teacher assessment of the implementation of the model of productive practicum management in technical expertise competency and automotive maintenance management in Vocational Schools based on the needs of industry 4.0	36	2.69	0.63	3.50	1.53	poor
5	Student assessment of the implementation of the model of productive practicum management in the technical competency in the automotive maintenance management in Vocational Schools based on the needs of industry 4.0	36	2.69	0.78	3.53	1.64	poor
	Average score	2, 69					poor

The results of the study consisted of: (1) teacher and student assessment of the competency according to demands of industry 4.0 and (2) assessment of teachers and students regarding the implementation of the management model of the productive skill practicum regarding the technical competency in automotive maintenance management based on the demands of industry 4.0. The results of this study are summarised in Table 3. The results of the study became the basis for the discovery of the factual model, which was then developed further into a hypothetical model and final model.

Development of Learning Management Models of Productive Material Practices

The factual model of productive practicum management, based on the needs of industry 4.0, has been developed into a hypothetical model. Development of a model was aimed to optimise the full potential of the schools and the industry in producing qualified graduates based on the needs of industry 4.0. Planning learning management models started from the formulation of (1) the vision, mission and goals of vocational education; (2) organisation of

the tasks involved with the productive skill practicum; (3) planning management functions of the productive skill practicum; (3) analysis of competencies and needs of the prospective workforce based on the technopreneurship industry 4.0; and (4) the standard implementation of the productive skill practicum.

The implementation of the learning management model of productive skill practicum adopted the learning steps of Zurek, Torquati & Acar (2014), which are summarised into eliciting, inferential questioning, prediction, focus, giving hints, provide material, feedback, generalisation, and concluding. Furthermore, it is integrated into management functions and management elements of the productive skill practicum and modified based on the needs of industry 4.0 (Hadromi, Rachman, Soesanto & Kartana, 2015). Assessment of the productive practicum management model focused on the assessment of the learning process (Räisänen & Räkköläinen, 2014). This is in line with the assessment in effective environments developed by Wiliam (2010, p.146). The assessment of students is carried out based on the learning process. Assessment was carried out to find the results of structured learning activities in the syntax of the needs of industry 4.0. The principles of assessment were: (1) comprehensive; (2) simultaneous; (3) objective; (4) authentic; (5) educational and (6) meaningful.

Expert Validation Results

The expert validation of the learning model resulted in two conclusions: weakness and excellence. The disadvantages of this model include (1) the need to simplify the language in the model to make it easier to understand, (2) the need to rearrange the syntax because it is too long, (3) and the need to select some appropriate assessments so that there are not many assessments. In addition, the advantages of this model are (1) the model can accommodate all aspects of industrial 4.0 development. This model could accommodate learning experience, knowledge, skills, behaviour, and a productive skill practicum, (2) provide ease of access to obtaining learning resources and media because of the formulation of the practicum needs between vocational schools and industry, (3) ease educators in looking for themes based on the needs of industry 4.0, (4) and the teachers could easily formulate semester programs and daily learning implementation plans.

User Validation Results

User validation was used to measure the readability level of the model. User validation was carried out by vocational teachers of technical competency in automotive maintenance management in vocational schools. The results of user validation showed that (1) educators required an explanation of several steps in the model implementation, (2) a good approach for education policy makers was required so they wanted to apply this model.

Revision

Based on the results of the expert validation and user validation, the model of productive skill practicum management based on the needs of industry 4.0 were improved on in these aspects: (1) revision of the arrangement of the contents of the model, (2) improvement of the writing system, (3) improvement of general principle, (4) improvements on goals and benefits of the model implementation, (5) revision of operational procedures, (6) revision of methods and techniques of the model, and (7) revision of the syntax of the model. The results of the field notes during the limited model testing at the vocational school showed that; (1) the shortcomings of this model were found in the assessment format that has not been properly implemented by teachers. Because there were many manual inputs in the assessment, (2) shortcomings in the model implementation were found because of the teachers' abilities to master learning material on the productive practicum based on the needs of industry 4.0. In addition to these two shortcomings, the excellence of this model was its ability to improve the quality of student learning process. Students became more active and were able to socialise and learn in a conducive atmosphere.

