Development of a Chatbot-Based Assessment System for Evaluating Career Readiness in Vocational Education

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Abstract: This study aims to develop, assess the feasibility of, and evaluate the effectiveness of a web-based chatbot, TemanKarir, for measuring vocational high school students' career readiness. The research employed a Research and Development (R&D) method using the ADDIE development model, which consists of five stages: analysis, design, development, implementation, and evaluation. The chatbot was developed using the Botpress platform and integrated with Google Sheets, WordPress, the Telegram Bot API, and QuickChart. The assessment instrument was based on the Employability Skills Framework and comprised 75 items across nine skill dimensions. All items demonstrated strong content validity (Aiken's V = 0.75–1.00), satisfactory item validity (r = 0.339–0.813), and high internal consistency (Cronbach's α = 0.985). The participants included two content experts, two media experts, and 50 Grade XI vocational high school students. Data were analyzed using descriptive statistical techniques based on a four-point Likert scale and software quality evaluation criteria from the ISO/IEC 25010 standard. The results indicate that: (1) the TemanKarir chatbot was successfully developed with key features, including career readiness assessment, automated feedback, result summaries for guidance counselors, and follow-up guidance recommendations; (2) the chatbot was rated as highly feasible based on evaluations by content experts (mean score = 3.62) and media experts (mean score = 3.52); and (3) the chatbot demonstrated high effectiveness as an assessment tool, with strong scores for effectiveness (3.57), efficiency (3.58), and user satisfaction (3.56). Overall, the findings confirm that the TemanKarir chatbot is both feasible and effective for assessing vocational high school students' career readiness and contributes positively to their career development processes.

Introduction

Indonesia is currently preparing to achieve its ambitious vision of "*Indonesia Emas 2045*" as a developed nation. This aspiration is grounded in the demographic dividend phenomenon, a projected surplus of the productive-age population by 2045 (Hasdiana et al., 2023). To realize this vision, comprehensive preparation of superior human resources is essential, particularly among the younger generation. Generation Z, often characterized by high creativity and imagination, is expected to serve as the backbone of the nation in advancing the economy and contributing to various strategic national sectors (Pohan & Rialdy, 2024). However, preparing for a generation with high competitiveness remains a significant challenge requiring serious efforts from all elements of society.

One of the most critical challenges is ensuring that young people possess adequate career readiness to face the increasingly dynamic and competitive demands of the labor

market (Hamzati & Naqiyah, 2023). Current employment conditions in Indonesia show that, although Generation Z is widely recognized as digitally proficient and adaptable, they still encounter substantial barriers in transitioning from education to employment, including skills mismatches and limited quality job opportunities (Nabilla et al., 2025; Nu'ma & Mangunsong, 2024). According to the report "*Keadaan Ketenagakerjaan Indonesia Februari 2024*" published by Statistics Indonesia (BPS), the open unemployment rate (*Tingkat Pengangguran Terbuka*, TPT) for the 15–24 age group reached 16.42% (Badan Pusat Statistik, 2024). This figure indicates that many young people, especially formal education graduates, are not fully prepared to enter the workforce.

The situation becomes increasingly concerning when examined by education level, with Vocational High School (SMK) graduates recording the highest unemployment rate compared to other educational levels at 8.62%. This is particularly alarming given that SMK is specifically designed to prepare graduates with skills directly applicable in the workplace (Hidayati et al., 2021). This aligns with systematic review findings by Hamidah et al. (2022), which identified several dominant problems among SMK students, including low career planning, weak career decision-making, and suboptimal career maturity. Similarly, research by Saripah et al. (2023) revealed career maturity problems among SMK students, including insufficient career knowledge, limited exploration, and hesitation in decision-making.

Similar challenges are also evident at SMK Negeri 2 Dompu, located in Dompu Regency, West Nusa Tenggara, a region characterized by limited industrial development and a labor market dominated by informal and agricultural sectors. Data from the *Statistik Ketenagakerjaan Kabupaten Dompu* published by Badan Pusat Statistik (BPS, 2023) indicate that more than 70% of the workforce is employed in the informal sector, reflecting restricted access to formal employment opportunities and industrial-based careers. Such regional labor market conditions pose structural challenges for vocational school graduates in transitioning into employment that aligns with their acquired competencies. In line with these regional characteristics, the Rapor Pendidikan of SMK Negeri 2 Dompu for the 2023–2024 academic year reports that the graduate absorption rate remains categorized as "low," signaling the need to strengthen support mechanisms that facilitate graduates' transition into employment, further education, or entrepreneurship. Within this context, the role of guidance and counseling teachers becomes particularly critical in assisting students to recognize their competencies, understand local labor market demands, and formulate realistic career plans aligned with their vocational skills (Thasfa & Daulay, 2024).

