JOURNAL REGY
RESEARCH IN EDUCATION AND TECHNOLOGY
Vol. 3 – No. 1, October (2024), Page: 54-59
P-ISSN (2963-0002) & E-ISSN (2963-0010)

MINI TRAINER SPEED SENSOR: VALIDATION OF LEARNING MEDIA

Daniel Parningotan Debataraja[1]*, Irma Yulia Basri[2], Rifdarmon[3], Iffarial Nanda[4]
[1,2,3,4]Department of Automotive Engineering, Universitas Negeri Padang, Padang, West Sumatra, Indonesia
* Corresponding Author. E-mail: zadama@marospub.com

Abstract

The problem of this research was the limitation of learning media for speed sensors in the Ototronics laboratory, which has an impact on three critical aspects in the teaching and learning process: (1) limited students gain practical experience, (2) decreased student motivation and participation, and (3) the difficulty of lecturers demonstrating material comprehensively in the Sensors and Transducers course. This research aimed to design a mini trainer speed sensor as an innovative learning media to overcome the limitations of practicum media in the Ototronics laboratory, impacting the student learning experience. The research used a quantitative-descriptive and Structural Equation Modeling-Partial Least Squares (SEM-PLS) validation involving 7 learning media experts. The results showed highly significant design validity. The didactic aspect proved to give the most superior contribution to improving the effectiveness of learning media. This research successfully addressed three main problems: student's limited practical experience, decreased participation motivation, and lecturers' difficulty demonstrating the material. The results confirm that this particular learning media effectively addresses three critical impacts in the teaching and learning process: student's limited practical experience, decreased participation motivation, and lecturers' difficulty demonstrating the material, thus opening up opportunities for developing transformative interactive learning media in technical vocational education.

Keywords: speed sensor mini trainer, learning media, vocational education

INTRODUCTION

Vocational education plays a strategic role in preparing a competent workforce capable of coping with the dynamics of modern industry. Vocational education aims to equip individuals with the professional skills, knowledge, and attitudes to effectively perform tasks in a particular field (Billet, 2011). In the context of technical education, innovative learning media serves as a critical instrument to transform the learning process, especially in courses that require practical understanding such as sensors and transducers.

Learning media is also one of the factors that influence learning outcomes. The factors that can affect learning outcomes include learning models (Batubara, 2020; Nasution et al., 2024; Sukardi & Rozi, 2019; Arpan et al., 2022; Rifdarmon et al., 2024; Sii et al., 2017; Almen & Dewi, 2024), learning approaches (Syaifullah et al., 2024; Ananda & Rakhmawati, 2022; Lesmana et al., 2019; Batubara, 2023), learning methods (Ronald et al., 2017; Sumadji, 2015; Arpan et al, 2020; Setiawan et al., 2022; Emiliya et al., 2023), and learning media (Budiman et al., 2018; Supardi et al., 2023; Sulistiyarini et al., 2018; Arpan et al., 2024; Sitompul et al., 2017; Feladi et al., 2017; Rifdarmon et al., 2023; Budiman et al., 2022). This research focuses on learning media, a strategic means of conveying messages that can stimulate students' attention and interest (Arsyad, 2014). Learning media significantly improves learning outcomes by visualizing abstract concepts and overcoming limitations of space, time, and sensory abilities (Nurrita, 2018).

Based on researcher observations in the Sensors and Transducers course, various learning

Submitted	Accepted	Published
06-12-2024	18-12-2024	19-12-2024

media such as mini trainer photo sensor, mini trainer proximity sensor, camshaft position sensor, capacitor, and fiber sensor were found as shown in Figure 1. However, interactive learning media in the form of a mini trainer speed sensor is not yet available. This condition impacts three main aspects of the teaching and learning process, namely limited students in gaining practical experience, decreased interaction during learning, and difficulties for lecturers in demonstrating material directly.

