

Analysis of Essential Learning Materials in the Automotive Body Subject at Vocational Schools: Delphi Technique

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ABSTRACT

Excessive learning materials can hinder the teaching and learning process by overwhelming students, reducing motivation, and impairing knowledge retention. In vocational education, irrelevant content may further contribute to graduates' lack of industry-aligned competencies, limiting their employability. This study aims to identify essential learning materials for the automotive panel and body frame course based on urgency, continuity, relevance, and industry application. A modified Delphi technique was used to gather expert consensus through a survey involving 21 automotive body and frame repair professionals from the automotive manufacturing and repair industry in Yogyakarta, Indonesia. The questionnaire, developed based on the automotive engineering curriculum, utilized a four-point Likert scale. Data collection was conducted via Google Forms and analyzed using descriptive statistics in SPSS software. Industry experts identified key learning materials essential for vocational students, including MIG-GMAW welding procedures, repairing damaged panels made of iron, aluminum, plastic, or fiberglass, applying putty, and assessing panel surface quality after putty application. These materials were deemed critical for aligning vocational training with industry requirements. The findings emphasize the importance of refining learning content to enhance student competency and employability. By prioritizing industry-relevant skills, vocational educators can improve instructional effectiveness and better prepare graduates for the workforce. This study provides valuable insights for curriculum developers to ensure that training programs meet industry standards, ultimately enhancing student learning outcomes.

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1. INTRODUCTION

Vocational education has been globally recognized for its significant role across various sectors. In the economic sector, vocational education drives economic growth (Brunello & Rocco,2017; Lee et al.,2014; Choi

et al., 2019). From an academic and political perspective, vocational education enhances access to education and offers alternative pathways to better living standards for students unable or unwilling to pursue academic education (Neuman & Ziderman, 1999; Psacharopoulos, 1997). Vocational education provides both short-term and long-term benefits in the employment sector, such as reducing youth and structural unemployment and supplying skilled labour (Choi et al., 2019). Vocational education is also believed to prepare students physically and mentally for immediate employment, ultimately making them more productive than those from academic schools (Choi et al., 2019).

Vocational education is generally classified into three types: informal training, dual apprenticeships, and school-based vocational education (Abdurrahman et al, 2022; Guo & Wang, 2020). In developing countries, school-based vocational education is more suitable than other systems, considering labour market disparities. In practice, school-based education follows a formal curriculum and teaches job skills supplemented with some academic education. The vocational education curriculum is dominated by practical subjects tailored to industry needs (Muja et al., 2019).

However, vocational education is currently under scrutiny due to the gap between the competencies possessed by vocational school graduates and labour market needs (Forster & Bol, 2018; Maragkou, 2020; Xie et al., 2020). In Indonesia, vocational school graduates contribute to the highest open unemployment rate compared to other school graduates (BPS, 2023; Ridwan & Vina, 2023). On the other hand, the growth of Indonesia's manufacturing industry continues to increase annually (BPS, 2023). Thus, the high open unemployment rate among vocational school graduates is not due to a lack of job vacancies but other factors.

Several factors contribute to the high open unemployment rate (TPT) among vocational school graduates. Rapid changes in the industry often outpace the skills taught in schools, leading to a mismatch between graduates' competencies and the demands of the business and industry sectors. The role of the industry in shaping vocational education remains suboptimal, and limited collaboration between schools and businesses in curriculum development further exacerbates the issue (Mukhlason et al., 2020; Ridwan & Vina, 2023). Similarly, Martono et al. (2018) highlighted a significant gap between the competencies taught in schools and those required by the industry, ranging from 14% to 29%. To address this issue, vocational education curricula should be developed with direct input from industry partners to ensure alignment with the skills and competencies needed in the workforce.

The vocational high school (SMK) curriculum often faces significant challenges in its development, particularly in achieving a balance between general subjects and vocational subjects (Trianto, 2011). In practice, the implementation of the SMK curriculum frequently encounters obstacles due to the large number of subjects that must be taught, leaving limited time to deepen core skills (Mulyasa, 2013). Herman & Mahmud (2023) argue that one of the reasons for the overly dense SMK curriculum is the high academic load that must be delivered to students, while, on the other hand, this content is not necessarily relevant to the demands of the job market.

In vocational high schools (SMK), the involvement of industry partners in curriculum development has primarily been focused on reviewing the learning outcomes outlined in the SMK curriculum (Kemendikbud, 2021). Meanwhile, the responsibility for teaching materials is entrusted to the teachers, who must still refer to the predetermined learning outcomes set by Kemendikbud. This creates a potential misalignment between the materials expected by the industry and those taught by teachers in the classroom, both in terms of content focus as well as the depth and breadth of the materials.

Excessive learning materials can negatively impact the teaching and learning process. When students are overwhelmed with too much information, they struggle to process and retain the material, leading to decreased motivation and confusion, hindering a deep understanding of essential concepts (Finch & Crunkilton, 1979). Teachers also face difficulties delivering the material effectively within a limited time.

Developing learning materials should involve collaboration with industry or business sectors. Such collaboration ensures that the materials taught are relevant to job market needs and current

technological advancements (Kulkani et al., 2020; Hassan et al., 2023; Sobari et al., 2023). Engaging practitioners from the field provides students with practical insights into applying classroom theories. This enhances student motivation and prepares them for professional challenges post-graduation.

Analyzing essential teaching materials with input from industry practitioners has become increasingly necessary to align vocational education with workforce demands. One effective approach is to invite industry professionals to assess existing teaching materials and compare them with the skills required in the field. The Delphi technique offers a valuable method for this process, as it enables systematic forecasting and curriculum planning to meet future industry needs (Finch & Crunkilton, 1979).

The Delphi technique is a structured method for reaching a consensus among experts by gathering their insights through multiple rounds of inquiry (Tierney et al., 2024). This approach involves a series of structured investigations based on a predefined set of questions aligned with the study’s objectives, which are then administered to specialists in the relevant field. One of its key strengths, as noted by Finch & Crunkilton (1979), is its ability to maintain objectivity by ensuring anonymity among panel experts, preventing direct interaction that could influence individual responses.