In this context, SMKN 2 Dompu still faces constraints due to the absence of a structured, systematic, and easily accessible career guidance service system. Based on preliminary study findings through unstructured interviews with the guidance and counseling teachers, information was obtained that the process of identifying students' career readiness is still conducted manually through open interviews without valid instrument support. Furthermore, there is no data management system to monitor students' career readiness development continuously. Manual and paper-based career readiness assessments are often considered ineffective because they may generate data that are difficult to standardize, compare, and audit, particularly when the assessment process relies on open-ended interviews and subjective interpretation. Limited standardization can weaken the reliability and validity of both the assessment instrument and the resulting data. In addition, paper-based data collection commonly requires manual transcription and data entry prior to analysis, which adds procedural steps and increases the likelihood of human error. Studies by Walther et al. (2011) and Fleischmann et al. (2017) indicate that paper-based workflows are generally

slower and more error-prone than electronic data capture systems, which streamline processing and support improved data quality. As a result, the time required to generate results and deliver timely feedback or follow-up services is often extended (Garza et al., 2023). These conditions indicate the need for career guidance service innovation to improve efficiency and accuracy in identifying career readiness among students at SMKN 2 Dompu. This aligns with Saripah et al. (2023), who stated that achieving good career maturity for SMK students requires an interactive career service system as an important strategy to help students gain better understanding of various career options and job prospects relevant to their interests and talents.

Responding to these needs, a preliminary study survey of the guidance and counseling teachers revealed strong support for implementing technology in career readiness guidance services. Most respondents expressed readiness to use new applications such as chatbots specifically designed to support career guidance processes. Respondents also assessed that implementing chatbot-based technology could expand service access, allowing students to receive guidance anytime through various devices, while supporting the guidance and counseling teachers' work efficiency. Similar to previous findings, AI-based counseling chatbots can make guidance services more accessible anytime and anywhere while allowing counselors to focus on more complex relational tasks by automating routine activities (Ristianti et al., 2025).

Recent developments in artificial intelligence and natural language processing have opened new opportunities for educational guidance services. Chatbots, as conversational AI agents, have demonstrated significant potential in providing personalized, accessible, and scalable career counseling services (Dalvi et al., 2024). Unlike traditional assessment methods that often rely on paper-based questionnaires or scheduled face-to-face sessions, chatbot-based systems offer 24/7 availability, immediate feedback, and consistent delivery of guidance services (Lee et al., 2019). In the context of vocational education, where students require timely and specific career information aligned with their technical competencies, chatbot technology presents a particularly promising solution (Dongre et al., 2021).

The integration of employability skills frameworks within chatbot assessment systems represents a novel approach to career readiness evaluation. Employability skills, which encompass communication, teamwork, problem-solving, initiative, planning, self-management, learning ability, and technology use, are crucial predictors of vocational graduates' workplace success (DEST, 2004; Tsaqib et al., 2025). However, systematic assessment of these skills at the individual student level remains challenging for the guidance and counseling teachers managing large student populations with limited resources. Technology-mediated assessment through chatbots can address this gap by providing standardized, objective, and comprehensive evaluation while reducing the administrative burden on counselors.

Despite the growing interest in educational chatbots, limited research has specifically examined their application in assessing career readiness within vocational education contexts, particularly in developing countries like Indonesia. Most existing studies focus on career information provision or course selection guidance (Mhatre et al., 2024); Suresh et al., 2021), rather than comprehensive skills assessment integrated with follow-up counseling services. Furthermore, few studies have investigated the effectiveness of chatbot-based assessment systems specifically designed for the unique needs of vocational high school students who face immediate workforce entry challenges.