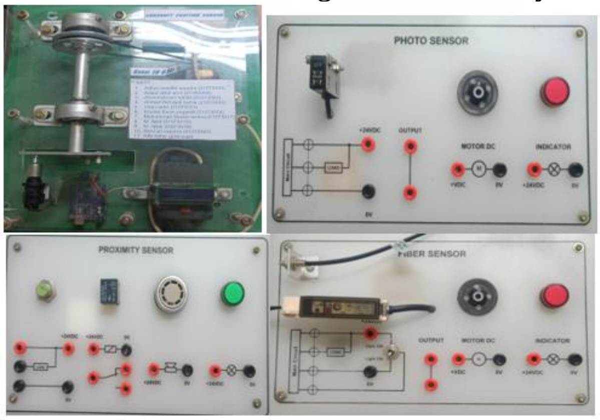

Figure 1. Learning Media Conditions in Ototronics Laboratory

Furthermore, in the first impact, students' limitations in operating and testing speed sensors directly can hinder their understanding of the concepts taught. Without practical experience, students have difficulty connecting theory with real applications, potentially reducing the depth of their understanding. Meanwhile, in the second impact, the lack of practical opportunities can reduce students' motivation and active participation in class discussions and activities. Finally, in the third impact, the lecturer's difficulty in demonstrating the operation and testing of speed sensors allows students to have difficulty understanding the process explained in class.

The effort that researchers offer to overcome the problems that have been described is to design a mini trainer speed sensor as a learning media. This is very relevant and important, because speed sensors are important components in various engineering applications, especially in motor speed control systems. The use of mini trainers can provide direct experience to students in understanding the working principles and applications of speed sensors. The importance of designing specialized learning media in the field of engineering is also supported by research on designing prototype vehicle bodies as learning media for Vehicle Body Construction courses (Rifdarmon et al., 2023). The results of this research indicate that specially designed learning media can improve students' understanding of the material taught and provide valuable practical experience.

Other studies have also shown the effectiveness of using trainers as learning media in the field of engineering, such as research on the design of potentiometric sensor mini trainers which have proven effective as learning media (Basri et al., 2022). Furthermore, the development of an Arduino-based mini trainer temperature sensor also showed positive results in increasing student understanding (Yandi & Basri, 2021). In line with that, the development of a weather station trainer with a wireless sensor network system has also succeeded in increasing student understanding of Microprocessor and Microcontroller subjects (Putra & Yundra, 2019) and the development of Arduino Uno-based color sensor trainer learning media has also proven effective in improving student understanding in Electronics Workshop courses (Kriswandono & Suprianto, 2014).

Based on the related research previously described, it was found that no research has designed and developed a mini trainer speed sensor. Therefore, the gap in this research lies in the need for interactive learning media that can provide practical experience for students in understanding and operating speed sensors. Based on this, it can be explained that the urgency of research on the design of mini trainer speed sensors lies in the urgent need to improve the quality of learning in the Sensors and Transducers course through innovative practical media. The existing condition of the Ototronics laboratory which does not have a special media for speed sensors results in three critical impacts: limited students in gaining practical experience, decreased motivation and participation in discussions, and difficulties for lecturers to demonstrate the material comprehensively.

This design will be carried out with a comprehensive analysis using the Structural Equation Modeling-Partial Least Squares (SEM-PLS) method. The SEM-PLS method was chosen in this research due to its ability to conduct a comprehensive analysis that not only focuses on a single variable but can evaluate the complex relationships between factors that influence the effectiveness of the mini trainer speed sensor.

P-ISSN (2963-0002) & E-ISSN (2963-0010)

With the ability of SEM-PLS to analyze latent variables, such as practical experience, learning motivation, and learning outcomes, researchers can identify in depth the critical factors that contribute to the success of this innovative learning media.

Based on the problems that have been described, the aim of this research was to validate a mini trainer speed sensor learning media in the Sensors and Transducers course.

METHOD

The research method used quantitative-descriptive. The research was carried out through a systematic process involving 7 learning media experts to validate the design of the mini trainer speed sensor with the use of the SEM-PLS method. The analysis process was carried out through a comprehensive measurement model evaluation, covering a series of measurement criteria including indicator reliability analyzed through the value of outer loadings, internal consistency reliability measured by Cronbach's alpha, composite reliability (rho_c), reliability coefficient (rho_a), and convergent validity identified from the average variance extracted (AVE) value.