This study focuses on analyzing the teaching materials for the automotive body panel and frame subject within the Light Vehicle Body Engineering expertise group at Phase F in vocational high schools. This area was selected due to the significant contribution of its graduates to Indonesia’s open unemployment rate in the automotive sector (Mukhlason et al., 2020). Identifying essential materials based on urgency, continuity, relevance, and applicability (Fikri & Hasudungan, 2021) ensures an optimal balance between the breadth and depth of content, allowing students sufficient time to comprehend and master key concepts effectively.

Based on these considerations, this study seeks to answer the research question: What are the essential teaching materials for the Automotive Body Panel and Frame subject in vocational schools?

2. METHODS

This study adopts a survey research approach, utilizing a modified Delphi technique. The Delphi method is chosen for its capacity to achieve consensus among experts through iterative rounds of structured questionnaires. Furthermore, to maintain the objectivity and validity of the data collected, several steps were taken, including ensuring the anonymity of the expert panel, conducting data collection in two rounds, structuring questions in the research instrument to include both open- and closed-ended formats, and utilizing descriptive statistical analysis.

The research procedures carried out using the Delphi technique are as follows:

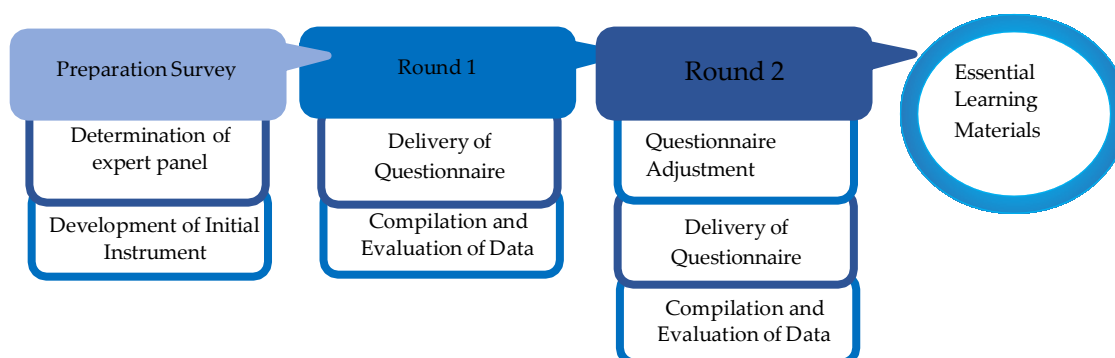


Figure 1. Delphi procedure

2.1 Determination of Expert Panel

The selection of experts as practitioner panel members in this study was based on several criteria, namely: working in the car industry, particularly in car body fabrication or repair, with at least 10 years of professional experience, and possessing an educational background in automotive studies, with at least a vocational high school degree. Based on these criteria, it was found that 21 individuals met the requirements and were willing to participate as practitioner panel members in this study.

2.2 Development of Initial Instrument

The research questionnaire in the first round was developed with reference to the learning outcomes of vocational secondary education, specifically in the field of Light Vehicle Body Engineering at Phase F (BSKAP Kemendikbud Ristek, 2022). Based on these learning outcomes, there are 20 instructional materials, namely: 1) Preparation of materials and equipment for repairs; 2) Heating and thermal cutting procedures; 3) MIG-GMAW welding procedures; 4) TIG-GTAW welding procedures; 5) SMAW welding procedures; 6) STRSW welding procedures; 7) FCAW Welding procedures; 8) Oxy-acetylene welding procedures; 9) Aluminium welding procedures; 10) Panel riveting applications; 11) Disassembly and assembly procedures for body panels, and additional components; 12) Panel replacement procedures; 13) Reforming damaged panels made of iron, aluminium, plastic, or fiberglass; 14) Removing corrosion/rust (sanding) and preparing body surfaces for primer application; 15) Applying primer and preparing surfaces after primer application; 16) Applying putty; 17) Testing, installing, repairing, and replacing vehicle sealer components; 18) Assessing the quality of body panel surfaces after putty application or repair; 19) Measuring and evaluating body panel dimensions for repair purposes; 20) Designing and manufacturing panels from steel and fiberglass or other materials.

The answers are grouped based on a four-point Likert scale: strongly agree, agree, disagree, and strongly disagree.

Round 1:

Delivery of Questionnaire

The developed instrument was then subjected to content validity and readability testing through a focus group discussion at the Department of Automotive Engineering Education, Faculty of Engineering, Yogyakarta State University. This was followed by the distribution of the instrument to 21 practitioners who met the criteria and were ready to participate. The allocated time for completing the instrument was one week.

Compilation and Evaluation of Data

The initial research data collected from the research instrument was then tabulated using Microsoft Excel. Subsequently, to identify respondents' feedback on which instructional materials should be added or removed from the research instrument, the data was analysed using SPSS.

Round 2:

Questionnaire Adjustment

The feedback from the practitioner panel served as the basis for developing the final instrument, which would be used for research data collection. At this stage, the instrument was structured into four categories: urgency, continuity, relevance, and applicability of automotive body and frame instructional materials. The response options provided in the instrument were: very low, low, high, and very high.

Delivery of Questionnaire

The developed research instrument, ready for use, was then distributed to 21 practitioners. The distribution was carried out via email, social media, and partially through direct delivery to respondents. The allocated time for completing the instrument was seven days.

Compilation and Evaluation of Data

The research data collected in the second round was then tabulated using Microsoft Excel and subsequently analyzed using SPSS software. The results of the data analysis served as the basis for determining whether a particular instructional material on automotive body and frame should be classified into a specific category, with prior confirmation using a predefined result interpretation table.

