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Systematic Literature Review: Gap Analysis, Trends, Methodologies, And Innovations of Job Sheet Development for Vocational High School

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A B S T R A C T

This study aims to analyze trends, innovations, and research gaps in the development of job sheets for vocational education published in Scopus-indexed journals from 2018 to 2023. The methodology used is SLR following the PRISMA guidelines on ten selected articles synthesized to identify development patterns and methodologies. The analysis of these ten studies revealed five main trends: the dominance of the 4-D development model (used by 50% of the studies) and ADDIE (20%), increased integration of digital technology (such as AR, QR codes, virtual laboratories, and animated videos), comprehensive expert validation, emphasis on HOTS, and limitations in effectiveness testing, which was found in only one study. The analytical synthesis revealed significant research gaps, including the lack of longitudinal studies to assess long-term skill retention, limited dissemination stages, and minimal integration of Industry 4.0 competencies and smart technologies like AI. The study concludes that although job sheet development shows rapid advancements in technological and pedagogical aspects, strengthening empirical effectiveness measurements, utilizing immersive technologies, and fostering closer industry collaboration are essential. These findings provide strategic direction for future research to develop more adaptive vocational learning media that aligns with the needs of the global labor market.

1. Introduction

Vocational Vocational education plays a strategic role in producing skilled workers ready to compete in the increasingly competitive and technologically advanced global labor market of the 21st century. The success of this education system is determined not only by the relevance of a theoretically structured curriculum but also heavily depends on the effectiveness of learning media that integratively and

contextually bridge theoretical concepts with practical applications (OECD, 2023). As a structured learning guide in vocational environments, the job sheet plays a central role in systematically detailing practical tasks and safety procedures (Sari et al., 2022). The effectiveness of this instrument is now enhanced by the development of interactive electronic modules, which have been proven to improve learning outcomes through dynamic material presentation and active student engagement (Hasibuan et al., 2023). The integration of structured guides and digital interactivity has produced the e-job sheet format, which effectively facilitates independent learning while accommodating diverse student preferences (Yuliana & Hambali, 2020). This phenomenon underscores the urgency for vocational institutions to revitalize job sheets by incorporating cutting-edge technology and interactivity to ensure their relevance in preparing competent and adaptive graduates for the modern industry.

The implementation of Industry 4.0, characterized by the dominance of automation, IoT, AI, and big data management, demands that vocational education institutions holistically integrate advanced digital competencies into their training programs (Wulandari et al., 2025). According to (Setiawan & Widiyanti, 2025), the application of structured technical learning modules has a significant impact on enhancing students' specific skills in operating industrial machines, where the effectiveness of such media serves as a crucial instrument driving the synchronization of SMK curricula with actual industry needs (Bidandari et al., 2024). Innovations such as Augmented Reality (AR), QR codes, virtual laboratories, and interactive video media are increasingly adopted to enrich immersive practical learning experiences for SMK students (Nugraha, 2023). The integration of these digital media aims to provide dynamic visualizations that strengthen conceptual understanding, minimize laboratory material waste, and mitigate safety risks through simulations of hazardous procedures prior to physical interaction (Kusandi, 2024). As a concrete illustration, AR based job sheets can project machine components in three-dimensional format, enabling students to interactively visualize complex mechanisms without limitations imposed by the availability of physical equipment in school workshops (Aditiawan et al., 2025).

This digital transformation is further accelerated by the COVID-19 pandemic from 2020-2022, which served as the primary catalyst for the rapid adoption of technology in vocational learning ecosystems traditionally reliant on physical practicums (Unesco, 2020). Limited access to laboratory facilities forced educators to shift to distance or blended learning modes, triggering a significant surge in research on developing digital and virtual job sheets as crucial substitutes (Alfia et al., 2023). The significance of these innovations has proven to persist in post-pandemic educational practices, indicating a permanent paradigm shift toward fully technology-mediated hybrid learning models (Arthur & Maulana, 2025). According to (Yohana & Nasir, 2025), the development of effective learning media must integrate materials relevant to students' contextual needs to optimally impact learning outcomes. The majority of existing development studies tend to overemphasize technical feasibility and visual design aesthetics, often neglecting empirical measurements of learning outcomes and long-term impacts on students' work readiness (Yanto et al., 2023).

