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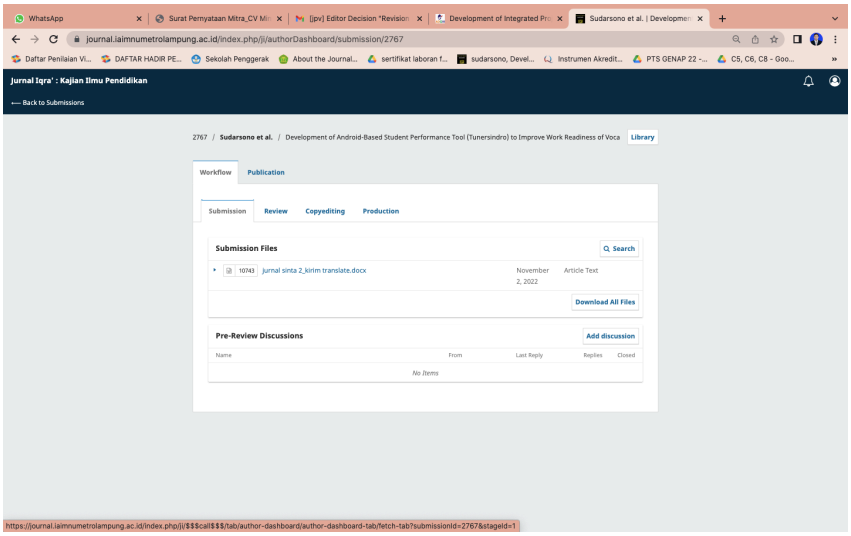

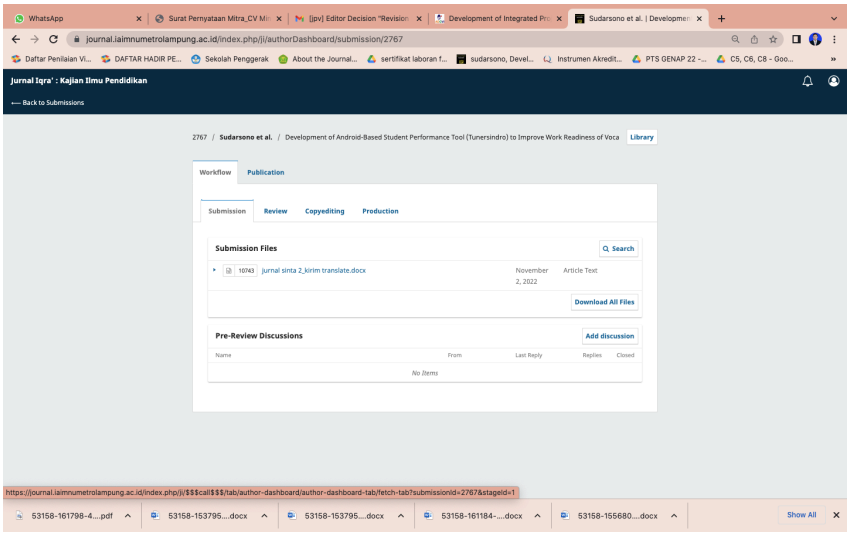

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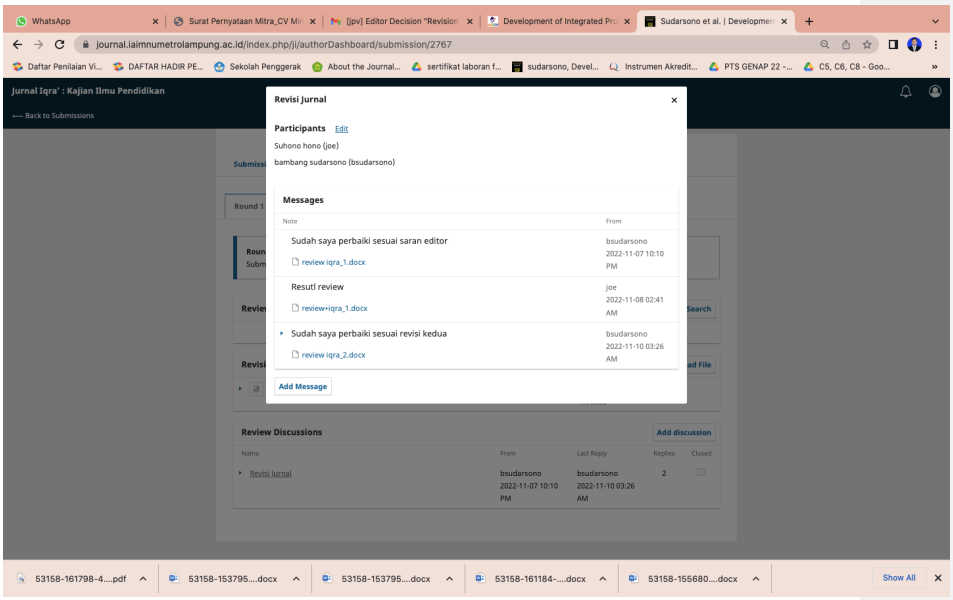
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REVIEW PERTAMA

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Development of Android-Based Student Performance Tool (Tunersindro) To Improve Work Readiness of Vocational High School Students

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ABSTRACT

Job readiness has an effect on the unemployment rate for SMK graduates. Work readiness can be improved by improving learning patterns and tools. This study aims to develop learning aids, test the feasibility and effectiveness of the product. The research design used is the ADDIE Research Development (R&D) design with the stages of Analysis, Design, Development or Production, Implementation or Delivery and Evaluations. The research site is at SMK Muhammadiyah 2 Tempel with research subjects of 134 students, 14 teachers of Automotive Engineering Vocational School and 5 automotive industry practitioners. Data collection techniques used were questionnaires and tests with interview research instruments, media and product questionnaires and practice test sheets. Android-based student performance aids (Tunersindro) have a very high feasibility of being used in vocational learning. Not only that, with two trials, Tunersindro has a very high level of effectiveness in increasing the work readiness of SMK students

Toywords: *Development, student performance aids, android-based, job readiness, vocational students*

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INTRODUCTION

Vocational education graduates in this case vocational high schools (SMK) are prepared to become competent and ready to work human resources(McGrath & Akoojee, 2009)(Choy & Yeung, 2022). The rapid development of the world of work and industry is very influential on the formation of the competence of vocational students(Thomas et al., 2019)(Çinar et al., 2009)(Hermanto & Sholikah, 2019). Especially at this time, Indonesia is faced with the era of the industrial

revolution 4.0, which demands the work readiness of vocational school graduates in the face of new developments and competencies in the industry. The industrial revolution 4.0 is an interesting thing and must be faced by vocational school organizers(Amiron et al., 2019)(Amen & Mustaqim, 2021)(Spöttl & Windelband, 2021). The industrial revolution 4.0 demands the development of technology where digitalization and automation are an important part in increasing industrial productivity. If work readiness is not anticipated properly, the industrial revolution 4.0 will become a big problem for SMKs(Spoettl & Tūtlys, 2020)(Rachinger et al., 2019). This question is evidenced by the highest number of unemployed SMK graduates of 10.38% in 2022. The data identifies that the job readiness of SMK students is still low. Job readiness is a person's ability to find work. Work readiness will be maximized if the competence aspects of attitudes, knowledge and skills are owned by each individual. Digitization, automation and communication information that are connected to the demands of industrial productivity are the subject of the development of the industrial progress process so that patterns of competency formation for vocational students are needed that are aligned with the demands of work in today's industry.(Baethge-Kinsky, 2020)(Hirsch-Kreinsen, 2016).