2.3 Data Analysis Techniques

In this study, the data analysis tool used is descriptive statistics, which includes graphs, maximum scores, minimum scores, averages, and modes. The average score results will then be used to determine the categorization levels for each aspect of the research being observed. The classification at each level refers to Sugiyono (2017), as shown in Table 1 :

Table 1. Interpretation Criteria

No.	Criteria	Range	Interpretation
1.	$Mi + 1,5SDi - Mi + 3,0SDi$	3.26 – 4.00	Very High
2.	$Mi - Mi + 1,5SDi$	2.51 – 3.25	High
3.	$Mi - 1,5SDi - Mi$	1.76 – 2.50	Low
4.	$Mi - 3,0SDi - Mi - 1,5SDi$	1.00 – 1,75	Very Low

3. FINDINGS AND DISCUSSION

The research on essential materials is determined based on four criteria: urgency, continuity, relevance, and applicability. The following is an explanation of each criterion:

3.1. Description of Urgency Criteria

The descriptive analysis of the urgency criteria indicated that the minimum value was 1, while the maximum value reached 4. The findings revealed that two learning materials were categorized as very low or not urgent, one material fell into the low or not urgent category, 12 learning materials were classified as high or urgent, and five materials were deemed very high or highly significant. These results suggest that the majority of the learning materials included in the curriculum are perceived as essential by industry practitioners, reinforcing the need to prioritize them in vocational education. The presence of materials with low urgency levels also highlights potential areas for curriculum optimization, ensuring that students focus on skills that align with industry demands. A detailed distribution of the urgency levels of the learning materials is presented in Figure 2 below.

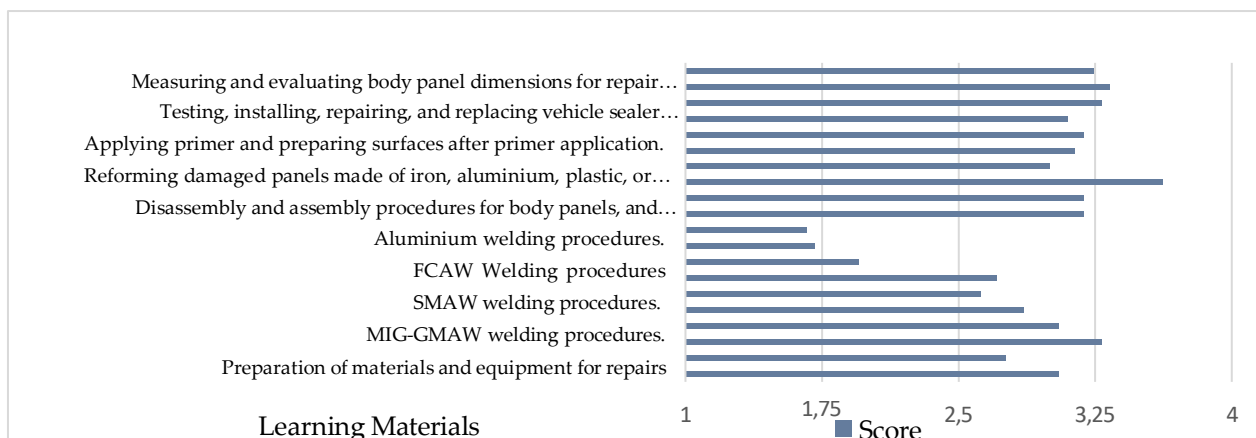


Figure 2. Description of Learning Material Data Based on Urgency Criteria

3.2. Description of Continuity Criteria

The results of the descriptive analysis of the continuity criteria revealed a minimum value of 1 and a maximum value of 4. Based on the average values, it was found that there are three materials at a low/no continuity level, 16 learning materials at a high/continuity level, and one learning material at a very high/very continuity level. The detailed distribution of the learning materials can be seen in Figure 3 below:

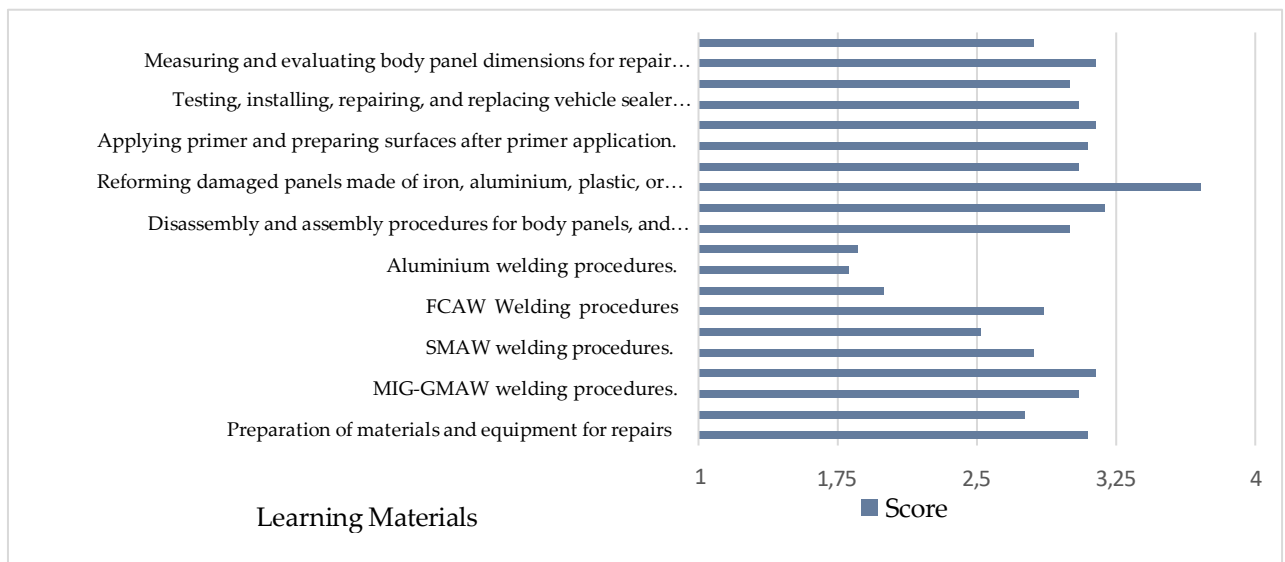


Figure 3. Description of Learning Material Data Based on Continuity Criteria

3.3. Description of Relevance Criteria

The descriptive analysis of the continuity criteria revealed a minimum value of 1 and a maximum value of 4. Based on the average values, it was found that there are three materials at a low/not relevant level, 11 learning materials at a high/ relevance level, and six learning materials at a very high/very relevant level. The detailed distribution of the learning materials can be seen in Figure 4 below:

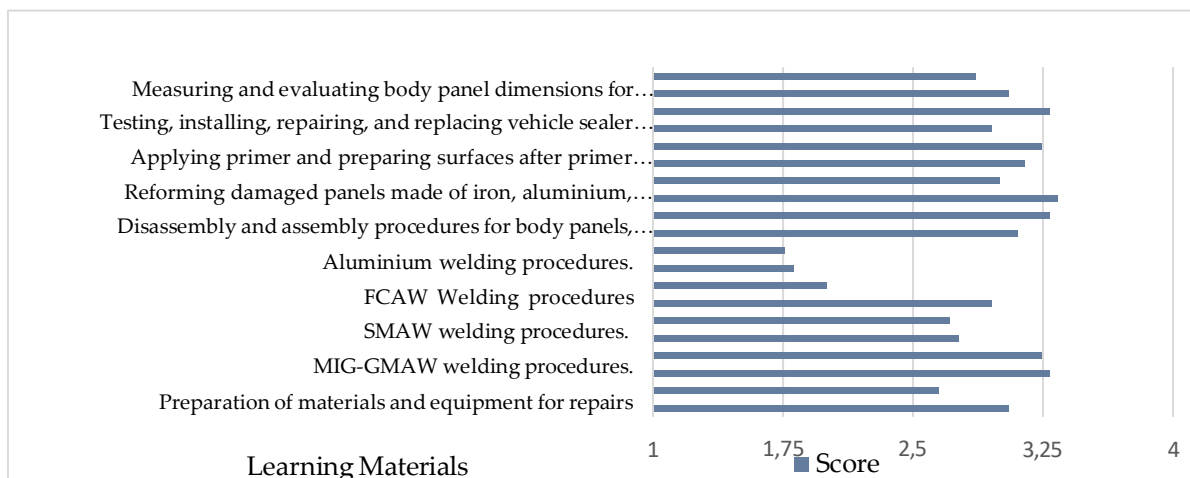


Figure 4. Description of Learning Material Data Based on Relevance Criteria

3.4. Description of Applicability Criteria

The results of the descriptive analysis of the continuity criteria revealed a minimum value of 1 and a maximum value of 4. Based on the average values, it was found that there are three materials at a low/not relevant level, 11 learning materials at a high/ relevance level, and six learning materials at a very high/very relevant level. The detailed distribution of the learning materials can be seen in Figure 5 below:

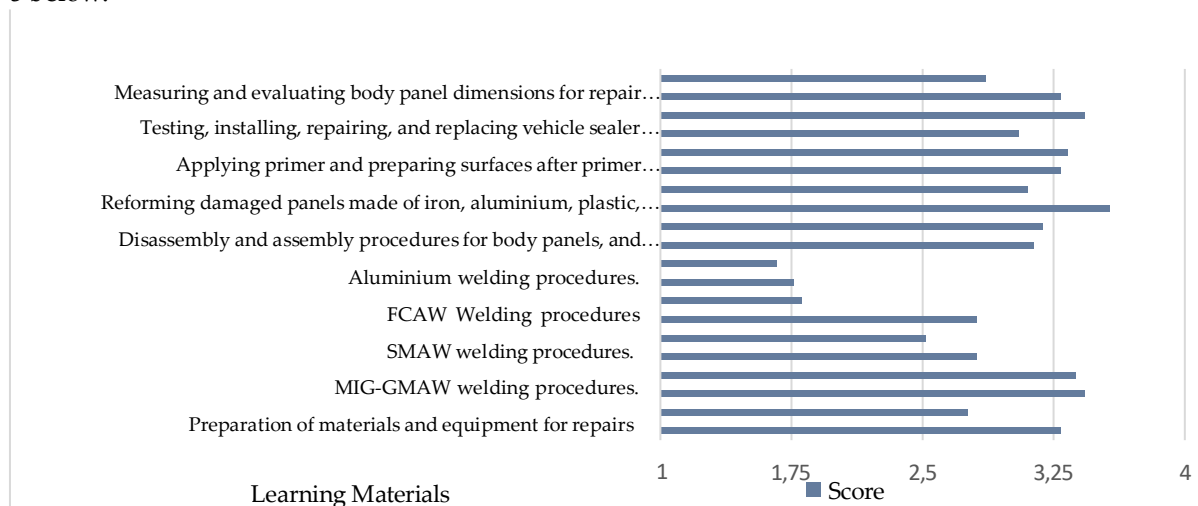


Figure 5. Description of Learning Material Data Based on Applicability Criteria

3.5. Description of Essential Material Learning Materials

Based on the mean values for the four criteria, urgency, continuity, relevance, and applicability, it can be determined that the lowest score is 1.67 and the highest score is 3.43. Furthermore, based on the mean, it can be identified that there are three non-essential learning materials, 11 essential learning materials, and six highly essential learning materials. The detailed distribution of the essential learning materials can be seen in Table. 2 below:

Table 2. Description of Essential Learning Material

No	Content	Xmin	Xmax	Mean	Category
1.	Preparation of materials and equipment for repairs	3.05	3.29	3.12	High
2.	Heating and thermal cutting procedures.	2.62	2.76	2.73	High
3.	MIG-GMAW welding procedures.	3.05	3.43	3.27	Very high
4.	TIG-GTAW welding procedures.	3.05	3.38	3.20	High
5.	SMAW welding procedures.	2.76	2.86	2.81	High
6.	STRSW welding procedures.	2.52	2.71	2.59	High
7.	FCAW Welding procedures	2.71	2.95	2.83	High
8.	Oxy-acetylene welding procedures.	1.81	2.00	1.94	Low
9.	Aluminum welding procedures.	1.71	1.81	1.77	Low
10.	Panel riveting applications.	1.67	1.86	1.74	Low
.					
11.	Disassembly and assembly procedures for body panels and additional components.	3.00	3.19	3.11	High
.					
12.	Panel replacement procedures.	3.19	3.29	3.22	High
13.	Reforming damaged panels made of iron, aluminum, plastic, or fiberglass.	3.33	3.71	3.56	Very high
.					
14.	Removing corrosion/rust (sanding) and preparing body surfaces for primer application.	3.00	3.10	3.04	High
.					