Evaluations of how job sheet innovations specifically impact critical psychological and cognitive domains such as intrinsic motivation, memory retention, and *higher-order thinking skills* (HOTS) remain very limited in the academic literature (Samkhan, 2016). Although technological advancements have expanded instructional delivery channels, many developed media lack robust theoretical frameworks, with few studies explicitly linking media design to constructivist learning theory (Nirfayanti et al., 2025). Vocational field studies also indicate that traditional job sheet formats often fail to stimulate HOTS and digital literacy, creating misalignment with the Kurikulum Merdeka vision targeting the Pancasila Student Profile with adaptive thinking skills (Aulia et al., 2025). According to (Safitri & Andromeda, 2023), learning media development must integrate interdisciplinary approaches such as STEAM and Problem-Based Learning models to enhance students' critical thinking skills and creativity in solving complex problems. The absence of AI utilization in digital job sheets also signals that the potential for personalized learning accommodating diverse student learning paces has not been adequately optimized.

According to (Wahyuni et al., 2025), the need for a transformational framework in learning media is crucial to integrate innovative learning models that can enhance students' digital literacy and creative thinking skills. Oriented toward this urgency, this study employs a Systematic Literature Review (SLR) approach to deeply map and analyze trends, methodologies, and innovations in job sheet development during the 2018-2023 periode. The SLR approach was selected for its ability to systematically and structuredly synthesize findings from various studies, yielding credible literature mapping as a valid basis for scientific decision-making. This study specifically explores the evolution of job sheets from conventional printed formats to digital formats enriched with advanced technologies, such as AR, QR codes, and virtual laboratories (Nugraha, 2023). It also examines the extent to which these developments incorporate modern pedagogical principles like constructivism and performance-based assessment to create meaningful learning experiences for vocational students (Anderson & Krathwohl, 2001).

This research is specifically designed to address five main questions: (1) what are the publication patterns of research on vocational job sheet development during 2018–2023; (2) which development models are most dominant; (3) how technology integration methods are applied in job sheet design; (4) what pedagogical innovations have been implemented; and (5) what research gaps remain open for further exploration. The overall objectives of this research are: (a) to map trends in vocational job sheet development in Indonesia during 2018–2023; (b) to analyze dominant development models and technology integration methods used; (c) to identify implemented pedagogical innovations in job sheet design; and (d) to formulate a future research agenda based on identified gaps. By achieving these objectives, this study is expected to provide strategic guidance for educators, researchers, and policymakers in designing transformative, relevant instructional media with tangible impacts on vocational education quality in the era of global technological disruption.

2. Methodology

This study uses a systematic literature review (SLR) approach following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines developed by (Moher et al., 2009). The SLR method was chosen because it allows for comprehensive and structured identification, evaluation, and synthesis of research findings in figure 1.