The demands of the era of industrial disruption are prepared as well as possible by SMK organizers to produce SMK graduates who are ready to compete in the world of work(Sima et al., 2020)(Suleiman et al., 2022)(Dwivedi et al., 2021). So far, there have not been many developments and improvements in the patterns of competency formation in Vocational Schools. Improvements and developments are still limited to the steps for implementing the learning model(Serdyukov, 2017)(Dziuban et al., 2018)(Suwandi et al., 2022). The development of learning models is still the best solution in the formation of vocational students' competencies and is expected to be able to overcome the number of unemployed(Nagy et al., 2018). However, from the results of data collection in SMK, it is stated that the SMK learning model that is applied will not be optimal if in practice it is not supported by learning aids. Not only that, learning aids should involve industry in designing and implementing learning aids. It is hoped that the industry will remain the best partner in the formation of student competencies. Moreover, in the process of competency formation, it is adjusted to the development of digitalization, automation and information in the industry(Wahyuni et al., 2021)(Ali et al., 2020)(Suartini, 2019). Learning aids are expected to be able to overcome problems in SMK. But now, learning aids used in vocational schools are learning aids that are integrated with learning models(Khamdun et al., 2021)(Ulseth et al., 2011).It is necessary to develop industrial-based learning aids which are expected to improve the quality of SMK graduates(Rokhmawan & Wulandari, 2019)(Nurtanto et al., 2019). Industry-based learning tools designed and developed with industry needs and

expectations. Industry-based learning aids have not been widely applied in vocational schools. In general, learning aids that are the main control of the school and do not involve the industrial world(Ricaurte & Viloria, 2020)(Sayekti & Suparman, 2020).

Several research results show that the application of learning models with industrial-based learning aids can improve the quality of vocational graduates. Sudjimat and Tuwoso (2021) state that the PjBL learning model with industry-based learning aids can increase group learning motivation, have high knowledge and learning outcomes are in line with industry expectations (Sudjimat & Tuwoso, 2021). Meanwhile, Khamdun (2021) states that the application of the PjBL learning model with industry-based learning aids can improve the soft skills of vocational students if implemented optimally(Khamdun et al., 2021). The learning aids developed are android-based student performance aids or Tunersindro or abbreviated as Tunersindro. Tunersindro is a learning tool that functions as a learning device and practical test for the performance of SMK students with industrial control by Android. Tunersindro is easy to use and is considered capable of aligning the needs of industry and schools because students are required to work on products, goods and services according to industry needs(Pratitis & Jama, 2020)(Simbolon & Koeswanti, 2020). Tunersindro can improve the quality of SMK graduates if it is designed according to the expectations and needs of the industrial world. Not only that, the development of Tunersindro must place the industry in the preparation, process and evaluation of learning so that the quality of graduates is in line with the expectations of the industrial world.

RESEARCH METHODOLOGY

This study uses an ADDIE research and development (R&D) type research design which consists of: Analysis, Design, Development or Production, Implementation or Delivery and Evaluations. This study aims to develop an android-based or Tunersindro-based student performance tool. Tunersindro was developed to support the improvement of vocational students' work readiness. The research subjects used were 34 students majoring in automotive at SMK Muhammadiyah Moyudan, teachers majoring in automotive engineering in Sleman Regency, totaling 14 teachers, and automotive industry practitioners totaling 5 practitioners. Data collection techniques used interviews in the form of focus group discussions (FGD), questionnaires and practice test sheets. (1) FGD aims to analyze the current learning needs of SMK. (2) Questionnaires are used to get input from media experts on the feasibility of android-based or Tunersindro-based student performance aids. (3) Practice test sheets are used to determine the effectiveness of Tunersindro products/tools in improving

Commented [S1]: All Data Result Interview and Analysis should be added in Discussion Section

students' practical performance. Tunersindro development stages can be seen in Figure 1.

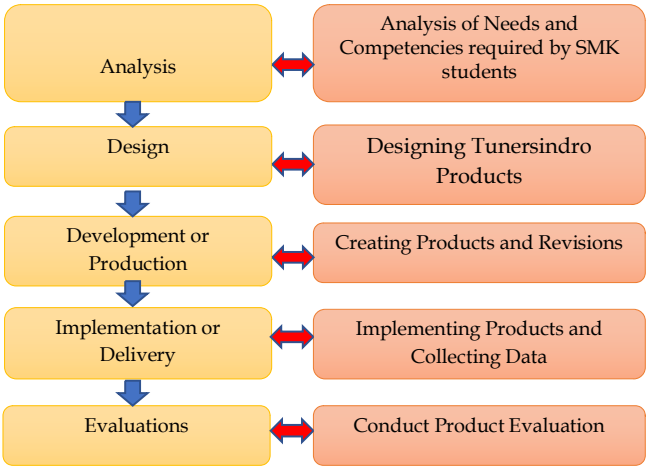


Figure 1. ADDIE Research and Development Stages

Interviews in the form of FGDs are a series of needs analysis activities that contain instruments with a number of questions that function to explore information related to the current state of vocational learning and future expectations. The FGD instrument grid can be seen in Table 1.

Table 1. FGD Instrument Grid

Grille	Question Items	Respondent
Current Conditions of Vocational Vocational Learning and Competence	1.2	Vocational Teacher, Industry
Industrial Needs for the Quality of Vocational High School Graduates	3.4	Industry
Vocational High School Needs for Industry Participation	5,6,7	SMK teacher
Learning Aids Needed by Vocational Schools and Industry	8	Vocational Teacher, Industry
Technical Design of Learning Aids	9.10	Vocational Teacher, Industry

Questionnaires, Tunersindro products and practice test sheets were validated by a content validity test. The content validity test contains consultation and simulation activities for experts/expert judgments. Media

eligibility questionnaires and practice test sheets were validated by material experts from academia, while Tunersindro's eligibility was validated by media experts from the Indonesian Robotic School. The media eligibility questionnaire and practice test sheets can be seen in Tables 2 and 3.

Table 2. Media Validation Questionnaire Indicators

Media Validation Questionnaire Indicator	
Media Engineering	Effectiveness in Use
	Usability (easy to use)
	Product appeal
Visual Communication	Communicative (easy to understand instructions)
	Creative and innovative
	Selection of the type of manufacture
	The suitability of the product form that supports
	Theory

Table 3. Practice Test Assessment Sheet

Competency Test Indicator	
Attitude	Initiative
	Responsibility
Knowledge	field of work
	work field work
Skills	punctuality

The data analysis of this research used descriptive quantitative data analysis techniques. After getting a number on the instrument, then the research data is changed in the form of a score and then the average answer is calculated based on the score of each answer with the following formula:

$$x = \frac{\sum \mathbf{x}}{n}$$

Note:
x= number of respondents
n = number of answer scores
x = average score of respondents

To find out how big the feasibility and effectiveness of the Tunersindro learning aid development process, the data can be categorized in Table 4 as follows.

Table 4. Feasibility Test of Tunersindro Learning Aids

Formula	Score	Category
X≥ x +1.SBx	X 3.00	Very high
x+ SBx > x x	3.00 > X 2.50	Tall
x> x x - 1.SBx	2.50 > X 2.00	Enough
X < x – 1.SBx	X< 2.00	Not enough

(Mardapi, 2008)

X: the score achieved by students
x : Average overall score of students in one class
SBx : Standard deviation of students' overall scores in one class
x : (1/2) (ideal maximum score – ideal minimum score)
SBx :(1/6) (ideal maximum score – ideal minimum score)
Ideal Max Score:Item criteria x highest score
Ideal Min Score:Item criteria x lowest score

RESULTS AND DISCUSSION

This study aims to develop and test the feasibility and effectiveness of an android-based student performance aid (Tunersindro) which is expected to improve the competence of vocational students. Tunersindro development stages use the ADDIE model (Analyze, Design, Develop, Implementation, Evaluate).