This study addresses these gaps by developing and evaluating a web-based chatbot system, named TemanKarir, specifically designed to assess and enhance career readiness among vocational students at SMKN 2 Dompu. The chatbot integrates an employability skills assessment framework with personalized feedback mechanisms, progress tracking for counselors, and follow-up guidance scheduling features. By employing the ADDIE development model and ISO/IEC 25010 quality standards, this research provides a rigorous approach to educational technology development and evaluation.

This study aims to develop, assess the feasibility, and evaluate the effectiveness of a web-based chatbot, TemanKarir, for measuring vocational high school students' career readiness. The study contributes to both theoretical understanding of technology-enhanced career counseling in vocational education and practical solutions for addressing career readiness challenges faced by Indonesian vocational students preparing for *Indonesia Emas 2045*.

Research Method

This study employed a Research and Development (R&D) method following the ADDIE instructional design model, which consists of five sequential phases: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2010). Figure 1 illustrates the complete research flow adapted from the ADDIE model.
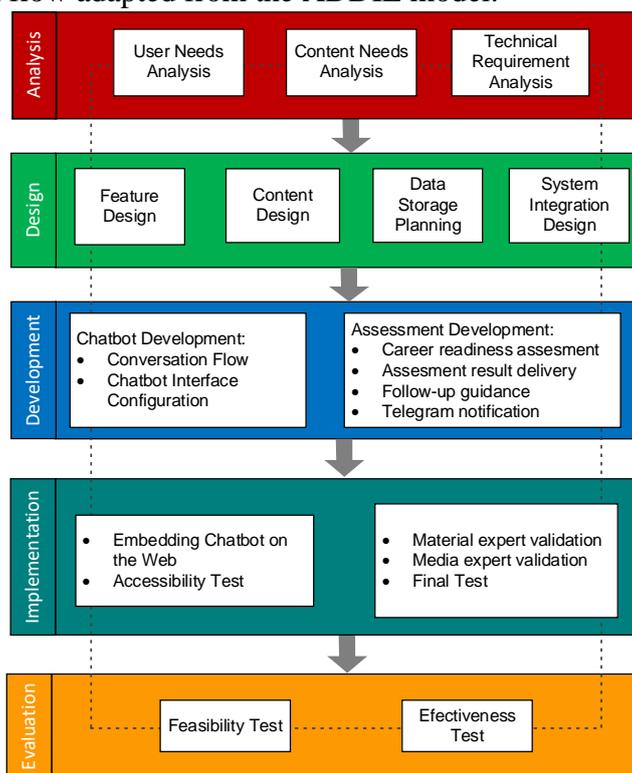

Figure 1. Research Flow Diagram based on ADDIE Model

The Analysis phase involved identifying user needs through interviews and surveys with guidance counselors, determining content requirements based on the Employability Skills Framework (DEST, 2004), and specifying technical requirements. The Design phase focuses on creating conversation flowcharts, workflow specifications, assessment item development, and system architecture planning. The Development phase implemented the chatbot using Botpress platform integrated with Google Sheets, WordPress, QuickChart API,

and Telegram Bot API. The Implementation phase embedded the system into the school website and conducted validation testing. The Evaluation phase assessed both feasibility and effectiveness of the developed chatbot system.

The population of this study was eleventh-grade students at SMKN 2 Dompu, West Nusa Tenggara, Indonesia. In addition to student participants, this study involved expert validators consisting of two material experts and two media experts who evaluated the feasibility of the developed product. The research subjects in the effectiveness test were 50 eleventh-grade students who had used the chatbot. After using the chatbot, students were asked to provide feedback in the form of an assessment of the chatbot's quality.

Instrument Development and Data Collection

The development of research instruments in this study comprised two distinct components. The first instrument was the career readiness assessment scale, which consisted of 75 items developed based on the Employability Skills Framework. The instrument integrated nine dimensions of employability skills, including communication (9 items), teamwork (9 items), problem-solving (7 items), initiative and enterprise (6 items), planning and organizing (5 items), self-management (6 items), learning (6 items), technology use (7 items), and personal attributes (20 items). Content validity of the career readiness scale was evaluated through expert judgment involving material experts to ensure the relevance, clarity, and representativeness of each item with respect to the intended constructs. The results of expert evaluations were analyzed using Aiken's V Index to determine the degree of agreement among experts regarding item validity. Construct validity through factor analysis was not conducted due to the limited sample size and the unfavorable item-to-sample ratio for a 75-item instrument, which may lead to unstable factor solutions. Therefore, construct validation is recommended in future studies with larger samples. Following content validation, empirical item validity was examined using Pearson product–moment correlation (r-table = 0.2787, $\alpha = 0.05$), while the internal consistency reliability of the scale was assessed using Cronbach's alpha, with a minimum acceptable threshold of $\alpha \geq 0.60$.