15	Apply primer and prepare surfaces after primer application.	3.10	3.29	3.17	High
16	Applying putty	3.14	3.33	3.27	Very high
17	Testing, installing, repairing, and replacing vehicle sealer components.	2.95	3.10	3.04	High
18	Assessing the quality of body panel surfaces after putty application or repair.	3.00	3.43	3.26	Very high
19	Measuring and evaluating body panel dimensions for repair purposes.	3.05	3.33	3.20	High
20	Designing and manufacturing panels from steel and fibreglass or other materials.	2.81	3.24	2.94	High

Based on Table 2, it is evident that three essential materials in the Automotive Body Subject are MIG-GMAW welding procedures, repairing damaged panels made of steel, aluminium, plastic, or fibreglass, and applying putty, along with assessing the quality of body panel surfaces after putty application or repair. The skill of repairing vehicle body panels made of steel, aluminium, plastic, or fibreglass is crucial in automotive bodywork, as each material has unique characteristics that require different repair techniques. This ability is vital for maintaining the aesthetic quality, safety, and durability of vehicles (Ahmadian et al., 2023).

The current development of the automotive industry also encourages the use of plastic and fibreglass materials, particularly in modern vehicles. These materials offer advantages over metal, especially in reducing weight and production costs. Repairing these materials requires a different approach compared to metal, such as using resin and appropriate sanding techniques. The ability to repair these materials is necessary to ensure that the repairs are strong and do not crack after completion (Pradeep et al., 2024). From an economic perspective, the skill of repairing damaged panels can reduce the need to replace entire sections, providing a more cost-effective solution for vehicle owners. Repairing a panel instead of replacing it not only saves on part costs but also reduces the time required to complete the repair (Thomas & Jund, 2013).

MIG-GMAW welding is widely regarded for its advantages and is highly suitable for vehicle bodywork. In terms of the welding process, MIG-GMAW welding offers good heat control, which is crucial to avoid excessive distortion of the material being joined. Precise heat control is essential during the welding of automotive panels to prevent excessive distortion, especially since most vehicle panels are made from thin sheets designed to reduce weight and achieve the desired body shape (Davies, 1993; Guo et al., 2023).

MIG-GMAW welding is also flexible and capable of welding a variety of materials, such as steel, aluminium, and other alloys, which are increasingly used in modern vehicles, particularly aluminium, to reduce weight and improve fuel efficiency (Gene, 2002). Therefore, mastering MIG-GMAW welding is crucial in the design and construction of modern vehicles. Additionally, the final result of MIG-GMAW welding has several advantages over other welding methods, including low spatter, cleanliness, and a smooth weld finish, making it ideal for exterior automotive bodywork, where neatness is essential (Carry & Helzer, 2005). Besides being clean and tidy, it also produces strong and durable welds, which are necessary for vehicle body construction to withstand various loads and vibrations during operation (Jeffus, 2012).

The research findings also indicate that applying putty is an essential material in the automotive body subject. This is because applying putty is a critical step in automotive body repairs to achieve a high-quality final result. Pfanstiehl (1998) states that putty is used to fill holes, dents, or scratches caused by accidents or daily use. Putty helps to quickly and effectively repair these imperfections, restoring the smooth surface of the vehicle before repainting. Szalai et al. (2023) argue that without the application of putty, imperfections on the vehicle body would remain visible after painting, reducing the aesthetic quality and value of the vehicle.

In addition to enhancing the vehicle's aesthetics, the use of putty ensures that damaged or affected areas remain strong and durable. Putty helps to reinforce areas that may have weakened, thereby maintaining the integrity of the vehicle's body structure (Haynes, 1995). This is because putty can seal small holes, preventing dirt and water from entering and damaging the metal plates of the vehicle body.

From a time efficiency standpoint, the use of putty in vehicle body repairs allows the repair process to be completed quickly. In many cases, putty is a more efficient solution compared to replacing entire damaged body panels (He & Chang, 2014). With the right mixture, using putty can shorten the repair time without compromising the quality of the outcome. Duffy (2008) notes that using putty is a more cost-effective solution, particularly for minor repairs that do not require extensive replacement. This makes it a popular choice in automotive body repair workshops.

Discussion

The success of the learning process is largely determined by the proper selection and arrangement of learning materials (Musingafi et al., 2015). Without preparing teaching materials, the learning objectives cannot be achieved optimally (Nnabuike et al., 2016). The selection and arrangement of materials and teaching methodologies need to be carried out during the lesson planning stage, specifically when designing the syllabus and lesson plans. Lesson planning helps identify ways to address problems and mitigate issues that may arise during the learning process. Moreover, lesson planning is essential as a reference framework to ensure efficiency in utilizing all resources, including infrastructure and human resources (Katuuk, 2013; Ornstein & Hunkins, 1998).

Miller and Seller (1990) assert that teaching materials are crucial in the learning process because they serve as a source of information that students can use to achieve competencies. Without teaching materials, the programmed objectives cannot be effectively met. Similarly, Wilkin, as cited in Miller and Seller (1990), emphasizes that without teaching materials and other supporting facilities, teachers are unlikely to achieve predetermined learning objectives, as they cannot determine the appropriate teaching methods.