Analyze

The analysis stage is an activity that aims to analyze the learning needs in SMK. This stage consists of Focus Group Discussion (FGD) activities with participants from teachers and industry practitioners. The FGD stages produced several notes and recommendations which can be seen in Table 5. Results of Needs Analysis

Teacher	Industrial Practitioner
1. The problems experienced by SMK related to the competence of graduates are increasingly declining. 2. SMK requires active participation from industry to help prepare SMK graduates	1. Vocational schools need to consult the curriculum with industry needs 2. Industry can take part at least in the competency test 3. Learning aids are very important made to support the role of industry,

3. The learning models used will not produce maximum competence without learning aids. 4. Learning aids in design and manufacture involve industry. 5. The industrial world participates in the preparation, implementation and evaluation of learning. 6. Competency testing is a measurement activity that can involve industry	4. Tools that are simple and easy to use, but have high usability. 5. Emphasis on the aspect of attitudinal competence includes the attitude of initiative and responsibility. Knowledge competence includes knowledge of the field of work. Competence skills include the execution of the field of work and punctuality.

From the results of the FGD, it can be concluded that the competence of vocational students has recently decreased which has an impact on work readiness. It takes a learning model that is supported by learning aids that can facilitate industry participation.

Design

After getting the results of the needs analysis, the next step is to design the Tunersindro learning tool. Tunersindro's design was obtained from input from industry and vocational schools. Tunersindo's design can be seen in Figure 3.

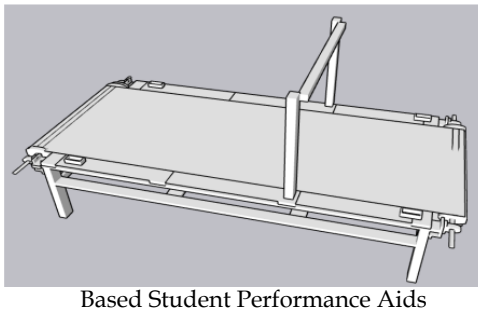
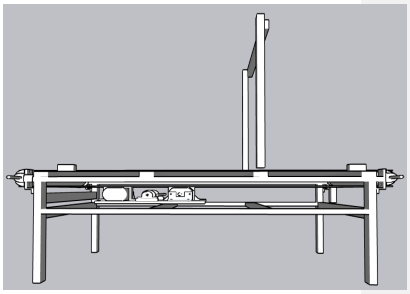


Figure 2. Design of Android-Based Student Performance Aids (Tunersindro)



Tunersinndrois a learning tool that is operated with android. Tunersindro consists of several components which can be seen in Table 6.

Component	Amount
V Slot Aluminum Profile Extrusion Rail 2020 Clear OX CNC Frame	4
Moveclap 20pcs Elbow Connector Bracket 90 Degree T Shape L Slot Slot	2
Zinc Alloy KP08 8mm Diameter Pillow Block Mounted Ball Bearing	27

BAUT L / HEX SOCKET HEAD CAP SCREW STAINLESS STEEL M5 X 20	5
nut m5 v-slot T hummer	100
Shaft 8mm Stainless Steel length 30cm 300mm SUS 201 Linear Rail	14
6mm open timing belt GT2 rubber Aramid Fiber belt.	2
42 Stepper motor NEMA 17 1.5A Torque 0.4Nm for CNC 3D Printer AI32	2
Bracket Stepper Motor 42 NEMA 17 Black 3MM Steel Anchor stepmotor AK05	2
Allen Hex Socket Head Cap Screw M3 x 12mm (10pcs) H/T 12.9 Grade	2
GT2 Timing Pulley 16 teeth bore 5mm belt 6mm	2
GT2 TIming Pulley 20 teeth bore 8mm belt 6mm	2
L Key Set 8pcs 1.5mm~6mm / 8 In 1 Hex Key Allen Wrench Set	2
A4988 STEPPER MOTOR DRIVER MODULE WITH HEATSHINK 3D PRINTER PART	2
[CNC] ARDUINO NANO V3 3.0 ATMEGA328P CH340 CH340G 5V BOARD + USB CABLE	2
Conveyor Belt - EP 100 size 50cm x 4 PLY	4
Digit 7 Segment Digital 5V LCD Display Module	4

Develop

At this stage, Tunersindro is produced according to the results of the design stage. The development and production were carried out by researchers assisted by electronics experts from the Indonesian Robotic School and the automotive industry from the Otomotif Jogjakarta Center (OJC), Gama Multi, Barokah Workshop, AnggaNewTech and RND Auto Service. The development and production of Tunersindro was carried out and produced Tunersindro according to Figure 3.

Figure 3. Android-Based Student Performance Tool (Tunersindro)

After Tunersindro works, the next step is to test the validity of the product with the help of expert judgment. The results of media validation show that Tunersindro has a very high feasibility to be used as a learning aid for vocational students. The results of media validation can be shown in Table 7.

Table 7. Media Validation Results

Media Validation Questionnaire Indicator		Score
Media Engineering	Effectiveness in Use	4
	Usability (easy to use)	3
	Product appeal	4
Visual Communication	Communicative (easy to understand instructions)	4
	Creative and innovative	4
	Selection of the type of manufacture	4
	The suitability of the product form that supports the material	3
Average Score		3.71

Implementation

At this stage, the researcher applied Tunersindro to determine its effectiveness in increasing the work readiness of vocational students. Work readiness is determined by the achievement of aspects of attitude, knowledge and skills competencies. Tunersindro is applied to automotive learning and practical exams. The material used is the competence of diesel motor nozzle maintenance. To see the improvement in the application of Tunersindro, three

times the application was carried out, namely: pretest, trial one and trial two (posttest). The results of the application of Tunersindro carried out for three times can be seen in Table 8.

Table 8. Results of Practice Test Competency Improvement

Competency Indicator		**Average Score**		
		PreTest	Trial One	Trial Two (PostTest)
Attitude	Initiative	1.3	2.2	3.2
	Responsibility	1.8	2.4	3.4
Knowledge	field of work	1.9	2.6	3.6
Skills	work field work	1.5	2.4	3.2
	punctuality	2.1	2.2	3.4

The results of the practical test showed that in the pretest, trial one and trial two there was an increase in aspects of attitude, knowledge and skill competencies gradually with the final result/posttest Tunersindro was very good at improving the work readiness of vocational students. The results of increasing competence in each trial can be seen in Figure 4.

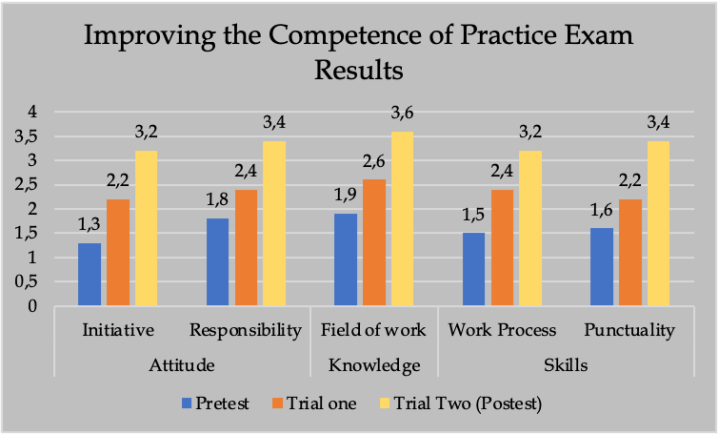


Figure 4. Results of Practice Test Competency Improvement

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CONCLUSION

The development of an Android-Based Student Performance Tool (Tunersindro) is designed to improve the work readiness of SMK students. The application of Tunersindro for three times resulted in data that there was an increase in the competence of attitudes, knowledge and skills. Aspects of attitude consisting of initiative and responsibility, knowledge aspects of the field of work and aspects of work skills and punctuality increased from high to very high category. This shows that the application of the Tunersindro learning aid will have a positive effect on improving aspects of attitude, knowledge and skill competence. This is in accordance with the results of research by Tamimi et al which stated that the application of learning aids with the internet system can help develop student competency skills and attitudes(M. Al-Tamimi & Attamimi, 2014). Arifah et al said that the application of learning through the role playing method with the help of online-based tools can improve social competence, attitude, responsibility and knowledge(Arifah Nurdin et al., 2018). The application of learning models assisted by internet-based learning tools can improve the work readiness of SMK students. This statement is in accordance with the results of research by Parjono et al, Sulistyaningrum and Novaliedry who concluded that learning models in vocational schools that are applied with learning aids will have an impact on increasing the work readiness of vocational students.(Novaliendry et al., 2020)(Sulistyaningrum et al., 2020) (Hasan & Pardjono, 2019).