The second component consisted of multiple evaluation instruments used to validate the TemanKarir chatbot as a developed product. Content validation instruments comprised 22 items adapted from the Dick and Carey instructional design model, assessing six dimensions: alignment with objectives and indicators, content accuracy and currency, appropriateness for student characteristics, motivational value, presentation clarity, and linguistic appropriateness. Media validation instruments consisted of 20 items evaluating three ISO/IEC 25010 product quality characteristics, namely functional suitability, usability, and performance efficiency. In addition, user response instruments consisted of 28 items measuring three ISO/IEC 25010 Quality in Use dimensions: effectiveness, efficiency, and satisfaction. Item validity and reliability analyses were also applied to the evaluation instruments to ensure the consistency of expert and user judgments.

Data Analysis Techniques

Quantitative data analysis employed descriptive statistics and inferential techniques. Feasibility assessment converted Likert ratings to numerical scores (4 = Very Feasible, 3 = Feasible, 2 = Less Feasible, 1 = Not Feasible) and calculated mean scores using the formula:

$$\bar{x} = \frac{\Sigma x}{n}$$

$\bar{x}$ = average score
$\sum x$ = total score
n = number of experts.

Mean scores were classified into feasibility categories using predetermined intervals:

Table 1. Feasibility Classification

Score Intervals	Categories
3.26-4.00	Highly Feasible
2.50-3.25	Feasible
1.75-2.49	Less Feasible
1.00-1.74	Not Feasible

Feasibility score intervals were derived by dividing the score range (3.00) by the number of categories (4), yielding an interval width of 0.75. Content validity analysis utilized Aiken's V index, calculated as:

$$V = \frac{\Sigma(s - lo)}{n(c - 1)}$$

V = validity index
s = expert ratings
lo = the lowest scale value
n = number of experts
c = number of rating categories

Items achieving $V \geq 0.70$ were retained as valid. Construct validity employed Pearson Correlation Coefficients, with items demonstrating r-calculated > r-table (0.2787) considered valid. Reliability analysis used Cronbach's alpha, with $\alpha \geq 0.60$ indicating acceptable internal consistency. Effectiveness assessment analyzed user response data using SPSS 27 software. Descriptive statistics including mean, standard deviation, minimum, and maximum values were computed for each Quality in Use dimension. Effectiveness criteria were established through equal interval classification:

Table 2. Effectiveness Classification

Score Intervals	Categories
3.26 – 4.00	Highly Effective
2.51 – 3.25	Effective
1.76 – 2.50	Less Effective
1.00 – 1.75	Ineffective

In this study, feasibility evaluation was conducted during the development stage through expert validation, while effectiveness evaluation based on ISO/IEC 25010 quality in use was carried out during the implementation stage through user responses. Qualitative data from expert comments, student feedback, and observational notes were analyzed thematically to identify patterns in usability issues, content appropriateness, and technical functionality. These insights complemented quantitative findings and informed iterative system refinements during development phases.

Results and Discussion

The development process successfully produced a web-based chatbot system called TemanKarir which was designed to assess the career readiness of vocational high school students as shown in Figure 1. The system architecture integrated multiple platforms to create a comprehensive assessment and guidance ecosystem. The integration between Botpress, Google Sheets, WordPress, QuickChart API, and Telegram Bot API is shown in Figure 2.
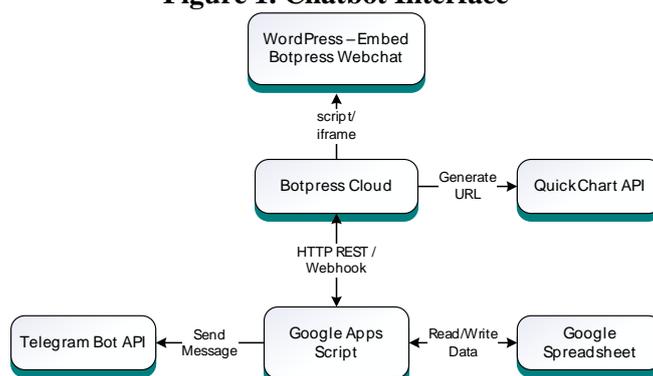
Figure 1. Chatbot Interface