Through this approach, each aspect of the learning media design will be analyzed in depth to ensure the quality, validity, and reliability of the speed sensor mini trainer design as an innovative learning media in the context of technical vocational education. The content validity test is conducted by correlating the score of each item with the total score which is the sum of the scores of each item.

The validation criteria: if the correlation coefficient value (r count) of each item's score with the total score is greater than or equal to (≥) the value (r table) with a significance level is 0.05, then the instrument statement item is declared valid; if the correlation coefficient value (r count) of each item's score with the total score is less than (<) the value (r table) with significance level is 0.05, then the instrument statement item is declared invalid (Surapranata, 2004).

The reliability criteria: if the correlation coefficient (r alpha) is greater than or equal to (≥) the value (r table) with a significance level is 0.05, then the instrument item is declared reliable; if the correlation coefficient value (r alpha) is smaller than (<) the value (r table) with a significance level is 0.05, then the instrument item is declared unreliable (Surapranata, 2004).

RESULTS AND DISCUSSION

The results of the validation of the mini trainer speed sensor design consist of three aspects assessed, including didactics, construction, and technical. The results of this validation are illustrated through the graphical output of testing using the SEM-PLS method on Smartpls4 software which shows the relationship between the three aspects assessed in the design of the mini trainer speed sensor as shown in Figure 2.

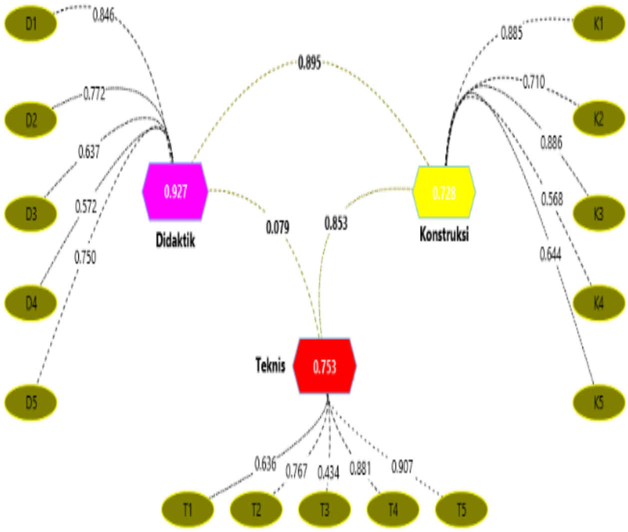

Figure 2. Graphical Output of SEM-PLS

Figure 2 shows the intrinsic relationship between the three key aspects that are the focus of validation, namely didactic, construction, and technical aspects. Each aspect was represented by a series of interconnected indicators, forming a structural network that describes the quality and feasibility of this innovative learning media. Visually, the diagram displays the relationship between latent variables and their observed variables through lines connecting each construct indicating the strength and significance of the relationship between variables.

This graphical structure assists researchers in comprehensively understanding how each aspect contributes to the overall quality of the mini trainer speed sensor, providing an in-depth perspective on the interconnection of design factors that influence the effectiveness of learning media in the context of technical vocational education. The results of the validation of the mini trainer speed sensor for the quality criteria can be seen in Table 1.

P-ISSN (2963-0002) & E-ISSN (2963-0010)

Table 1. Quality Criteria R-Square Results

Aspects	R-Square	R-Square Adjusted
Didactics	0.927	0.907
Construction	0.728	0.694
Technical	0.753	0.722

Table 1 shows a comprehensive analysis that demonstrates the quality and reliability of the construct in three main aspects: didactic, construction, and technical. In the R-Square analysis, all three aspects displayed highly significant values, with the didactic aspect recording the highest values of 0.927 (R-Square) and 0.907 (Adjusted R-Square), indicating that the variables in the didactic aspect were able to explain the research phenomenon very well. The construction and technical aspects also showed strong values of 0.728 (R-Square) and 0.753 (R-Square) respectively, indicating that the model has reliable predictive ability.

The results of the construct reliability and validity of the mini trainer speed sensor can be seen in Table 2.