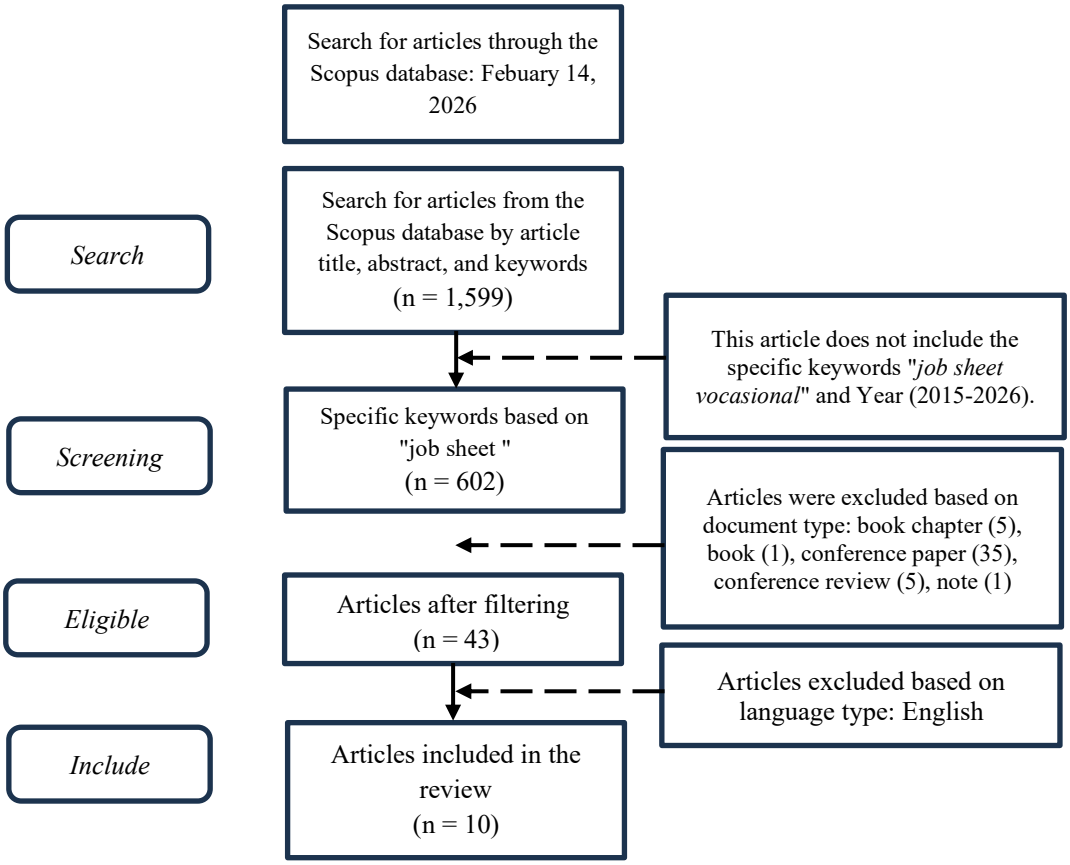

Figure 1. PRISMA Diagram

Data Collection

The Literature Search Was Conducted On February 14, 2026, Through The Scopus Database. The Keywords Used Were Combinations Of: (Title-Abs-Key (Job Sheet) And Title-Abs-Key (Vocational)) And Pubyear > 2015 And Pubyear < 2026 And (Limit-To (Doctype , "Ar"))And (Limit-To (Language , "English") .

Inclusion and Exclusion Criteria

The inclusion criteria in this study comprised: (1) peer-reviewed articles published in Scopus-indexed journals; (2) research focused on the development of job sheets, worksheets, or e-job sheets; (3) research conducted within vocational education contexts (vocational high schools or vocational higher education institutions); (4) publications between 2018 and 2023; (5) articles written in either Indonesian or

English; and (6) studies employing research and development (R&D) methodologies. The exclusion criteria were: (1) non-peer-reviewed publications such as conference abstracts, editorials, or book reviews; (2) studies in general education without vocational contexts; (3) articles lacking full-text access; and (4) duplicate publications.

Selection and Analysis Process

The selection process was conducted in four stages. The identification stage found 1.599 potentially relevant articles, screening based on titles and abstracts resulted in 602 articles. A full-text eligibility assessment of 43 articles resulted in 10 articles that met all inclusion criteria for further analysis. Data extraction was performed by recording bibliographic information, research context, development model, technological innovation, pedagogical approach, validation method, main findings, and research limitations. Thematic analysis was used to identify patterns, trends, and gaps between studies.

3. Results and Discussion

General Overview of the Study Analyzed

Based on the synthesis of ten articles that met the inclusion criteria, a research distribution pattern was found that closely correlated with the global emergency. Publication trends showed a significant spike in 2020 and 2021 in response to the COVID-19 pandemic, which demanded the digitalization of practical learning media. The data in Table 1 confirms that the majority of research was conducted at the Vocational High School (SMK) level, focusing on engineering. From a methodological perspective, the 4-D development model (Define, Design, Develop, Disseminate) was the most dominant framework, used by 50% of the total studies by (Djatmiko et al., 2020), (Nuryanto et al., 2020), (Ratnawati et al., 2020), and (Setiadi et al., 2020) due to its structured validation procedures for instructional materials. Meanwhile, the ADDIE model was applied by 20% of the studies by (Munawwarah et al., 2020) and (Putrama et al., 2020) to support iterative evaluation at each stage of development. Overall, all articles (100%) have gone through a comprehensive expert validation stage, but only 1 of the 10 studies by (Kahar et al., 2021) conducted an effectiveness test using a pre-test and post-test design to empirically measure student competency improvement.