Figure 2. System Architecture Diagram

The chatbot encompasses four primary functional modules: (1) career readiness assessment module covering eight employability skills dimensions plus personal attributes with 75 structured items; (2) automated feedback generation providing personalized development recommendations; (3) counselor dashboard for monitoring student progress through Google Sheets integration; and (4) follow-up scheduling with automated notification system. The workflow interface showing the conversation flow design in the Botpress platform can be seen in Figure 3.
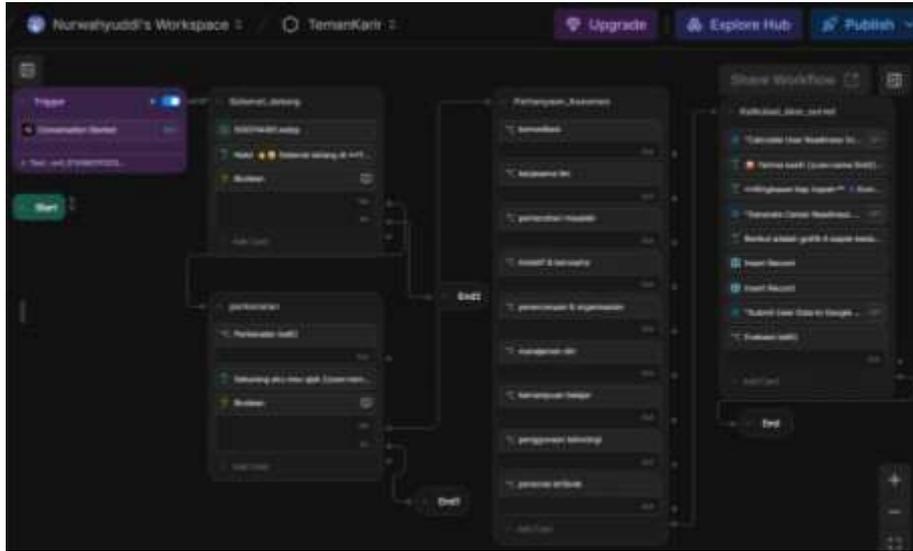
Figure 3: Botpress Workflow Interface

After going through the development phase, the chatbot was embedded on the website and tested for accessibility. Next, the chatbot was evaluated by material experts and media experts. The material experts assessed content validity to ensure that each item in the TemanKarir chatbot's assessment instrument accurately aligns with the aspects of career readiness being measured. The content validation results are shown in Table 3.

Table 3. Summary of Content Validity Test Results

Aiken's V Score Range	Number of Items	Percentage
1,00	28	37,33%
0,875	29	38,67%
0,75	18	24,00%
< 0,75	0	0%
Total	**75**	**100%**

The assessment results demonstrated strong content validity, with all 75 items achieving Aiken's V indices ranging from 0,75 to 1,00, substantially exceeding the minimum threshold of 0,70. These scores indicate high inter-rater agreement among content experts regarding item relevance and representativeness of employability skills constructs. The concentration of items with V = 1,00 (37,33%) and V = 0,875 (38,67%) suggests that most assessment questions accurately operationalize the theoretical framework. This robust content validity is critical because it ensures that the chatbot measures authentic career readiness competencies rather than tangential or irrelevant attributes, thereby providing actionable information for counselors and students (Almanasreh et al., 2019).

Item validity testing using Pearson product-moment correlation revealed that all 75 assessment items achieved correlation coefficients exceeding the critical value ($r > 0,2787$, $p < 0,05$), with coefficients ranging from 0,339 to 0,813. This indicates that each item correlates significantly with the total score, confirming that individual items measure aspects consistent with the overall career readiness assessment. The reliability analysis yielded a Cronbach's alpha of 0,985 for the career readiness instrument, substantially exceeding the conventional threshold for acceptable reliability ($\alpha > 0,70$). This high reliability coefficient suggests strong internal consistency and minimal measurement error in the assessment items.