Table 2. Construct Reliability and Validity Results

	Cronbach's Alpha	rho_a	rho_c	AVE
Didactics	0.765	0.796	0.842	0.521
Construction	0.807	0.854	0.862	0.562
Technical	0.783	0.866	0.855	0.556

Table 2 shows that the construct reliability analysis was at a high level of internal consistency. Cronbach's alpha values for the three aspects were in the range of 0.765-0.807, indicating good reliability. Composite reliability (rho_a and rho_c) ranged from 0.796-0.866, indicating excellent construct consistency. Convergent validity aspects measured through AVE displayed values of 0.521-0.562, which statistically met the criteria for construct validity. These results comprehensively prove that the speed sensor mini trainer has a very strong methodological quality, with the didactic aspect occupying the most superior position in contributing to the effectiveness of the learning media.

This research produced significant findings in the development of a mini trainer speed sensor, which methodologically makes an important contribution to the field of technical vocational education. The results of SEM-PLS analysis showed that this learning media design has very strong validity and reliability, with didactic aspects occupying the most superior position with an R-squared value of 0.927. This finding was in line with previous research that emphasizes the importance of specialized learning media in improving student understanding (Rifdarmon et al., 2023; Basri et al., 2022) but makes a unique contribution through a specific focus on speed sensors in the context of the Sensors and Transducers course.

The important implication of this research lies in its ability to address three critical impacts on the teaching and learning process: student's limited practical experience, decreased participation motivation, and difficulty of material demonstration by lecturers. Compared to previous research on technical learning media development (Yandi & Basri, 2021; Putra & Yundra, 2019), this research offered a more comprehensive approach by using the SEM-PLS method for validation. This enables in-depth analysis of critical factors that influence the effectiveness of learning media, such as practical experience, learning motivation, and learning outcomes.

The significance of this study lies not only in the development of innovative learning media but also in the methodological contribution of vocational education research approaches. With high construct reliability values, this study proves that a systematic and analytical approach can effectively design learning media that are responsive to the dynamic needs of technical education (Arsyad, 2014; Nurrita, 2018). This finding opens up opportunities for further research in the development of interactive learning media that can transform students' learning experiences in the field of sensors and transducers.

CONCLUSION

Through the SEM-PLS method, validation by 7 learning media experts produced significant findings that comprehensively proved the methodological quality of the speed sensor mini trainer design. The results confirm that this particular learning media effectively addresses three critical impacts in the teaching and learning process: students' limited practical experience, decreased participation motivation, and lecturers' difficulty demonstrating the material, thus opening up opportunities for developing transformative interactive learning media in technical vocational education.

P-ISSN (2963-0002) & E-ISSN (2963-0010)

REFERENCES

Almen, A., & Dewi, M. (2024). Development of a basic technical learning model for long jump squat style based on traditional games for students. *Research in Education and Technology (REGY)*, *2*(2), 80-86. https://doi.org/10.62590/regy.v2i2.117.

Ananda, I., & Rakhmawati, A. (2022). Pembelajaran sastra populer sebagai peningkatan literasi digital dengan penggunaan media aplikasi Wattpad: Studi Kasus. *Research in Education and Technology (REGY)*, *1*(1), 36-45. https://doi.org/10.62590/regy.v1i1.6.

Arpan, M., Ambiyar, A., & Rizal, F. (2022). *Konsep Project and peer tutoring-based learning pada pembelajaran abad 21*. Sukoharjo: Tahta Media.

Arpan, M., Ambiyar, A., Ridwan, Nasution, A., & Rifdarmon, R. (2024). Augmented reality solutions by utilizing mobile technology for enhanced skill development. *International Journal of Interactive Mobile Technologies (iJIM), 18*(20), 129-141. https://doi.org/10.3991/ijim.v18i20.50809.

Arpan, M., Salaman, S., Budiman, R. D. A., Ambyar, A., & Wakhinuddin, W. (2020). Student learning outcomes using drill and practice type of computer assisted instruction. *International Journal of Scientific & Technology Research, 9*(04), 1433-1436.

Arsyad, A. (2014). *Media pembelajaran*. Jakarta: Rajawali Pers.