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REFERENCES

Ali, M., Triyono, B., & Koehler, T. (2020). Evaluation of Indonesian Technical and Vocational Education in Addressing the Gap in Job Skills Required by Industry. *Proceeding - 2020 3rd International Conference on Vocational Education and Electrical Engineering: Strengthening the Framework of Society 5.0 through Innovations in Education, Electrical, Engineering and Informatics Engineering, ICVEE 2020*. https://doi.org/10.1109/ICVEE50212.2020.9243222

Amin, M., & Mustaqim, B. (2021). Vocational Teachers Readiness in Integration The Principles of Industrial Revolution 4 . 0 into The Learning Process. *Elinvo (Electronics, Informatics, and Vocational Education)*, *6*(2), 106–119.

Amiron, E., Latib, A. A., & Subari, K. (2019). Industry revolution 4.0 skills and enablers in technical and vocational education and training curriculum. *International Journal of Recent Technology and Engineering*, *8*(1C2), 484–490.

Arifah Nurdin, T., Japar, M., & G. Bachtiar, I. (2018). Improving Social Attitudes and Knowledge Through Role Playing Method. *American Journal of Educational Research*, *6*(7), 1040–1045. https://doi.org/10.12691/education-6-7-23

Baethge-Kinsky, V. (2020). Digitized Industrial Work: Requirements, Opportunities, and Problems of Competence Development. *Frontiers in Sociology*, *5*(June). https://doi.org/10.3389/fsoc.2020.00033

Choy, M. W., & Yeung, A. S. (2022). Cognitive and affective academic self-concepts: Which predicts vocational education students' career choice? *International Journal of Educational Research Open*, *3*(February), 100123. https://doi.org/10.1016/j.ijedro.2022.100123

Çinar, H., Döngel, N., & Söğütlü, C. (2009). A case study of technical and vocational education in Turkey. *Procedia - Social and Behavioral Sciences*, *1*(1), 160–167. https://doi.org/10.1016/j.sbspro.2009.01.030

Dwivedi, Y. K., Ismagilova, E., Hughes, D. L., Carlson, J., Filieri, R., Jacobson, J., Jain, V., Karjaluoto, H., Kefi, H., Krishen, A. S., Kumar, V., Rahman, M. M., Raman, R., Rauschnabel, P. A., Rowley, J., Salo, J., Tran, G. A., & Wang, Y. (2021). Setting the future of digital and social media marketing research: Perspectives and research propositions. *International Journal of Information Management*, *59*(May), 102168. https://doi.org/10.1016/j.ijinfomgt.2020.102168

Dziuban, C., Graham, C. R., Moskal, P. D., Norberg, A., & Sicilia, N. (2018). Blended learning: the new normal and emerging technologies. *International Journal of Educational Technology in Higher Education*, *15*(1), 1–16. https://doi.org/10.1186/s41239-017-0087-5

Hasan, A., & Pardjono, P. (2019). The Correlation of Higher Order Thinking Skills

and Work Readiness of Vocational High School Students. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *25*(1), 52–61. https://doi.org/10.21831/jptk.v25i1.19118

Hermanto, F. Y., & Sholikah, M. (2019). the Need of Practical Teaching in Vocational High. *Jurnal Pendidikan Vokasi*, *9*(3), 238–248.

Hirsch-Kreinsen, H. (2016). Digitization of industrial work: development paths and prospects. *Journal for Labour Market Research*, *49*(1), 1–14. https://doi.org/10.1007/s12651-016-0200-6

Khamdun, K., Suparmi, S., Maridi, M., & Rusilowati, A. (2021). Development of vocational science learning devices to improve project based soft skills. *Linguistics and Culture Review*, *5*(S1), 201–213. https://doi.org/10.21744/lingcure.v5ns1.1348

M. Al-Tamimi, N. O., & Attamimi, R. A. (2014). Effectiveness of Cooperative Learning in Enhancing Speaking Skills and Attitudes towards Learning English. *International Journal of Linguistics*, *6*(4), 27. https://doi.org/10.5296/ijl.v6i4.6114

Mardapi, D. (2008). *Teknik Penyusunan Instrumen Tes Dan Non Tes*. Mitra Cendikia Offset.

McGrath, S., & Akoojee, S. (2009). Vocational education and training for sustainability in South Africa: The role of public and private provision. *International Journal of Educational Development*, *29*(2), 149–156. https://doi.org/10.1016/j.ijedudev.2008.09.008

Nagy, J., Oláh, J., Erdei, E., Máté, D., & Popp, J. (2018). The role and impact of industry 4.0 and the internet of things on the business strategy of the value chain-the case of hungary. *Sustainability (Switzerland)*, *10*(10). https://doi.org/10.3390/su10103491

Novaliendry, D., Darmi, R., Hendriyani, Y., Nor, M., & Azman, A. (2020). Smart Learning Media Based on Android Technology. *International Journal of Innovation, Creativity and Change.*, *12*(11), 715–735.

Nurtanto, M., Sofyan, H., Fawaid, M., & Rabiman, R. (2019). Problem-based learning (PBL) in industry 4.0: Improving learning quality through character-based literacy learning and life career skill (LL-LCS). *Universal Journal of Educational Research*, *7*(11), 2487–2494. https://doi.org/10.13189/ujer.2019.071128

Pratitis, T., & Jama, J. (2020). Project Based Learning Module Development On Design Curling Competency In SMK. *EDUTEC : Journal of Education And Technology*, *3*(2), 174–182. https://doi.org/10.29062/edu.v3i2.132

Rachinger, M., Rauter, R., Müller, C., Vorraber, W., & Schirgi, E. (2019). Digitalization and its influence on business model innovation. *Journal of*

Manufacturing Technology Management, *30*(8), 1143–1160. https://doi.org/10.1108/JMTM-01-2018-0020

Ricaurte, M., & Viloria, A. (2020). Project-based learning as a strategy for multi-level training applied to undergraduate engineering students. *Education for Chemical Engineers*, *33*, 102–111. https://doi.org/10.1016/j.ece.2020.09.001

Rokhmawan, T., & Wulandari, B. (2019). The Relevance of Project-Based Lecture in Industrial Revolution 4.0 : Meta – Synthesis Study. *Jurnal Iqra' : Kajian Ilmu Pendidikan*, *4*(2), 146–167. https://doi.org/10.25217/ji.v4i2.515

Sayekti, A. M., & Suparman. (2020). Development of PJBL-based LKPD with STEM approach design to improve critical thinking skills. *International Journal of Scientific and Technology Research*, *9*(3), 3390–3394.