Limited Model Testing Improvement

The revision made after a limited model testing was the assessment was performed by using a single assessment: the observation sheet. The observation sheet included the development of students, student learning processes, student learning outcomes based on predetermined indicators and student behaviour records. This observation sheet was used every day for each student. Subsequent changes improved the themes and sub - themes for implementation and learning equipment as clearer examples.

Expanded Model Testing

The implementation of a productive practicum management model can improve student learning. The results of field notes showed that (1) a shortcoming was found in the lack of learning material that reflected the concept of learning based on the needs of industry 4.0 and the absence of industry (related assessment), and (2) this model can improve the quality of students' learning processes with support from the concept of a productive practicum based on the needs of industry 4.0. It can increase the trust of industry 4.0 and the ability of students.

Expanded Model Testing Improvements

Improvements made after the expanded test consisted of (1) adding the productive materials according to the needs of industry 4.0. and (2) adding a column on the observation sheet

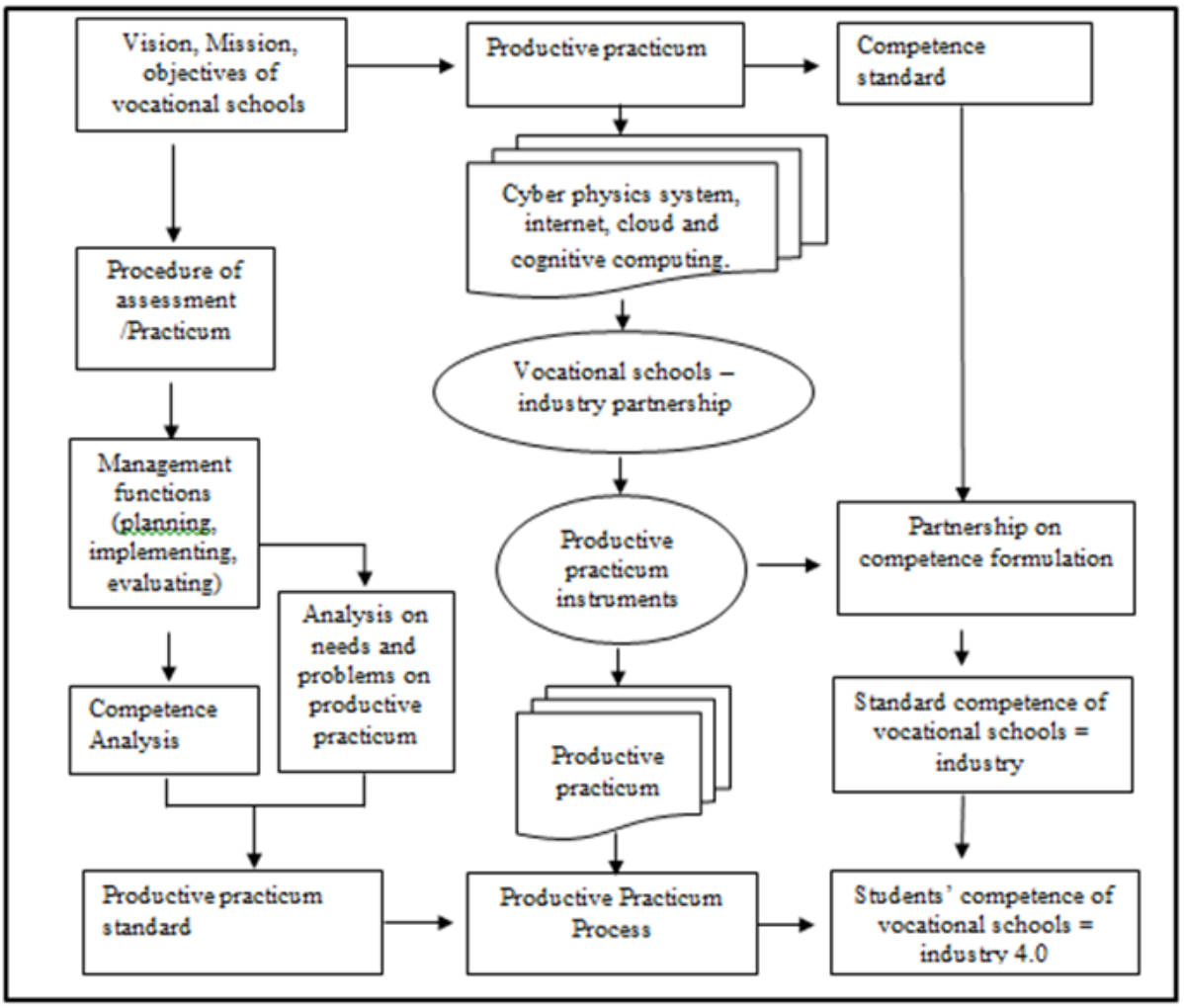
about students' relationships with competence according to needs of industry 4.0. Completion of the final model was performed by adding the reference images in the model book, adding examples of the implementation of the model in vocational schools, improvement of cover design, addition of introductory remarks, and replacement of some images in the model book to be more interesting.