Teaching materials play a significant role in the learning process. There are at least five benefits of teaching materials in the learning process: enhancing communication quality between students and teachers, leading to more effective learning; improving students' retention, resulting in more permanent learning outcomes; increasing students' accessibility to learning; boosting students' motivation; and encouraging active participation in the learning process (Effiong & Charles, 2015).

Adalikwu and Iorkpilgh (2013) state that teaching materials are essential for successful teaching, especially for less experienced teachers. These materials serve as communication channels between teachers and students for delivering instructions, motivating the learning process, increasing student attention, and alleviating boredom. Less experienced teachers rely on teaching materials for every aspect of teaching, particularly for information related to the learning process. For new teachers, teaching materials are often used for lesson planning, assessing students' knowledge through assignments, creating projects, and managing exams.

In vocational education, the selection and development of learning materials must prioritize alignment with the required competencies and available job opportunities, as emphasized by Finch and Crunkilton (1979). This alignment is vital to ensure that graduates acquire skills and expertise directly applicable to the labour market, enabling them to secure employment more easily and perform effectively in their professional roles. Furthermore, by tailoring educational content to meet the evolving needs of businesses and industries, vocational institutions can bridge the gap between theoretical knowledge and practical application. This approach ensures that students are well-prepared to handle real-world challenges in their chosen fields. Collaborative partnerships with companies and industry stakeholders play a pivotal role in shaping curriculum content, allowing vocational education to remain adaptable and responsive to the dynamic demands of the job market (Abdurrahman et al., 2022).

Research findings indicate that there are four learning materials deemed essential by practitioners in the Body and Frame Panel subject: MIG-GMAW welding procedures; Reforming damaged panels made of iron, aluminium, plastic, or fibreglass; Applying putty; and Assessing the quality of body panel surfaces after putty application or repair. These findings demonstrate that the industry, particularly in body and frame panel repair, highly requires these four skills.

The identification of these four essential materials provides a basis for teachers to reconsider teaching all the content in the *Panel Body and Automotive Frame* subject. Instead, they can focus solely on the essential materials. A teaching approach centred on essential content will positively impact teachers' performance, as they will have sufficient time to plan lessons effectively. Additionally, teachers will have the opportunity to conduct learning with up-to-date resources, diverse methods, and innovative media, which can enhance student participation. In the evaluation stage, teachers will be better able to conduct assessments effectively, provide meaningful feedback, and take follow-up actions according to students' needs.

Teaching that focuses on essential content will also enhance students' understanding of topics relevant to the industry, as it allows for sufficient time. Students also have the opportunity to seek learning resources and explore the subject matter more deeply. From the perspective of learning load, focusing on essential content will reduce students' learning burden, preventing stress and allowing them to enjoy the learning process. Print (1993) asserts that essential-content-focused teaching will have a positive impact, as long as it does not hinder the achievement of the established curriculum goals. Similarly, Bruner, as cited by Rusman (2017), emphasizes the importance of understanding essential content in education, as it is key to building a strong foundation of understanding.

From the perspective of the learning experience gained by students, teaching that focuses on essential content will enhance their ability to understand basic concepts of the real world, ultimately improving their critical thinking and problem-solving skills (Gordon & English, 2016). Meanwhile, Vygotsky (1986) argues that understanding basic concepts is a crucial foundation for individuals to develop advanced thinking abilities and cognitive skills. Furthermore, based on the data analysis results, it can be concluded that essential content is largely determined by the extent to which the subject matter is applicable in the industry or business world. When this finding is related to the objectives of vocational schools, it is a reasonable conclusion, as the goal of vocational education is to prepare students for the workforce. The applicability of learning material will also enhance the alignment between the needs of the industry and the availability of skilled labor from vocational school graduates.

The description above provides an overview of the benefits of learning that focuses on essential material. However, learning that is overly concentrated on essential material can have negative impacts, particularly on students, by limiting their opportunities to explore broader and more creative areas in the learning process. More interdisciplinary or creative activities may be neglected. Garner (1983) states that human intelligence is highly diverse, and relying solely on learning that focuses on one area can overlook other forms of intelligence, such as interpersonal, musical, or kinesthetic intelligence. Education should encompass various learning styles and types of intelligence to enable students to develop comprehensively.

While emphasizing essential material in learning is crucial, an overly rigid focus on it can limit students' overall educational experience. Strict adherence to only essential content may narrow their learning scope, restricting opportunities to explore broader knowledge areas that contribute to personal and professional growth. This limitation can hinder the development of social, emotional, and additional skills that are equally valuable in real-world situations. Adler (1982) emphasizes that education should not be confined to core academic subjects but should also equip students with the skills and competencies necessary to navigate and contribute meaningfully to society. A well-balanced curriculum should integrate essential material while allowing flexibility for interdisciplinary learning, creativity, and holistic skill development.

Furthermore, considering the diversity of learners, a curriculum that is too focused on essential material risks neglecting students' individual needs, interests, and learning styles. Tomlinson (1999)

emphasizes the importance of differentiation in teaching to meet students' individual needs. Tomlinson further suggests that each student should be given the opportunity to learn in ways that align with their learning styles and interests. Overemphasizing essential material can overlook the importance of differentiation.

4. CONCLUSION

This research involves practitioners in the field of automotive body repair, both those working in the industrial sector and the business world. Practitioners agree that the important learning material in the subject of automotive body panels and frames is MIG-GMAW welding procedures; Reforming damaged panels made of iron, aluminum, plastic, or fiberglass; Applying putty; and Assessing the quality of body panel surfaces after putty application or repair. These findings will be useful for teachers and students. These findings will help teachers focus their teaching more on the most important core concepts and skills while also ensuring that students grasp the foundational knowledge necessary for a deep understanding of essential material. Secondly, identifying the essential material helps teachers maintain consistency between learning objectives and curriculum implementation. This enables the achievement of uniform educational standards, particularly in environments where multiple teachers are teaching the same subject. Thirdly, by understanding the essential material, teachers are expected to be able to design more targeted assessments aligned with learning objectives. This makes it easier for teachers to measure students' understanding of key topics and provide more effective feedback.