Serdyukov, P. (2017). Innovation in education: what works, what doesn't, and what to do about it? *Journal of Research in Innovative Teaching & Learning*, *10*(1), 4–33. https://doi.org/10.1108/jrit-10-2016-0007

Sima, V., Gheorghe, I. G., Subić, J., & Nancu, D. (2020). Influences of the industry 4.0 revolution on the human capital development and consumer behavior: A systematic review. *Sustainability (Switzerland)*, *12*(10). https://doi.org/10.3390/SU12104035

Simbolon, R., & Koeswanti, H. D. (2020). Comparison Of Pbl (Project Based Learning) Models With Pbl (Problem Based Learning) Models To Determine Student Learning Outcomes And Motivation. *International Journal of Elementary Education*, *4*(4), 519–529. https://ejournal.undiksha.ac.id/index.php/IJEE

Spoettl, G., & Tūtlys, V. (2020). Education and Training for the Fourth Industrial Revolution. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *26*(1), 83–93. https://doi.org/10.21831/jptk.v26i1.29848

Spöttl, G., & Windelband, L. (2021). The 4th industrial revolution–its impact on vocational skills. *Journal of Education and Work*, *34*(1), 29–52. https://doi.org/10.1080/13639080.2020.1858230

Suartini, T. (2019). Influence Application of Learning Model on Vocational Education Based on Quality Issurance. *SAGE Open*, *9*(2). https://doi.org/10.1177/2158244019851552

Sudjimat, D. A., & Tuwoso. (2021). Impact of Work and Project-Based Learning Models on Learning Outcomes and Motivation of Vocational High School Students Dwi Agus Sudjimat. *Educational Sciences : Theory & Practice*, *21*(April), 131–144. https://doi.org/10.12738/jestp.2021.2.009

Suleiman, Z., Shaikholla, S., Dikhanbayeva, D., Shehab, E., & Turkyilmaz, A. (2022). Industry 4.0: Clustering of concepts and characteristics. *Cogent Engineering*, *9*(1), 0–26. https://doi.org/10.1080/23311916.2022.2034264

Sulistyaningrum, H., Winata, A., Cacik, S., & Munawaroh, M. (2020). The Effectiveness of Developing Android-Based IPA Learning Devices to Improve Students 21 st Century Skills. *International Journal of Science and Research (IJSR)*, *9*(9), 970–979. https://doi.org/10.21275/SR20911062524

Suwandi, S., Hanafiah, H., Iriantara, Y., & ... (2022). Dual Based Assessment in Improving the Quality of Skills at the Center of Excellence Vocational School. *… Journal of Educational …*, 1701–1707. https://www.ijersc.org/index.php/go/article/view/469%0Ahttps://www.ijersc.org/index.php/go/article/download/469/447

Thomas, T. L., Prasad Muliyala, K., Jayarajan, D., Angothu, H., & Thirthalli, J. (2019). Vocational challenges in severe mental illness: A qualitative study in persons with professional degrees. *Asian Journal of Psychiatry*, *42*(February), 48–54. https://doi.org/10.1016/j.ajp.2019.03.011

Ulseth, R. R., Froyd, J. E., Litzinger, T. A., Ewert, D., & Johnson, B. M. (2011). A new model of project based learning. *ASEE Annual Conference and Exposition, Conference Proceedings*, *January*.

Wahyuni, V. S., Nurlela, N., Haryanto, Y., & Bogor, S. M. (2021). The Implementation of Vocational Regulation of Education. *Edutec*, *5*(2), 348–357.

REVIEW KEDUA

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Development of Android-Based Student Performance Tool (Tunersindro) To Improve Work Readiness of Vocational High School Students

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ABSTRACT

Job readiness has an effect on the unemployment rate for SMK graduates. Work readiness can be improved by improving learning patterns and tools. This study aims to develop learning aids, test the feasibility and effectiveness of the product. The research design used is the ADDIE Research Development (R&D) design with the stages of Analysis, Design, Development or Production, Implementation or Delivery and Evaluations. The research site is at SMK Muhammadiyah 2 Tempel with research subjects of 134 students, 14 teachers of Automotive Engineering Vocational School and 5 automotive industry practitioners. Data collection techniques used were questionnaires and tests with interview research instruments, media and product questionnaires and practice test sheets. Android-based student performance aids (Tunersindro) have a very high feasibility of being used in vocational learning. Not only that, with two trials, Tunersindro has a very high level of effectiveness in increasing the work readiness of SMK students

Toywords: *Development, student performance aids, android-based, job readiness, vocational students*

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INTRODUCTION

Vocational education graduates in this case vocational high schools (SMK) are prepared to become competent and ready to work human resources(McGrath & Akoojee, 2009)(Choy & Yeung, 2022). The rapid development of the world of work and industry is very influential on the formation of the competence of

vocational students(Thomas et al., 2019)(Çinar et al., 2009)(Hermanto & Sholikah, 2019). Especially at this time, Indonesia is faced with the era of the industrial revolution 4.0, which demands the work readiness of vocational school graduates in the face of new developments and competencies in the industry. The industrial revolution 4.0 is an interesting thing and must be faced by vocational school organizers(Amiron et al., 2019)(Amen & Mustaqim, 2021)(Spöttl & Windelband, 2021). The industrial revolution 4.0 demands the development of technology where digitalization and automation are an important part in increasing industrial productivity. If work readiness is not anticipated properly, the industrial revolution 4.0 will become a big problem for SMKs(Spoettl & Tūtlys, 2020)(Rachinger et al., 2019). This question is evidenced by the highest number of unemployed SMK graduates of 10.38% in 2022. The data identifies that the job readiness of SMK students is still low. Job readiness is a person's ability to find work. Work readiness will be maximized if the competence aspects of attitudes, knowledge and skills are owned by each individual. Digitization, automation and communication information that are connected to the demands of industrial productivity are the subject of the development of the industrial progress process so that patterns of competency formation for vocational students are needed that are aligned with the demands of work in today's industry.(Baethge-Kinsky, 2020)(Hirsch-Kreinsen, 2016).

The demands of the era of industrial disruption are prepared as well as possible by SMK organizers to produce SMK graduates who are ready to compete in the world of work(Sima et al., 2020)(Suleiman et al., 2022)(Dwivedi et al., 2021). So far, there have not been many developments and improvements in the patterns of competency formation in Vocational Schools. Improvements and developments are still limited to the steps for implementing the learning model(Serdyukov, 2017)(Dziuban et al., 2018)(Suwandi et al., 2022). The development of learning models is still the best solution in the formation of vocational students' competencies and is expected to be able to overcome the number of unemployed(Nagy et al., 2018). However, from the results of data collection in SMK, it is stated that the SMK learning model that is applied will not be optimal if in practice it is not supported by learning aids. Not only that, learning aids should involve industry in designing and implementing learning aids. It is hoped that the industry will remain the best partner in the formation of student competencies. Moreover, in the process of competency formation, it is adjusted to the development of digitalization, automation and information in the industry(Wahyuni et al., 2021)(Ali et al., 2020)(Suartini, 2019). Learning aids are expected to be able to overcome problems in SMK. But now, learning aids used in vocational schools are learning aids that are integrated with learning models(Khamdun et al., 2021)(Ulseth et al., 2011).It is necessary to develop industrial-based learning aids which are expected to improve the quality of SMK

graduates(Rokhmawan & Wulandari, 2019)(Nurtanto et al., 2019). Industry-based learning tools designed and developed with industry needs and expectations. Industry-based learning aids have not been widely applied in vocational schools. In general, learning aids that are the main control of the school and do not involve the industrial world(Ricaurte & Viloria, 2020)(Sayekti & Suparman, 2020).

Several research results show that the application of learning models with industrial-based learning aids can improve the quality of vocational graduates. Sudjimat and Tuwoso (2021) state that the PjBL learning model with industry-based learning aids can increase group learning motivation, have high knowledge and learning outcomes are in line with industry expectations (Sudjimat & Tuwoso, 2021). Meanwhile, Khamdun (2021) states that the application of the PjBL learning model with industry-based learning aids can improve the soft skills of vocational students if implemented optimally(Khamdun et al., 2021). The learning aids developed are android-based student performance aids or Tunersindro or abbreviated as Tunersindro. Tunersindro is a learning tool that functions as a learning device and practical test for the performance of SMK students with industrial control by Android. Tunersindro is easy to use and is considered capable of aligning the needs of industry and schools because students are required to work on products, goods and services according to industry needs(Pratitis & Jama, 2020)(Simbolon & Koeswanti, 2020). Tunersindro can improve the quality of SMK graduates if it is designed according to the expectations and needs of the industrial world. Not only that, the development of Tunersindro must place the industry in the preparation, process and evaluation of learning so that the quality of graduates is in line with the expectations of the industrial world.