Table 1. Characteristics of Studies Analyzed

No	Author (Year)	Level	Field of Study	Development Model	Key Innovations
1	(Djatmiko et al., 2020)	Vocational High School	SMAW welding	4-D	Augmented Reality
2	(Kahar et al., 2021)	Vocational Education	Physics	3-Stage R&D	Integrasi HOTS

3	(Ningsih & Ruhidayati, 2019)	Vocational Education	History	Survei	E-job sheet QR code
4	(Yanto et al., 2023)	Vocational Education	Power Electronics	Validitas	Laboratorium Virtual
5	(Bayu et al., 2020)	Vocational High School	Bio-Briquette Production	Demonstrasi	Video + Job Sheet
6	(Munawwarah et al., 2020)	Junior high school	Environmental Pollution	ADDIE	Constructivist-based
7	(Nuryanto et al., 2020)	Vocational High School	Technical Drawing	4-D	Job Sheet Konvensional
8	(Putrama et al., 2020)	Vocational High School	Basic Programming	ADDIE	Performance Evaluation
9	(Ratnawati et al., 2020)	Vocational High School	Lathe Machining	4-D	Animated Video
10	(Setiadi et al., 2020)	Vocational Education	Technical Drawing	4-D	Job Sheet Konvensional

Job Sheet Development Research Trends

Based on the graph in Figure 2, it can be seen that in Indonesia, there was a slow start from 2017 to 2019, with only a few publications each year. This period represents the initial exploratory phase focusing on traditional worksheet methods in vocational education. However, the emergence of the COVID-19 pandemic in 2020 led to a dramatic increase in research output, reaching nine documents, driven by the urgent need to adapt to online learning and integrate digital tools such as virtual laboratories and technology-enhanced worksheets. This surge peaked in 2021 with a total of ten publications, as educational institutions rapidly innovated in response to the pandemic. After this peak, research output declined in 2022 and 2023, possibly due to the return of face-to-face learning and the conclusion of emergency-driven innovations. Projected data for 2024 and 2025 indicate a further decline, highlighting post-pandemic exhaustion and a return to stability in the research field. Overall, the data show a pattern of responsive research cycles from early exploration, through an accelerated innovation period triggered by crisis, to a post-crisis stabilization phase with a renewed focus on the long-term impact of technological innovations on vocational education.

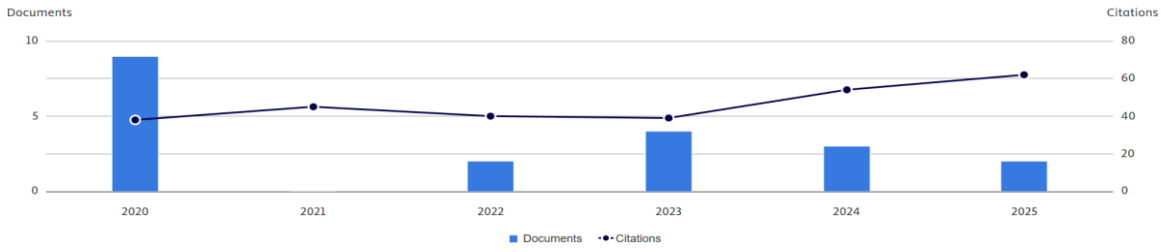

Figure 2. Citacion Overview

Development Model and Methodology

In terms of development models, the 4-D model (Define, Design, Develop, Disseminate) proposed by Thiagarajan, Semmel, and Semmel (1974) emerged as the most frequently employed framework, utilized in half of the analyzed studies,

due to its systematic and structured validation procedures specifically designed for developing instructional materials. The ADDIE model was applied in two studies, offering the advantage of iterative evaluation at each development stage, while modified R&D approaches were used in the remaining studies. Regarding validation and testing approaches, all studies incorporated expert validation involving material, media, and language specialists, with (Yanto et al., 2023)conducting the most comprehensive validation involving 18 experts and employing Aiken's V analysis, yielding high validity coefficients above 0.84. Product testing was conducted through limited and broad-scale trials involving student samples ranging from 17 to 140 participants. However, a notable limitation across most studies is that only(Kahar et al., 2021) employed pre-test and post-test designs with statistical analysis to measure actual effectiveness in improving learning outcomes, while the majority of research focused primarily on feasibility testing and user response, reflecting a broader pattern in Indonesian educational media development research that emphasizes initial validation over rigorous effectiveness testing.