For policymakers, it is essential to establish curriculum standards that focus on essential material while still allowing flexibility for schools and teachers to adapt to local needs and student conditions. This approach enables teaching that is relevant, contextual, and effective. Secondly, policymakers should provide comprehensive and ongoing professional development for teachers to ensure they understand and can effectively implement essential material. This is crucial for enabling teachers to apply core content effectively in their instruction and to develop the skills needed for differentiation across different types of students. Although essential material is critical, the government should also encourage space within the curriculum for interdisciplinary activities and the development of creativity. This is important to ensure that students not only master core content but also develop the ability to think critically and creatively in solving problems across various contexts.

REFERENCES

- Abdurrahman, Parmin, Muryanto. (2022) Evaluation of the automotive skill competency test through the 'discontinuity' model and the competency test management of vocational education school in Central Java, Indonesia. *Heliyon* 8.e08872. <https://doi.org/10.1016/j.heliyon.2022.e08872>
- Adalikwu, S.A., & Iorkpilgh, I.T. (2013). The Influence of Instructional Materials on Academic Performance of Senior Secondary School Students In Chemistry In Cross River State. *Global Journal of Educational Research*, 12, 39–45.
- Adler, M. J. (1982). *The Paideia Proposal*. Macmillan Publishing
- Ahmadian, S., Alabdullah, T., Motaghian, I. (2023). Maintenance and Repairs System of Automotive Industry For Sustainable Internationalization. *International Journal on Advanced Technology Engineering and Information System* 2(2). DOI:10.55047/ijateis.v2i2.804
- BPS - Central Agency of Statistics. (2023). Pengangguran Terbuka Menurut Pendidikan Tertinggi yang Ditamatkan (Orang) tahun 2023. <https://www.bps.go.id/id/statistics-table/2/Njc0IzI=/pengangguran-terbuka-menurut-pendidikan-tertinggi-yang-ditamatkan.html>.
- Brunello, G. & Rocco, L. (2017). The effects of vocational education on adult skills, employment, and wages: What can we learn from PIAAC? *SERIEs* 8 (4), 315–343

- BSKAP Kemendikbud Ristek. (2022). *Learning Outcomes in Early Childhood Education, Basic Education, and Secondary Education in the Merdeka Curriculum*. Kemendikbud Ristek
- Carry, H. B. & Helzer, S. (2005). *Modern Welding Technology*. Pearson Education.
- Choi, S.J., Jeong, J. C., Kim, S. N. (2019). Impact of vocational education and training on adult skills and employment: An applied multilevel analysis. *International Journal of Educational Development*. 66. 120-138. <https://doi.org/10.1016/j.ijedudev.2018.09.007>.
- Davies, A.C. (1993). *The Science and Practice of Welding*: Cambridge University Press
- Duffy, J. (2008). *Auto Body Repair Technology*. Cengage Learning
- Effiong, O.E. & Charles, E.I. (2015). Impact of Instructional Materials in Teaching and Learning of Biology in Senior Secondary Schools. *International Letters of Social and Humanistic Sciences*, 62(2005), 27–33. <http://doi.org/10.18052/www.scipress.com/ILSHS.62.27>
- Fikri, A. & Hasudungan, A.N. (2021). Analisis Kompetensi Dasar Esensial pada Mata Pelajaran Sejarah Indonesia di Masa Pandemi Covid-19. *Indonesian Journal of Social Science Education (IJSSE)*. Vol. 3, No. 1. DOI:10.29300/ijssse.v3i1.4008
- Finch, C. R. & Crunkilton, J. (1979). *Curriculum Development in Vocational and Technical Education Planning, Content, and Implementation*. Allyn and Bacon, inc
- Forster, A. G. & Bol, T. (2018). Vocational education and employment over the life course using a new measure of occupational specificity. *Social Science Research*. <https://doi.org/10.1016/j.ssresearch.2017.11.004>
- Garner, H. (1983). *Frames of mind : the theory of multiple intelligence* : Basic Books
- Gene, M. (2002). *Welding of Aluminium and Its Alloys*: Woodhead Publishing.
- Gordon, M & English, A. R. (2016). John Dewey's Democracy and Education in an Era of Globalization. *Education Philosophy and Theory*. Vol. 48 Issue 10. DOI:10.1080/00131857.2016.1204742
- Guo, D.& Wang, A. (2020). Is vocational education a good alternative for low-performing students in China? *International Journal of Educational Development*. 75. 102187. DOI:10.1016/j.ijedudev.2020.102187
- Guo, N.H.H., Tang, X., Ma, X., Wang, X., (2023). The Effect of TIG Welding Heat Input on the Deformation of a Thin Bending Plate and Its Weld Zone. *Coating*. 13, <https://doi.org/10.3390/coatings13122008>
- Hassan, M.U., Alaliyat, S., Sarwar, R., Nawaz, R., Hameed, I.A. (2023). Leveraging deep learning and big data to enhance computing curriculum for industry-relevant skills: A Norwegian case study. *Heliyon*. Vol. 9 Issue 4. <https://doi.org/10.1016/j.heliyon.2023.e15407>
- Haynes, J. (1995). *Automotive Body Repair and Painting Manual*. Haynes Publishing
- He, T.H & Chang, Z, S.(2014). Study on the Automotive Body Collision Damage and the Repair Method. *Applied Mechanics and Materials* 538:146-149 DOI:10.4028/www. Scientific. Net/AMM.538.146
- Herman., P.A.L. & Mahmud, M.E. (2023). Kebijakan Perubahan Kurikulum di Indonesia. *An-Nadzir: Jurnal Manajemen Pendidikan Islam*, 01 (02), 92-104
- Jeffus, L. (2012). *Welding Principles and Applications*. Cengage Learning.
- Katuuk, D. A. (2013). Manajemen Implementasi Kurikulum: Strategi Penguatan Implementasi Kurikulum 2013. *Cakrawala Pendidikan*, 33(1), 13–26.
- Kemendikbud. (2021). *Kembangkan SMK, Kemendikbud Ajak Industri Reviu Kurikulum*. <https://www.kemdikbud.go.id/>
- Kulkani, V., Gaitonde, V.N., Kotturshettar, B.B., Satish, J. (2020). Adapting Industry-Based Curriculum Design for Strengthening Post Graduate Programs in Indian Scenario. *Procedia Computer Science* 172 . 253–258. <https://doi.org/10.1016/j.procs.2020.05.040>
- Lee, Y.H., Hsiao, C., Ho, C.H. (2014). The effects of various multimedia instructional materials on students' learning responses and outcomes: A comparative experimental study. *Computers in Human Behavior*. 40. 119–132. <http://dx.doi.org/10.1016/j.chb.2014.07.041>