RESEARCH METHODOLOGY

This study uses an ADDIE research and development (R&D) type research design which consists of: Analysis, Design, Development or Production, Implementation or Delivery and Evaluations. This study aims to develop an android-based or Tunersindro-based student performance tool. Tunersindro was developed to support the improvement of vocational students' work readiness. The research subjects used were 34 students majoring in automotive at SMK Muhammadiyah Moyudan, teachers majoring in automotive engineering in Sleman Regency, totaling 14 teachers, and automotive industry practitioners totaling 5 practitioners. Data collection techniques used interviews in the form of focus group discussions (FGD), questionnaires and practice test sheets. (1) FGD aims to analyze the current learning needs of SMK. (2) Questionnaires are used to get input from media experts on the feasibility of android-based or Tunersindro-based student performance aids. (3) Practice test sheets are used to

Commented [S4]: Data Questionnaire and Analysis should be added in Discussion Section

determine the effectiveness of Tunersindro products/tools in improving students' practical performance. Tunersindro development stages can be seen in Figure 1.

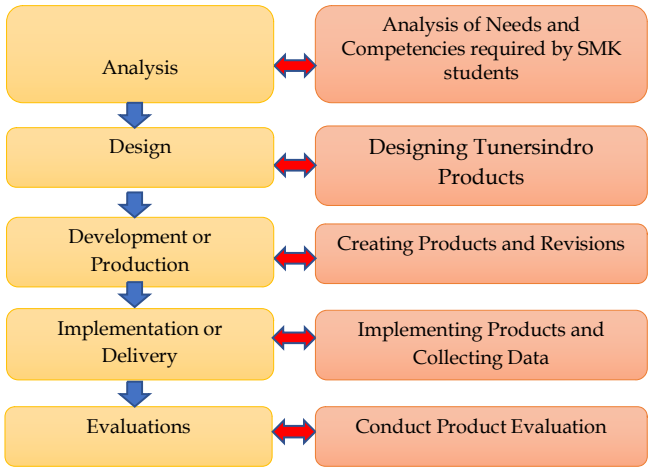


Figure 1. ADDIE Research and Development Stages

Interviews in the form of FGDs are a series of needs analysis activities that contain instruments with a number of questions that function to explore information related to the current state of vocational learning and future expectations. The FGD instrument grid can be seen in Table 1.

Table 1. FGD Instrument Grid

Grille	Question Items	Respondent
Current Conditions of Vocational Vocational Learning and Competence	1.2	Vocational Teacher, Industry
Industrial Needs for the Quality of Vocational High School Graduates	3.4	Industry
Vocational High School Needs for Industry Participation	5,6,7	SMK teacher
Learning Aids Needed by Vocational Schools and Industry	8	Vocational Teacher, Industry
Technical Design of Learning Aids	9.10	Vocational Teacher, Industry

Questionnaires, Tunersindro products and practice test sheets were validated by a content validity test. The content validity test contains consultation and simulation activities for experts/expert judgments. Media eligibility questionnaires and practice test sheets were validated by material experts from academia, while Tunersindro's eligibility was validated by media experts from the Indonesian Robotic School. The media eligibility questionnaire and practice test sheets can be seen in Tables 2 and 3.

Table 2. Media Validation Questionnaire Indicators

Media Validation Questionnaire Indicator	
Media Engineering	Effectiveness in Use
	Usability (easy to use)
	Product appeal
Visual Communication	Communicative (easy to understand instructions)
	Creative and innovative
	Selection of the type of manufacture
	The suitability of the product form that supports
	Theory

Table 3. Practice Test Assessment Sheet

Competency Test Indicator	
Attitude	Initiative
	Responsibility
Knowledge	field of work
	work field work
Skills	punctuality

The data analysis of this research used descriptive quantitative data analysis techniques. After getting a number on the instrument, then the research data is changed in the form of a score and then the average answer is calculated based on the score of each answer with the following formula:

$$x = \frac{\sum \mathbf{x}}{n}$$

Note:
x= number of respondents
n = number of answer scores
x = average score of respondents

To find out how big the feasibility and effectiveness of the Tunersindro learning aid development process, the data can be categorized in Table 4 as follows.

Table 4. Feasibility Test of Tunersindro Learning Aids

Formula	Score	Category
X≥ x +1.SBx	X 3.00	Very high
x+ SBx > x x	3.00 > X 2.50	Tall
x> x x - 1.SBx	2.50 > X 2.00	Enough
X < x – 1.SBx	X< 2.00	Not enough

(Mardapi, 2008)

X: the score achieved by students
x : Average overall score of students in one class
SBx : Standard deviation of students' overall scores in one class
x : (1/2) (ideal maximum score – ideal minimum score)
SBx :(1/6) (ideal maximum score – ideal minimum score)
Ideal Max Score:Item criteria x highest score
Ideal Min Score:Item criteria x lowest score

RESULTS AND DISCUSSION

This study aims to develop and test the feasibility and effectiveness of an android-based student performance aid (Tunersindro) which is expected to improve the competence of vocational students. Tunersindro development stages use the ADDIE model (Analyze, Design, Develop, Implementation, Evaluate).

Analyze

The analysis stage is an activity that aims to analyze the learning needs in SMK. This stage consists of Focus Group Discussion (FGD) activities with participants from teachers and industry practitioners. The FGD stages produced several notes and recommendations which can be seen in Table 5. Results of Needs Analysis

Teacher	Industrial Practitioner
7. The problems experienced by SMK related to the competence of graduates are increasingly declining.	6. Vocational schools need to consult the curriculum with industry needs

8. SMK requires active participation from industry to help prepare SMK graduates 9. The learning models used will not produce maximum competence without learning aids. 10. Learning aids in design and manufacture involve industry. 11. The industrial world participates in the preparation, implementation and evaluation of learning. 12. Competency testing is a measurement activity that can involve industry	7. Industry can take part at least in the competency test 8. Learning aids are very important made to support the role of industry, 9. Tools that are simple and easy to use, but have high usability. 10. Emphasis on the aspect of attitudinal competence includes the attitude of initiative and responsibility. Knowledge competence includes knowledge of the field of work. Competence skills include the execution of the field of work and punctuality.

From the results of the FGD, it can be concluded that the competence of vocational students has recently decreased which has an impact on work readiness. It takes a learning model that is supported by learning aids that can facilitate industry participation.

Design

After getting the results of the needs analysis, the next step is to design the Tunersindro learning tool. Tunersindro's design was obtained from input from industry and vocational schools. Tunersindo's design can be seen in Figure 3.

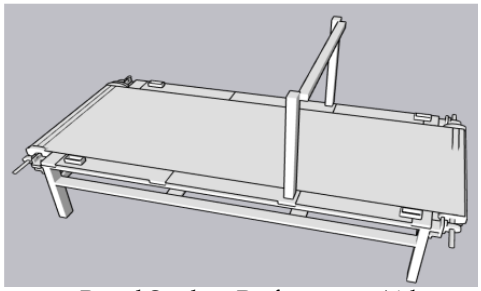
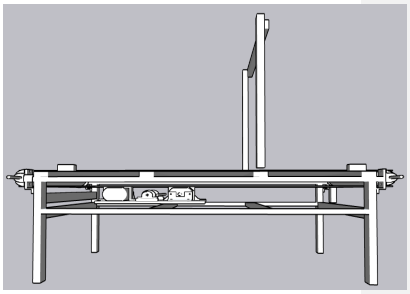


Figure 2. Design of Android-Based Student Performance Aids (Tunersindro)



Tunersinndrois a learning tool that is operated with android. Tunersindro consists of several components which can be seen in Table 6.