Technology Integration in Job Sheets

The integration of technology in job sheet development synthesized from the ten articles shows an evolutionary trajectory in three main phases. The initial phase is represented by two studies by (Nuryanto et al., 2020) and (Setiadi et al., 2020) which focused on standardizing conventional print-based job sheets. The transitional or hybrid phase is represented by one study by (Ningsih & Ruhidayati, 2019) which utilized QR Code integration as a bridge to multimedia content. The third phase, the advanced digital phase, is supported by four studies that implement cutting-edge technologies such as Augmented Reality by (Djatmiko et al., 2020), virtual laboratories by (Yanto et al., 2023), and interactive animated videos by (Bayu et al., 2020) and (Ratnawati et al., 2020). From a pedagogical perspective, innovations have begun to be directed at strengthening Higher Order Thinking Skills (HOTS) and constructivist approaches, as demonstrated by (Kahar et al., 2021) and (Munawwarah et al., 2020), which marks a paradigm shift from mere procedural guidance to developing critical thinking and problem-solving skills.

Pedagogical Innovation

Recent developments in job sheet design have increasingly incorporated pedagogical innovations aimed at enhancing higher-order thinking skills, constructivist learning, and performance-based assessment. (Kahar et al., 2021)developed HOTS-oriented worksheets for physics education that integrated analyzing, evaluating, and creating dimensions from Bloom's revised taxonomy, demonstrating significant improvements in both learning outcomes ($t = 37{,}233$; $p < 0.001$) and student motivation. (Munawwarah et al., 2020) applied a constructivist approach to environmental pollution worksheets, emphasizing active knowledge construction through guided discovery, simple experiments, and reflective activities, achieving high learning mastery at 82.21% by enabling students to explore, collect data, analyze findings, and draw conclusions independently. (Putrama et al., 2020) introduced performance-based assessment in programming

job sheets, incorporating clear competency standards, detailed observation checklists, and scoring rubrics that enabled objective evaluation of student abilities while helping learners understand success criteria from the outset, aligning with competency-based curriculum principles that prioritize demonstrable skills over theoretical knowledge alone. These pedagogical innovations collectively reflect a shift toward developing 21st century competencies, including critical thinking, problem-solving, creativity, and authentic skill demonstration, moving beyond traditional job sheet designs that focused primarily on procedural guidance and content delivery.

Research Gap Analysis

Job sheets play a crucial role in vocational education, but an analysis of existing research reveals several gaps in their development. These include a lack of empirical evidence on their impact, limited integration of technologies like AI and virtual reality, and insufficient focus on soft skills and differentiated learning. Addressing these gaps is essential to enhance job sheets' effectiveness in meeting both educational and industry needs.

a. Methodological Gap

The analysis reveals three significant methodological gaps in job sheet development research. First, there is a notable lack of effectiveness testing, as only one out of ten studies employed experimental designs to measure actual improvements in learning outcomes, with the majority focusing exclusively on feasibility testing and user responses, resulting in insufficient empirical evidence regarding the genuine impact of job sheets on student competency development. Second, no longitudinal studies have been conducted to assess long-term skill retention among students who used developed job sheets, despite the critical importance of durable competencies in vocational education where graduates must apply their skills in real work environments. Third, dissemination remains severely limited across studies; although the 4-D development model includes a dissemination phase, implementation has been confined to publishing articles, uploading videos to YouTube, or sharing with small groups of teachers, with no research examining large-scale implementation across multiple institutions or evaluating how job sheets adapt to different contextual settings.

b. Content and Pedagogical Gaps

Four additional critical gaps emerge from the analysis of job sheet development research. Regarding Industry 4.0 competency integration, existing studies have failed to explicitly map developed skills against emerging workplace demands such as the Internet of Things, data analytics, cyber physical systems, or additive manufacturing, despite vocational education's mandate to prepare students for increasingly digital and automated work environments. In terms of soft skills development, job sheets remain predominantly focused on technical competencies, with minimal attention to cultivating essential non-technical skills such as communication, collaboration, and creativity (Kahar et al., 2021) integration of