Feasibility Assessments

The feasibility evaluation synthesized validation data from multiple perspectives. The results of the chatbot feasibility assessment by material experts are shown in Table 4 below.

Table 4. Material Expert Validation Results

Aspect Assessed	Score	Qualification
Alignment between material objectives and indicators	3,50	Highly Feasible
Accuracy and currency of content	3,62	Highly Feasible
Learner characteristics and needs	3,25	Feasible
Motivational value and attractiveness of the material	4,00	Highly Feasible
Clarity and organization of content presentation	3,50	Highly Feasible
Language quality and style of delivery	3,50	Highly Feasible
Alignment with social values and norms	4,00	Highly Feasible
Total	**3,62**	**Highly Feasible**

Material experts rated the chatbot content with a mean score of 3,62, categorizing it as highly feasible. The assessment covered seven key aspects adapted from the Dick and Carey instructional design model. The highest ratings were achieved for motivational value and attractiveness of material (4,00) and alignment with social values and norms (4,00), indicating that the content successfully engaged students while maintaining appropriate cultural and ethical standards. Strong scores were also observed for accuracy and currency of content (3,62), clarity and organization of content presentation (3,50), and language quality and style of delivery (3,50). The alignment between material objectives and indicators received a score of 3,50, demonstrating appropriate mapping of employability skills constructs to assessment items. The aspect of learner characteristics and needs scored at 3,25, suggesting minor adjustments were needed to better match the content with eleventh grade vocational students' developmental levels and technical competencies. Taken together, these results confirm that the employability skills framework was successfully contextualized for Indonesian SMK students, aligning with previous findings that emphasize the importance of culturally responsive content and learner-oriented design in vocational education product development (Areisy & Sudira, 2022). Such alignment reinforces the conclusion that the chatbot's assessment materials are appropriate, accurate, and pedagogically robust for supporting career readiness interventions. The results of the media expert validation are presented in Table 5.

Table 5. Media Expert Validation Results

Aspect Assessed	Score	Qualification
Functional Suitability	3,50	Highly Feasible
Usability	3,56	Highly Feasible
Performance Efficiency	3,50	Highly Feasible
Total	**3,52**	**Highly Feasible**

Media experts evaluated the system with a mean score of 3,52, categorizing it as highly feasible. The assessment covered three ISO/IEC 25010 product quality characteristics. Usability received the highest rating (3,56), indicating effective interface design and ease of interaction. Functional suitability and performance efficiency both scored 3,50, demonstrating that the chatbot adequately fulfilled its intended assessment functions while maintaining responsive system performance. These results indicate that the chatbot meets the ISO/IEC 25010 criteria for product quality and is technically ready for broader implementation in school settings with varying levels of technological readiness. This finding

is particularly important because the success of any media-based product largely relies on how clearly it delivers information and how effectively it supports user interaction (Abdulrahaman et al., 2020). Based on the results from the two validation sources above, the overall feasibility score can be calculated as shown in Table 7.

Table 7. Feasibility Assessment Results

Validation Source	Feasibility Score	Qualification
Material Expert	3.62	Highly Feasible
Media Expert	3.52	Highly Feasible
Overall Feasibility	**3,57**	**Highly Feasible**

The feasibility assessment results show that the TemanKarir chatbot achieved consistently high ratings across all validation sources. The material expert provided the highest score of 3,62, indicating strong alignment between the material and the employability skills framework. The media expert evaluation yielded a score of 3,52, reflecting that the technical design, interface, and functionality met the expected standards of usability and instructional media quality. With an overall feasibility score of 3,57, these findings confirm that the TemanKarir chatbot is classified as highly feasible and is suitable for implementation in vocational career guidance services.

Effectiveness of the Chatbot in Assessing Career Readiness

Prior to examining the chatbot's effectiveness, the measurement instruments were tested for item validity and reliability. The results showed that all 28 items in the user response instrument showed item–total correlations exceeding the critical value ($r > 0.2787$, $\alpha = 0.05$), indicating that each statement was valid for measuring students' responses to the TemanKarir chatbot. Reliability analysis further demonstrated strong internal consistency, with Cronbach's alpha reaching 0.955 for the 28-item scale (N = 50), well above the minimum acceptable threshold ($\alpha \geq 0.60$).