Component	Amount
V Slot Aluminum Profile Extrusion Rail 2020 Clear OX CNC Frame	4
Moveclap 20pcs Elbow Connector Bracket 90 Degree T Shape L Slot Slot	2
Zinc Alloy KP08 8mm Diameter Pillow Block Mounted Ball Bearing	27
BAUT L / HEX SOCKET HEAD CAP SCREW STAINLESS STEEL M5 X 20	5
nut m5 v-slot T hummer	100
Shaft 8mm Stainless Steel length 30cm 300mm SUS 201 Linear Rail	14
6mm open timing belt GT2 rubber Aramid Fiber belt.	2
42 Stepper motor NEMA 17 1.5A Torque 0.4Nm for CNC 3D Printer AI32	2
Bracket Stepper Motor 42 NEMA 17 Black 3MM Steel Anchor stepmotor AK05	2
Allen Hex Socket Head Cap Screw M3 x 12mm (10pcs) H/T 12.9 Grade	2
GT2 Timing Pulley 16 teeth bore 5mm belt 6mm	2
GT2 TIming Pulley 20 teeth bore 8mm belt 6mm	2
L Key Set 8pcs 1.5mm~6mm / 8 In 1 Hex Key Allen Wrench Set	2
A4988 STEPPER MOTOR DRIVER MODULE WITH HEATSHINK 3D PRINTER PART	2
[CNC] ARDUINO NANO V3 3.0 ATMEGA328P CH340 CH340G 5V BOARD + USB CABLE	2
Conveyor Belt - EP 100 size 50cm x 4 PLY	4
Digit 7 Segment Digital 5V LCD Display Module	4

Develop

At this stage, Tunersindro is produced according to the results of the design stage. The development and production were carried out by researchers assisted by electronics experts from the Indonesian Robotic School and the automotive industry from the Otomotif Jogjakarta Center (OJC), Gama Multi, Barokah Workshop, AnggaNewTech and RND Auto Service. The development and production of Tunersindro was carried out and produced Tunersindro according to Figure 3.

Figure 3. Android-Based Student Performance Tool (Tunersindro)

After Tunersindro works, the next step is to test the validity of the product with the help of expert judgment. The results of media validation show that Tunersindro has a very high feasibility to be used as a learning aid for vocational students. The results of media validation can be shown in Table 7.

Table 7. Media Validation Results

Media Validation Questionnaire Indicator		Score
Media Engineering	Effectiveness in Use	4
	Usability (easy to use)	3
	Product appeal	4
Visual Communication	Communicative (easy to understand instructions)	4
	Creative and innovative	4
	Selection of the type of manufacture	4
	The suitability of the product form that supports the material	3
Average Score		3.71

Implementation

At this stage, the researcher applied Tunersindro to determine its effectiveness in increasing the work readiness of vocational students. Work readiness is determined by the achievement of aspects of attitude, knowledge and skills competencies. Tunersindro is applied to automotive learning and practical exams. The material used is the competence of diesel motor nozzle maintenance. To see the improvement in the application of Tunersindro, three

times the application was carried out, namely: pretest, trial one and trial two (posttest). The results of the application of Tunersindro carried out for three times can be seen in Table 8.

Table 8. Results of Practice Test Competency Improvement

Competency Indicator		**Average Score**		
		PreTest	Trial One	Trial Two (PostTest)
Attitude	Initiative	1.3	2.2	3.2
	Responsibility	1.8	2.4	3.4
Knowledge	field of work	1.9	2.6	3.6
Skills	work field work	1.5	2.4	3.2
	punctuality	2.1	2.2	3.4

The results of the practical test showed that in the pretest, trial one and trial two there was an increase in aspects of attitude, knowledge and skill competencies gradually with the final result/posttest Tunersindro was very good at improving the work readiness of vocational students. The results of increasing competence in each trial can be seen in Figure 4.

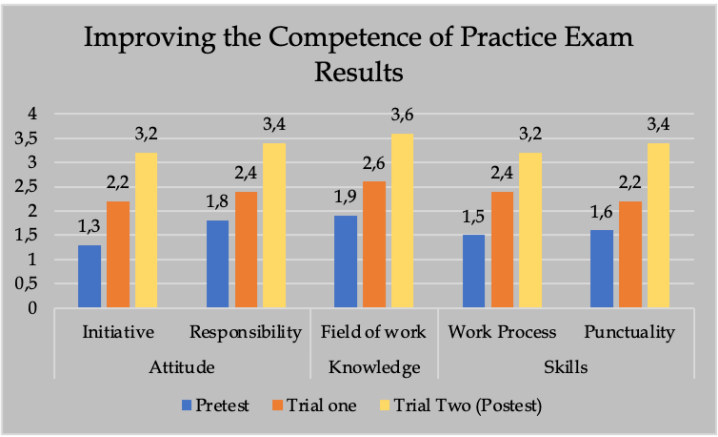


Figure 4. Results of Practice Test Competency Improvement

ADD SOME PARAGRPAH MAIN FINDING

Paragraph 1

Paragraph 2

Paragprah 3

Commented [WU5]:

•The author should give argumentation the difference finding among previous research (at least 8 references)

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•The author should describes the implications or impact of the research.

CONCLUSION

The development of an Android-Based Student Performance Tool (Tunersindro) is designed to improve the work readiness of SMK students. The application of Tunersindro for three times resulted in data that there was an increase in the competence of attitudes, knowledge and skills. Aspects of attitude consisting of initiative and responsibility, knowledge aspects of the field of work and aspects of work skills and punctuality increased from high to very high category. This shows that the application of the Tunersindro learning aid will have a positive effect on improving aspects of attitude, knowledge and skill competence. This is in accordance with the results of research by Tamimi et al which stated that the application of learning aids with the internet system can help develop student competency skills and attitudes(M. Al-Tamimi & Attamimi, 2014). Arifah et al said that the application of learning through the role playing method with the help of online-based tools can improve social competence, attitude, responsibility and knowledge(Arifah Nurdin et al., 2018). The application of learning models assisted by internet-based learning tools can improve the work readiness of SMK students. This statement is in accordance with the results of research by Parjono et al, Sulistyaningrum and Novaliedry who concluded that learning models in vocational schools that are applied with learning aids will have an impact on increasing the work readiness of vocational students.(Novaliendry et al., 2020)(Sulistyaningrum et al., 2020) (Hasan & Pardjono, 2019).

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REFERENCES

Ali, M., Triyono, B., & Koehler, T. (2020). Evaluation of Indonesian Technical and Vocational Education in Addressing the Gap in Job Skills Required by Industry. *Proceeding - 2020 3rd International Conference on Vocational Education and Electrical Engineering: Strengthening the Framework of Society 5.0 through Innovations in Education, Electrical, Engineering and Informatics Engineering, ICVEE 2020*. https://doi.org/10.1109/ICVEE50212.2020.9243222

Amin, M., & Mustaqim, B. (2021). Vocational Teachers Readiness in Integration The Principles of Industrial Revolution 4 . 0 into The Learning Process. *Elinvo (Electronics, Informatics, and Vocational Education)*, *6*(2), 106–119.

Amiron, E., Latib, A. A., & Subari, K. (2019). Industry revolution 4.0 skills and enablers in technical and vocational education and training curriculum. *International Journal of Recent Technology and Engineering*, *8*(1C2), 484–490.