- Maragkou, K. (2020). Socio-economic inequality and academic match among post- compulsory education participants. *Economics of Education Review*. Vol. 79. 102060. <https://doi.org/10.1016/j.econedurev.2020.102060>
- Martono, T., Saputro, H., Wahyono, B., Laksono, P.W., Isnantyo, F.D. (2018). *Optimalisasi Kompetensi Lulusan SMK Dalam Industri/Teknologi Terapan*. Direktorat Pembinaan Sekolah Menengah Kejuruan-Kementerian Pendidikan dan Kebudayaan.
- Miller, J. & Seller, W. (1990). *Curriculum Perspectives and Practice*. Longman
- Muja, A., Blommaert, L., Gesthuizen, M., Wolbers, M.H.J. (2019). The vocational impact of educational programs on youth labor market integration. *Research in Social Stratification and Mobility* 64.100437. <https://doi.org/10.1016/j.rssm.2019.100437>
- Mukhlason, A., Winanti, T., Yundra, E. (2020). Analisa Indikator SMK Penyumbang Pengangguran di Provinsi Jawa Timur. *JVTE: Journal of Vocational and Technical Education - Volume 02, Nomor 02*. <https://doi.org/10.26740/jvte.v2n2.p29-36>
- Mulyasa. (2013). *Pengembangan dan Implementasi Kurikulum 2013*. Remaja Rosdakarya
- Musingafi, M.C.C., Mhute, I., Zebron, S., Kaseke, K. E. (2015). Planning to Teach : Interrogating the Link among the Curricula, the Syllabi, Schemes, and Lesson Plans in the Teaching Process. *Journal of Education and Practice*, 6(9), 54–60.
- Neuman, S. & Zideman, A. (1999). Vocational education in Israel: wage effects of the VocEd-occupation match. *J. Hum. Resource*. 34 (2), 407–420
- Nnabuike, E., Aneke, M., Otegbulu, R. (2016). Curriculum Implementation and The Teacher: Issues, Challenges, and The Way Forward. *International Journal in Commerce, IT & Social Sciences*, 3(6), 41–48.
- Ornstein, A. C. & Hunkins, F. P. (1998). *Curriculum : foundations, principles, and issues*. (V. Lanigan, Ed.) (3rd ed.). Allyn and Bacon.
- Pfanstiehl, J. (1998). *Automotive Paint Handbook*: HP Books
- Pradeep, S.A., Deshpande, A.M., Limaye, M., Iyer, R. K., Kazan, H., Li, G., Pilla, S (2024). A Perspective on the Evolution of Plastics and Composites in the Automotive Industry. *Applied Plastics Engineering Handbook* (Third Edition). <https://doi.org/10.1016/B978-0-323-88667-3.00016-3>
- Print, Murray. (1993). *Curriculum Development and Design*. Allen & Unwin
- Psacharopoulos, G. (1997). Vocational education and training today: challenges and responses. *Journal of Vocational Education & Training* 49, 3.
- Ridwan, D. & Vina, D. (2023). Missmatch Industri Dan SMK: Fenomena SMK Penyumbang Angka Pengangguran Tinggi. *Journal Innovation in Education (INOVED)* Vol. 2 No. 1. : <https://doi.org/10.59841/inoved.v2i1.893>
- Rusman. (2017). *Belajar dan Pembelajaran Berorientasi Standar Proses Pendidikan*. Kencana.
- Sobari, M., Wahyudin, D., Dewi, L. (2023). Keterlibatan Industri Dalam Pengembangan Kurikulum Pada Tingkat SMK. *Jurnal Education and Development*. Vol. 11. No.3 pp 230-238. DOI:10.37081/ed.v11i3.4771
- Sugiyono. (2017). *Metode Penelitian Kuantitatif, Kualitatif, R & D*. CV. Alfabeta.
- Szalai, S., Szívós, B.F., Kurhan, D., Németh, A., Sysyn, M., Fischer, S. (2023). Optimization of Surface Preparation and Painting Processes for Railway and Automotive Steel Sheets. *Infrastructures*, 8, 28. <https://doi.org/10.3390/infrastructures8020028>
- Thomas, A & Jund, M. (2013). *Collision Repair and Refinishing: A Foundation Course for Technicians*. Cengage Learning.

- Tierney, O., Vasilevski, V., Kinsman, L., Sweet, L. (2024). Development of the essential learning outcomes for the midwifery student continuity of care learning model: A Delphi study. *Women and Birth*. 37. 101586
- Tomlinson, C. A. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*. Association for Supervision and Curriculum Development
- Trianto. (2011). *Mendesain Model Pembelajaran Inovatif-Progresif: Konsep, Landasan, dan Implementasinya*. Kencana.
- Vygotsky, L. S. (1986). *Thought and Language*. (Translate, revised, and edited by Alex Kozulin). The Massachusetts Institute of Technology
- Xie, J., Wang, L., Wang, S., Duan, Y., Wang, K., Zhong, Z., Yan, J., Ding, S., Li, L., Cheng, A.S.K., (2020). What influences new graduate nurses' core competencies transformation to clinical in China? A cross-sectional study. *Nurse Education Today*.(100).104855. <https://doi.org/10.1016/j.nedt.2021.104855>