After establishing the validity and reliability of the instrument responses, the chatbot's effectiveness evaluation using the ISO/IEC 25010 Quality in Use standard was conducted by examining three dimensions: effectiveness, efficiency, and satisfaction. The results of the effectiveness assessment are presented in Table 7.

Table 8. Effectiveness Assessment Results Based on ISO/IEC 25010 Quality in Use

Dimension	N	Mean	SD	Min	Max	Category
Effectiveness	50	3.57	0.55	1.20	4.00	Highly Effective
Efficiency	50	3.58	0.48	2.17	4.00	Highly Effective
Satisfaction	50	3.56	0.45	2.29	4.00	Highly Effective

The effectiveness evaluation based on ISO/IEC 25010 quality in use standards demonstrates that the TemanKarir chatbot performed at a high level across all measured dimensions. All dimensions achieved mean scores above 3.50, placing them within the highly effective category. These findings indicate that the chatbot effectively supported students' engagement with employability skills assessment, operated efficiently with minimal user effort, and generated positive user satisfaction. Overall, the results confirm that the chatbot meets ISO/IEC 25010 quality in use criteria and is well accepted by vocational students.

The findings of this study offer important theoretical contributions to the integration of conversational AI within career readiness assessment. By embedding the Employability Skills Framework into a chatbot workflow, the study demonstrates that complex constructions related to career readiness can be operationalized through automated dialogue without compromising theoretical integrity. This reinforces earlier arguments that AI-driven

conversational agents can function as valid mediators of learning, self-reflection, and diagnostic assessment in educational settings. Furthermore, the application of ISO/IEC 25010 quality-in-use standards provides a methodological model for evaluating educational chatbots using structured software quality criteria, extending the theoretical discourse on how human–computer interaction frameworks can intersect with career development theory in vocational education contexts. Through this alignment, the study shows that career guidance theories traditionally applied in human-mediated contexts can be meaningfully adapted into digital platforms.

Practically, the TemanKarir chatbot provides a scalable and feasible solution for vocational schools seeking to strengthen career readiness interventions with limited human and infrastructural resources. The system's strong feasibility and effectiveness ratings across content experts, media experts, and student users highlight its potential to support counselors by automating assessments, generating immediate feedback, and simplifying data management processes. Such automation reduces the administrative burden on the guidance and counseling teachers and expands student access to career guidance services beyond scheduled counseling sessions. The chatbot's integration with Google Sheets, Telegram notifications, and web-based embedding demonstrates that technology-supported guidance can be implemented even in schools with modest technological capacity. These practical outcomes align with growing evidence that AI-based tools can enhance the efficiency and reach of counseling services, supporting efforts to better prepare vocational students for workforce demands and national development goals such as *Indonesia Emas 2045*.

Conclusion

This study developed and evaluated the TemanKarir chatbot as an assessment tool designed to measure the career readiness of vocational high school students. Guided by the ADDIE development model and evaluated using ISO/IEC 25010 quality standards, the chatbot demonstrated strong feasibility based on expert validation and was perceived as effective, efficient, and satisfying by student users. These outcomes indicate that a chatbot-based system can successfully integrate the Employability Skills Framework into a scalable, user-friendly assessment platform suitable for vocational education contexts. Beyond its technical and pedagogical strengths, the system also offers practical value by supporting counselors in monitoring student development and streamlining follow-up guidance processes.

The findings of this research contribute both to theoretical discussions on AI-driven educational guidance and to practical innovations addressing challenges faced by Indonesian vocational schools. As Indonesia prepares its young workforce for *Indonesia Emas 2045*, tools such as TemanKarir provide a promising avenue for strengthening students' employability competencies and supporting more systematic career development services.

Recommendation

Based on the findings of this study, the integration of the TemanKarir chatbot into career readiness services is recommended for guidance and counseling teachers to enhance efficiency, personalization, and systematic monitoring of students' progress. Students are encouraged to use the chatbot independently to continuously evaluate and develop their employability skills, fostering better preparedness for employment or further education. Parents are advised to utilize the assessment outcomes to gain insight into their children's career readiness and support meaningful discussions on skill development and future career

planning. For future research, further investigation is suggested to examine the long-term effectiveness, scalability, and integration of AI-based career guidance tools within vocational education contexts.

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