Arifah Nurdin, T., Japar, M., & G. Bachtiar, I. (2018). Improving Social Attitudes and Knowledge Through Role Playing Method. *American Journal of Educational Research*, *6*(7), 1040–1045. https://doi.org/10.12691/education-6-7-23

Baethge-Kinsky, V. (2020). Digitized Industrial Work: Requirements, Opportunities, and Problems of Competence Development. *Frontiers in Sociology*, *5*(June). https://doi.org/10.3389/fsoc.2020.00033

Choy, M. W., & Yeung, A. S. (2022). Cognitive and affective academic self-concepts: Which predicts vocational education students' career choice? *International Journal of Educational Research Open*, *3*(February), 100123. https://doi.org/10.1016/j.ijedro.2022.100123

Çinar, H., Döngel, N., & Söğütlü, C. (2009). A case study of technical and vocational education in Turkey. *Procedia - Social and Behavioral Sciences*, *1*(1), 160–167. https://doi.org/10.1016/j.sbspro.2009.01.030

Dwivedi, Y. K., Ismagilova, E., Hughes, D. L., Carlson, J., Filieri, R., Jacobson, J., Jain, V., Karjaluoto, H., Kefi, H., Krishen, A. S., Kumar, V., Rahman, M. M., Raman, R., Rauschnabel, P. A., Rowley, J., Salo, J., Tran, G. A., & Wang, Y. (2021). Setting the future of digital and social media marketing research: Perspectives and research propositions. *International Journal of Information Management*, *59*(May), 102168. https://doi.org/10.1016/j.ijinfomgt.2020.102168

Dziuban, C., Graham, C. R., Moskal, P. D., Norberg, A., & Sicilia, N. (2018). Blended learning: the new normal and emerging technologies. *International Journal of Educational Technology in Higher Education*, *15*(1), 1–16. https://doi.org/10.1186/s41239-017-0087-5

Hasan, A., & Pardjono, P. (2019). The Correlation of Higher Order Thinking Skills and Work Readiness of Vocational High School Students. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *25*(1), 52–61. https://doi.org/10.21831/jptk.v25i1.19118

Hermanto, F. Y., & Sholikah, M. (2019). the Need of Practical Teaching in Vocational High. *Jurnal Pendidikan Vokasi*, *9*(3), 238–248.

Hirsch-Kreinsen, H. (2016). Digitization of industrial work: development paths and prospects. *Journal for Labour Market Research*, *49*(1), 1–14. https://doi.org/10.1007/s12651-016-0200-6

Khamdun, K., Suparmi, S., Maridi, M., & Rusilowati, A. (2021). Development of vocational science learning devices to improve project based soft skills. *Linguistics and Culture Review*, *5*(S1), 201–213. https://doi.org/10.21744/lingcure.v5ns1.1348

M. Al-Tamimi, N. O., & Attamimi, R. A. (2014). Effectiveness of Cooperative Learning in Enhancing Speaking Skills and Attitudes towards Learning English. *International Journal of Linguistics*, *6*(4), 27. https://doi.org/10.5296/ijl.v6i4.6114

Mardapi, D. (2008). *Teknik Penyusunan Instrumen Tes Dan Non Tes*. Mitra Cendikia Offset.

McGrath, S., & Akoojee, S. (2009). Vocational education and training for sustainability in South Africa: The role of public and private provision. *International Journal of Educational Development*, *29*(2), 149–156. https://doi.org/10.1016/j.ijedudev.2008.09.008

Nagy, J., Oláh, J., Erdei, E., Máté, D., & Popp, J. (2018). The role and impact of industry 4.0 and the internet of things on the business strategy of the value chain-the case of hungary. *Sustainability (Switzerland)*, *10*(10). https://doi.org/10.3390/su10103491

Novaliendry, D., Darmi, R., Hendriyani, Y., Nor, M., & Azman, A. (2020). Smart Learning Media Based on Android Technology. *International Journal of Innovation, Creativity and Change.*, *12*(11), 715–735.

Nurtanto, M., Sofyan, H., Fawaid, M., & Rabiman, R. (2019). Problem-based learning (PBL) in industry 4.0: Improving learning quality through character-based literacy learning and life career skill (LL-LCS). *Universal Journal of Educational Research*, *7*(11), 2487–2494. https://doi.org/10.13189/ujer.2019.071128

Pratitis, T., & Jama, J. (2020). Project Based Learning Module Development On Design Curling Competency In SMK. *EDUTEC : Journal of Education And Technology*, *3*(2), 174–182. https://doi.org/10.29062/edu.v3i2.132

Rachinger, M., Rauter, R., Müller, C., Vorraber, W., & Schirgi, E. (2019). Digitalization and its influence on business model innovation. *Journal of Manufacturing Technology Management*, *30*(8), 1143–1160. https://doi.org/10.1108/JMTM-01-2018-0020

Ricaurte, M., & Viloria, A. (2020). Project-based learning as a strategy for multi-level training applied to undergraduate engineering students. *Education for Chemical Engineers*, *33*, 102–111. https://doi.org/10.1016/j.ece.2020.09.001

Rokhmawan, T., & Wulandari, B. (2019). The Relevance of Project-Based Lecture in Industrial Revolution 4.0 : Meta – Synthesis Study. *Jurnal Iqra' : Kajian Ilmu Pendidikan*, *4*(2), 146–167. https://doi.org/10.25217/ji.v4i2.515

Sayekti, A. M., & Suparman. (2020). Development of PJBL-based LKPD with STEM approach design to improve critical thinking skills. *International Journal of Scientific and Technology Research*, *9*(3), 3390–3394.

Serdyukov, P. (2017). Innovation in education: what works, what doesn't, and what to do about it? *Journal of Research in Innovative Teaching & Learning*, *10*(1), 4–33. https://doi.org/10.1108/jrit-10-2016-0007

Sima, V., Gheorghe, I. G., Subić, J., & Nancu, D. (2020). Influences of the industry 4.0 revolution on the human capital development and consumer behavior: A systematic review. *Sustainability (Switzerland)*, *12*(10). https://doi.org/10.3390/SU12104035

Simbolon, R., & Koeswanti, H. D. (2020). Comparison Of Pbl (Project Based Learning) Models With Pbl (Problem Based Learning) Models To Determine Student Learning Outcomes And Motivation. *International Journal of Elementary Education*, *4*(4), 519–529. https://ejournal.undiksha.ac.id/index.php/IJEE

Spoettl, G., & Tūtlys, V. (2020). Education and Training for the Fourth Industrial Revolution. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *26*(1), 83–93. https://doi.org/10.21831/jptk.v26i1.29848

Spöttl, G., & Windelband, L. (2021). The 4th industrial revolution–its impact on vocational skills. *Journal of Education and Work*, *34*(1), 29–52. https://doi.org/10.1080/13639080.2020.1858230

Suartini, T. (2019). Influence Application of Learning Model on Vocational Education Based on Quality Issurance. *SAGE Open*, *9*(2). https://doi.org/10.1177/2158244019851552

Sudjimat, D. A., & Tuwoso. (2021). Impact of Work and Project-Based Learning Models on Learning Outcomes and Motivation of Vocational High School

Students Dwi Agus Sudjimat. *Educational Sciences : Theory & Practice*, *21*(April), 131–144. https://doi.org/10.12738/jestp.2021.2.009

Suleiman, Z., Shaikholla, S., Dikhanbayeva, D., Shehab, E., & Turkyilmaz, A. (2022). Industry 4.0: Clustering of concepts and characteristics. *Cogent Engineering*, *9*(1), 0–26. https://doi.org/10.1080/23311916.2022.2034264

Sulistyaningrum, H., Winata, A., Cacik, S., & Munawaroh, M. (2020). The Effectiveness of Developing Android-Based IPA Learning Devices to Improve Students 21 st Century Skills. *International Journal of Science and Research (IJSR)*, *9*(9), 970–979. https://doi.org/10.21275/SR20911062524

Suwandi, S., Hanafiah, H., Iriantara, Y., & ... (2022). Dual Based Assessment in Improving the Quality of Skills at the Center of Excellence Vocational School. *… Journal of Educational …*, 1701–1707. https://www.ijersc.org/index.php/go/article/view/469%0Ahttps://www.ijersc.org/index.php/go/article/download/469/447

Thomas, T. L., Prasad Muliyala, K., Jayarajan, D., Angothu, H., & Thirthalli, J. (2019). Vocational challenges in severe mental illness: A qualitative study in persons with professional degrees. *Asian Journal of Psychiatry*, *42*(February), 48–54. https://doi.org/10.1016/j.ajp.2019.03.011

Ulseth, R. R., Froyd, J. E., Litzinger, T. A., Ewert, D., & Johnson, B. M. (2011). A new model of project based learning. *ASEE Annual Conference and Exposition, Conference Proceedings*, *January*.

Wahyuni, V. S., Nurlela, N., Haryanto, Y., & Bogor, S. M. (2021). The Implementation of Vocational Regulation of Education. *Edutec*, *5*(2), 348–357.