The End Product of the Productive Practicum Management Model

The final product of the productive practicum management model based on the needs of industry 4.0 regarding technical competency in automotive maintenance management is shown in Figure 1. The final model was called MOMANTIKPROIN 4.0. This is a learning model with the principles of the application of management functions in productive practicum learning based on the needs of industry 4.0.

Description of the model showed the procedures or steps in achieving the learning objectives of the vocational schools. Furthermore, these steps can be used to measure success or failure in achieving expected goals (Yang, You & Chen, 2005). This productive practicum management model is a representation of a system that is seen as representing the real system (Law & Kelton, 1991: 5). The management functions of productive practicum management emphasise the making of themes and plans for implementing sub-themes in learning (RPPST). The formulation of plans for implementing sub-themes in learning involved collaboration between vocational schools and industry. The theme chosen in the model was a theme that supported the needs of the industrial revolution 4.0. This accommodates cyber physical, internet, cloud and cognitive computing systems. Planning functions were important for achieving vision, mission and educational goals (Gray & Radloff, 2010).

Figure 1. The model of productive practicum management based on the needs of industry 4.0 regarding technical competency in automotive maintenance management in vocational schools (MOMANTIKPROIN 4.0)



The implementation of the practicum management model consisted of three steps: preliminary activities, core activities, and closing activities. Preliminary activities consisted of giving apperception to figure out the level of initial experience of the students, and or connecting the current material with the previous material, fostering the responses so that they were interested in the learning process. The introductory activities could be in the form of stories, pictures, dialogues, singing and so on. An interesting preliminary activity became the starting point for the success of learning. The core activities were carried out in three stages: collecting information in the field, communicating findings in the field, then carrying out development activities.

The functions of evaluation management using the principle of model assessment were (1) comprehensive; (2) simultaneous; (3) objective; (4). authentic; (5) educating; (6)

meaningfulness. Assessment methods in the model consisted of observation and portfolio, as well as skills tests. Assessments concern student competencies and industry competencies. This condition can avoid different cultural judgments between schools and workplaces, including student perceptions of assessment, assessment criteria, tools for assessment and vocational knowledge (Sandal, Smith & Wangensteen, 2014).

Effectiveness of the Implementation of MOMANTIKPROIN 4.0

The results of testing the differences and effectiveness of the implementation of MOMANTIKPROIN 4.0 showed the value of $t_{statistics}$: -15,909 and for df 35 with a 95% confidence level, t_{table} = 1.6896. Therefore, t_{table} = 1.6896> $t_{statistics}$ = -15,909, then H0 is rejected. There was a difference in the quality of students' practicum learning outcomes regarding productive material based on industry 4.0 after MOMANTIKPROIN 4.0 was implemented. The results of the analysis of the paired sample t test are shown in table 4. The results of the t-test calculation are shown in table 5.