Basri, I. Y., Nasrianto, A., & Andrizal, A. (2022). Rancang bangun mini trainer potensiometrik sensor sebagai media pembelajaran. *JTEV (Jurnal Teknik Elektro dan Vokasional)*, *8*(1), 85-95. https://doi.org/10.24036/jtev.v8i1.114269.

Batubara, I. H. (2020). Pengaruh model pembelajaran guided discovery learning terhadap hasil belajar pengembangan silabus pembelajaran matematika pada masa pandemic Covid 19. *Jurnal Penelitian, Pendidikan dan Pengajaran: JPPP*, *1*(2), 13-17. https://doi.org/10.30596/jppp.v1i2.4948.

Batubara, Q. N. M. (2023). ICT-based needs analysis of learning arts and culture in middle school at Sunggal. *Research in Education and Technology (REGY)*, *2*(1), 38-41. https://doi.org/10.62590/regy.v2i1.96.

Billet, S. (2011). *Vocational education: Purposes, traditions and prospects*. Dordrecht: Springer Dordrecht.

Budiman, R. D. A., Arpan, M., & Verawardina, U. (2018). Readiness assessment penerapan media pembelajaran pengenalan hardware jaringan komputer berbasis augmented reality. *Jurnal Pendidikan Informatika dan Sains, 7*(1), 118-125.

Budiman, R. D. A., Liwayanti, U., & Arpan, M. (2022). Analisis kebutuhan dan kesiapan penerapan media pembelajaran berbasis Android Materi Ilmu Akidah. *EDUMATIC: Jurnal Pendidikan Informatika, 6*(1), 31-38. https://doi.org/10.29408/edumatic.v6i1.5087.

Emiliya, E., Erikson, S., Arianto, D. P., Florida, R., & Almahdi, A. (2023). Application of jigsaw type cooperative learning to student learning outcomes in class IX SMP Negeri 2 Ngabang. *Research in Education and Technology (REGY)*, *2*(1), 16-20. https://doi.org/10.62590/regy.v2i1.98.

Feladi, V., Arpan, M., & Verawardina, U. (2017). Pelatihan pembuatan media pembelajaran berbasis animasi di SMP Negeri 2 Siantan Kabupaten Mempawah. *Gervasi: Jurnal Pengabdian kepada Masyarakat, 1*(1), 32-42.

Kriswandono, D. A., & Suprianto, B. (2014). Pengembangan media pembelajaran trainer sensor warna berbasis Arduino Uno dalam bentuk aplikasi alat pembaca 8 jenis warna pada mata kuliah Bengkel Elektronika di Universitas Negeri Surabaya. *Jurnal Pendidikan Teknik Elektro, 3*(2), 163-168.

Lesmana, C., Arpan, M., Ambiyar, A., Wakhinuddin, W., & Fatmawati, E. (2019). Respons mahasiswa terhadap pelaksanaan program matrikulasi. *Edukasi: Jurnal Pendidikan, 17*(2), 227-237. http://dx.doi.org/10.31571/edukasi.v17i2.1528.

Nasution, A., Ambiyar, Refdinal, Arpan, M., & Putri, E. (2024). POGIL learning model—metaphorming for mobile-based cryptography creation. *International Journal of Interactive Mobile Technologies (iJIM), 18*(11), 146-159. https://doi.org/10.3991/ijim.v18i11.49057.

Nurrita, T. (2018). Pengembangan media pembelajaran untuk meningkatkan hasil belajar siswa. *Misykat: Jurnal-ilmu-ilmu Al-Quran, Hadits, Syariah dan Tarbiyah*, *3*(1), 171-187.

P-ISSN (2963-0002) & E-ISSN (2963-0010)

https://doi.org/10.33511/misykat.v3n1.171.

Putra, A. N., & Yundra, E. (2019). Pengembangan trainer weather station dengan sistem wireless sensor network sebagai media pembelajaran pada mata pelajaran Mikroprosesor dan Mikrokontroler di SMK Negeri 1 Blitar. *Jurnal Pendidikan Teknik Elektro*, *8*(1), 75-80.