Higher Order Thinking Skills represents progress, other crucial soft skills have yet to receive adequate consideration in job sheet design. Furthermore, no studies have addressed differentiated learning approaches that accommodate student diversity in terms of prior knowledge, learning styles, or special needs, with developed job sheets maintaining a one-size-fits-all approach despite vocational classrooms typically comprising students with varied backgrounds and abilities. These gaps collectively highlight the need for more comprehensive job sheet designs that address both technical and non-technical competencies while adapting to individual learner characteristics and evolving industry demands.

c. Technology Gap

The analysis identifies three additional technological gaps in job sheet development research. First, no studies have integrated artificial intelligence capabilities into job sheets, despite AI's potential to provide intelligent tutoring, automated feedback, and personalized learning recommendations based on student performance analysis, which could substantially enhance job sheets' effectiveness as self-directed learning tools. Second, while augmented reality and virtual laboratory studies represent progress, immersive virtual reality-based job sheets remain unexplored, even though VR technology could create realistic practice environments for dangerous, expensive, or logistically impractical procedures that cannot be conducted in school laboratories. Third, although some studies mention Android device accessibility, none have optimized job sheets specifically for mobile learning through responsive design, offline functionality, and interaction patterns tailored to smartphone user characteristics, representing a missed opportunity to leverage the ubiquity of mobile devices for flexible, anytime-anywhere vocational learning.

d. Contextual Gap

The final three gaps identified in job sheet research pertain to industry collaboration, assessment validity, and cost-effectiveness analysis. Regarding industry partnerships, most studies have been conducted by academic researchers and school practitioners with minimal involvement from industry partners, despite the critical importance of workplace input for ensuring job sheet content aligns with actual industry needs and prevailing competency standards. In terms of assessment validity, although job sheets typically include scoring rubrics, there has been little effort to validate these assessment tools against national competency standards or to examine inter-rater reliability in authentic evaluation contexts, raising questions about the consistency and credibility of competency measurements. Furthermore, no studies have conducted cost-effectiveness analyses comparing technology-based job sheet development investments against the educational benefits gained, despite such information being essential for schools and institutions making informed decisions about allocating limited resources to learning media development initiatives. These gaps collectively underscore the need for more comprehensive research approaches that consider institutional, industrial, and economic dimensions alongside pedagogical and technological innovations.

4. Conclusion

Despite advances in visual innovation and technology, this systematic review uncovers several crucial research gaps that should be prioritized for future research. First, there is an urgency to conduct experimental effectiveness testing, given that 90% of current studies are still limited to feasibility and user feedback. Second, the absence of longitudinal studies in the ten articles analyzed indicates a lack of empirical evidence regarding students' long-term skill retention in the workforce. Third, there is significant opportunity in the integration of intelligent technologies such as Artificial Intelligence (AI) and fully immersive Virtual Reality (VR), AI technology can provide personalized, adaptive feedback, while VR can facilitate practical work on hazardous or costly procedures that are currently underexplored in the current literature. Finally, the low level of industry partner involvement in the content validation process (as seen in the research subject profiles) underscores the need for closer collaboration to ensure that developed job sheets align with current competency needs in the Industry 4.0 era.

Recommendations

Based on the identified gaps, future research is recommended to conduct experimental studies that empirically measure the effectiveness of job sheets in improving student competencies. Longitudinal designs also need to be implemented to determine long-term skill retention. Researchers can also develop job sheets that explicitly integrate Industry 4.0 competencies and soft skills, as well as explore the utilization of artificial intelligence to create adaptive learning systems. Collaboration with industry partners needs to be strengthened to ensure content relevance with workplace demands. Finally, cost-effectiveness analysis is needed to assist institutions in making investment decisions regarding technology-based learning media development.

Limitations of the study

This study has several limitations. Its scope is limited to studies in Indonesian and English, potentially overlooking relevant research in other languages. The number of studies analyzed is relatively small (n=10), so generalizations of the findings should be made with caution. The quality assessment relies on published information, so it is possible that methodological details have not been captured completely

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