Table 4: Paired samples statistics

		Mean	N	Std. Deviation	Std. Mean Error
Pair 1	Before	60.36	36	8,754	1,459
	After	86.11	36	4,160	.693

After knowing the value of the t test, then the effectiveness test of MOMANTIKPROIN 4.0 was carried out. Based on the results of NGain calculation, the average value of the effectiveness of the increase in learning management practices of the material productive was 59.6 5%. The effectiveness of the quality of students' practicum learning outcomes in productive materials based on needs of industry 4.0 was 62.6 % with the criteria e f extract (table 6).

Table 5: Conclusion of t test results

Statistics			Pair 1
			Before after
Paired Differences	Mean		-25,750
	Std. Deviation		9,711
	Std. Mean Error		1,619
	95% Confidence Interval of the Difference	Lower	-29,036
		Upper	-22,464
t			-15,909
df			35
Sig. (2-tailed)			.000

Discussion

The application of Momantikproin 4.0 can effectively improve the quality of students' understanding of productive material. This is in line with Hadromi's opinion (2018), that the management of practicum learning in strategic vocational schools can produce qualified graduates based on the needs of the labour market (Hadromi, 2018). Momantikproin 4.0 accommodates the needs of workforce competencies in the industrial era 4.0. This is in line with the opinion of Singh and Sudarshan (2015), who indicate the criteria that must be possessed by vocational educational institutions are: (1) orientation to individual performance in the industry; (2) special justification of actual needs on the field; (3) curriculum focus on psychomotor, affective, and cognitive aspects; (4) sensitivity to the industry; and (5) adequate facilities, infrastructure, and community support.

Table 6: Analysis of the NGain test results

Class	Descriptions		statistics	Std Error	Category
NGain_Percentage MOMANTIKPROIN 4.0.	Mean		59.65	1,759	Effective
	95% Confidence Interval for mean	Lower bound	56.05		
		Upper Bound	63.25		
	Maximum		75.00		
	Minimum		42.31		
	Median		57.42		
NGain_Percentage the quality of student learning outcomes	Mean		62.69	2,699	Effective
	95% Confidence Interval for mean	Lower bound	57.21		
		Upper Bound	68.17		
	Maximum		82.00		
	Minimum		7.41		
	Median		66.22		

Momantikproin 4.0 was designed based on the management functions of planning, implementation, and evaluation. The planning function was carried out to achieve the vision, mission and goals of vocational schools. The planning function was conducted in these following stages: (1) the division of the productive practicum tasks; (2) competency analysis and analysis on the needs and problems of the productive practicum; and (3) setting standards for the implementation of the productive practicum. These measures were planned through the partnership between vocational schools and the industry (Hadromi, 2018). The implementation of productive practicum learning can be performed in the workplace, such as through the use of partnership and shared practicum between industry and vocational schools (Manuti et al., 2015; Laine & Hämäläinen, 2015; du Plessis, 2020).

The implementation of Momantikproin 4.0 effectively improved the quality of learning outcomes based on the demands of industry 4.0. The test results showed that the effectiveness

resulted in a 59.655 % improvement in the quality of graduates. The factors of effective implementation of Momantikproin 4.0 were as follows: (1) the implementation of the productive practicum was carried out more in line with the standards of the productive practicum; (2) productive practice material accommodated cyber-physical systems, the internet, clouds and cognitive computing systems in vocational school competence based on the needs of industry; and (3) productive material learning was carried out as authentically as possible in the real conditions in industry 4.0.