Rifdarmon, R., Ganefri, G., Lapisa, R., Giatman, M., Jalinus, N., & Maksum, H. (2024). Integration of mobile learning in Rifdarmon model to improve student learning outcomes. *International Journal of Interactive Mobile Technologies (iJIM), 18*(23), 98-109. https://doi.org/10.3991/ijim.v18i23.51217.

Rifdarmon, R., Sa'diah, H., & Syaifullah, L. (2023). Perancangan bodi kendaraan prototype arrow concept sebagai media pembelajaran mata kuliah Konstruksi Badan Kendaraan. *Edukasi: Jurnal Pendidikan, 21*(1), 172-186. https://doi.org/10.31571/edukasi.v21i1.5679.

Ronald, J., Amelia, M., & Erita, E., Verawati, R. (2017). Pengaruh metode pembelajaran sosiodrama terhadap hasil belajar materi Hukum Dagang pada mahasiswa 2014 Sesi F Pendidikan Ekonomi STKIP PGRI Sumbar. *Economica: Journal of Economic and Economic Education*, *5*(2), 106-113.

Setiawan, D., Rifdarmon, R., Yuvenda, D., & Nasir, M. (2022). Pengaruh metode diskusi menggunakan aplikasi Zoom terhadap hasil belajar mahasiswa. *Edumaspul: Jurnal Pendidikan, 6*(1), 592-598. https://doi.org/10.33487/edumaspul.v6i1.1870.

Sii, P., Verawardina, U., Arpan, M., & Sulistiyarini, D. (2017). Penerapan model pembelajaran inkuiri pada mata pelajaran KKPI terhadap kemampuan psikomotorik siswa. *Jurnal Pendidikan Informatika dan Sains*, *6*(2), 166-176.

Sitompul, H., Setiawan, D., & Purba, E. (2017). Pengaruh media pembelajaran dan motivasi belajar terhadap hasil belajar desain sistem instruksional pendekatan TPACK. *Jurnal Teknologi Informasi & Komunikasi dalam Pendidikan*, *4*(2), 141-146. https://doi.org/10.24114/jtikp.v4i2.8761.

Sukardi, S., & Rozi, F. (2019). Pengaruh model pembelajaran online dilengkapi dengan tutorial terhadap hasil belajar. *JIPI (Jurnal Ilmiah Penelitian dan Pembelajaran Informatika)*, *4*(2), 97-102. https://doi.org/10.29100/jipi.v4i2.1066.

Sulistiyarini, D., Bibi, S., Fatmawati, E., & Arpan, M. (2018). Pelatihan pembuatan media pembelajaran interaktif di SMP dan SMK Mandiri Pontianak. *Gervasi: Jurnal Pengabdian kepada Masyarakat*, *2*(1), 39-46.

Sumadji, S. (2015). Pengaruh metode pembelajaran terhadap hasil belajar mahasiswa. *Jurnal Inspirasi Pendidikan*, *5*(2), 653-662. https://doi.org/10.21067/jip.v5i2.799.

Supardi, S., Putra, R. K., Iqbal, M., & Toni, K. (2023). Development of mobile AR applications as a science learning media in increasing junior high school students' interest in learning. *Research in Education and Technology (REGY)*, *2*(1), 1-5. https://doi.org/10.62590/regy.v2i1.93.

Surapranata, S. (2004). *Analisis, validitas, reliabilitas dan interpretasi hasil test: Implementasi Kurikulum 2004*. Bandung: PT Remaja Rosdakarya.

Syaifullah, L., Ambiyar, A., Zaus, M. A., & Arpan, M. (2024). Efektivitas pendekatan blended learning berbantuan e-learning terhadap hasil belajar mahasiswa. *Juwara Jurnal Wawasan dan Aksara*, *4*(1), 1-12. https://doi.org/10.58740/juwara.v4i1.73.

Yandi, R. P., & Basri, I. Y. (2021). Rancang Bangun mini trainer temperatur sensor berbasis Arduino sebagai media pembelajaran. *JTEV (Jurnal Teknik Elektro dan Vokasional)*, *7*(1), 18-26. https://doi.org/10.24036/jtev.v7i1.110119.

P-ISSN (2963-0002) & E-ISSN (2963-0010)