Momantikproin 4.0 could improve the quality of learning outcomes. Momantikproin 4.0 fulfilled the characteristics indicative of a good model. According to Marrelli, Tondora, and Hoge (2005), these mean it is 1. simple, 2. applicable, 3. important, 4. controllable, 5. adaptable, and 6. communicable. Therefore, the quality of graduates is higher and relevant to the needs of industry 4.0. Furthermore, Momantikproin 4.0 accommodated partnership between vocational schools and industry. This is confirmed by Hadromi (2017): The management of partnership between schools and industry must be well established and intended to reduce the gap in the quality of graduates with the competencies required by the industry.

Management of productive practicum can be used as a system framework. The system consists of parts that interact in a process to convert input into output. Billing (2003) stated that students' satisfaction in learning depends on several factors, which include interaction between teachers and students. Students' perceptions of good interaction impact on increasing interest in learning. Furthermore, the lack of work competencies of the graduates basically came from poor training in schools caused by less competent teachers and inadequate facilities. This condition is driven by ineffective curricula, incompetent teachers, and lack of knowledge and skills (Hoekstra & Crocker, 2015). The implementation of Momantikproin 4.0 can reduce and avoid these conditions.

Sartika (2020) revealed basic principles of industrial 4.0 are the integration of an engine, workflow, and system implemented by implementing an intelligent network. Hermann, Pentek & Otto (2016) add there are four design principles of industrial 4.0: (1) Interconnection regards the ability of machines, devices, sensors, and people to connect and communicate with each other through the Internet of Things (IoT) or the Internet of People (IoP). This principle requires co-operation, security, and standards. (2) Transparent confirmatory factor analysis (CFA) information is an information system's ability to create a virtual copy of the physical world, enriching digital models with sensor data, including analysis and provision of information; and (3) technical assistance includes (a) the ability of the assistance system to support humans by combining and evaluating information consciously to make the right decisions and solve urgent problems in a short time and (b) the ability of the system to support humans by carrying out various tasks

that are unpleasant, too tiring, or unsafe. This material has been accommodated in the cyber physical system, internet, cloud and cognitive computing systems in Momantikproin 4.0. Therefore, the application of the model supports the quality of graduates based on the needs of industry 4.0.

Education is one of the important factors in developing a nation, both from a global perspective, and the perspectives of individuals who represent the main source of investment in a community. Akhavan Kazemi (2005) states that the development of society often depends on the level of higher education, but also on the qualitative and quantitative development of the education system. At the global level, education is seen as a major factor in sustainable economic, social and human development (Al-Dulaimi, 2016). The application of Momantikproin 4.0 supports the suitability of the quality of graduates with the needs of the workforce based on needs of industry 4.0. The implementation of the model could accelerate graduates in industry 4.0, as well as reduce unemployment of vocational school graduates.

Conclusion

The results of the study show the average score of teachers' assessments and students regarding student ability to master technical competency in automotive maintenance management based on the needs of industry 4.0. Before the implementation of Momantikproin 4.0, the score of teachers and students' assessments respectively were 2.65 and 2.69 in a scale of four. This indicates that students' mastery of productive material competency, technical expertise competence and automotive maintenance management, based on the needs of industry 4.0, were categorised as sufficient.
The final result of the model development was the Momantikproin 4.0 model. It is a model of productive practicum based on the needs of industry 4.0 by integrating the implementation of the management functions of planning, implementation, and evaluation. The implementation of the Momantikproin 4.0 model can improve the quality of graduates according to the needs of industry 4.0. The Momantikproin 4.0 model fulfilled the category of a good model by Marrelli, Tondora & Hoge (2005). In addition, the implementation of the model supports the fulfillment of the basic principles of industry 4.0 (Lifter & Tschiener, 2013). Momantikproin 4.0 is a productive practicum management model that is more suitable for producing qualified vocational graduates based on the needs of industry 4.0. The Implementation of Momantikproin 4.0 increased the knowledge and skills of students on an on-going basis so that it can overcome the problem of competency mismatch between vocational graduates and industry 4.0. Moreover, if this competency is associated with the demands of industry 4.0 era skills, then the implementation of Momantikproin 4.0 can foster capability covering aspects of knowledge, skills and strengthening graduate competencies according to industry needs.

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