Senostik: Diagnostic Insights for Smarter Education

[1]Susyam Widiantho, *[2]Zaamah Mohd Nor, [3]Sumasno Hadi, [4]Widiya Aris Radiani, [5]Nor Fadzleen Sa'don

[1]Universitas Negeri Samarang, Indonesia,

[2] Universiti Teknologi MARA, Malaysia,

[3]Universitas Lambung Mangkurat, Indonesia,

[4] UIN Antasari Banjarmasin, Indonesia

[5]English Language Teaching Centre, Ministry of Education Malaysia

***Corresponding Author**

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ABSTRACT

Senostik is an Android-based diagnostic application developed to support an evidence-driven, student-centred approach in Indonesian schools. Despite the Merdeka Curriculum highlighting diagnostic assessment as a foundation for teaching and learning, many schools still struggle to implement it due to teachers' limited understanding, time constraints, and lack of accessible tools. This gap has created a pressing need for a scalable and validated digital platform that simplifies the diagnostic process while ensuring data accuracy. Using a Research and Development (R&D) approach grounded in educational diagnostic and data-driven decision-making frameworks, Senostik integrates cognitive and non-cognitive dimensions to measure students' readiness and learning characteristics. The validity and reliability of its instruments were established through Exploratory Factor Analysis (EFA) and Cronbach's Alpha. Field trials conducted across more than 1,000 schools confirmed its usability, affordability, and scalability. Findings show that Senostik provides teachers and counsellors with clear, actionable diagnostic reports that enhance lesson planning and counselling decisions. In doing so, it bridges the gap between educational psychology and digital technology, advancing Indonesia's digital education agenda and setting a model for evidence-based assessment in the region.

Keywords: diagnostic, application, cognitive, non-cognitive, digital education

INTRODUCTION

Education is the cornerstone of the successful implementation of Indonesia's vision, Indonesia Emas 2045, which involves developing superior human resources through fair and quality education (Purnawanto, 2022). This vision aligns with the mission of producing Pancasila Siswa, students who are critical and creative thinkers, independent and collaborative, and global-minded. Within the Merdeka Curriculum, diagnostic assessment is highlighted as the foundation for planning curriculum, teaching, and guidance services (Kemendikbud, 2020). Bimbingan & Kaunseling (BK) or guidance and counselling teachers play a strategic role in mapping the strengths, weaknesses, and socio-emotional conditions of students to provide differentiated learning that is timely and appropriate for each learner in school (Nuraini et al., 2022).

Diagnostic assessment is an important stage in preparing differentiated learning under the Merdeka Curriculum. It determines students' characteristics, initial competencies, strengths, and weaknesses in learning strategies. Accurate education plans are possible when teachers ensure that teaching materials are matched with students' abilities (Maryani et al., 2023).

Diagnostic assessments help students organise themselves into groups based on their abilities, interests, and learning styles. This means that different content learning strategies can be adopted for diverse groups of students, yielding significant learning effects (Susanti, 2025).

Responding to these educational shifts, Senostik was developed as a digital innovation to operationalise diagnostic assessment through technology. The application bridges policy aspirations with classroom realities, providing a validated and user-friendly tool that enables teachers to collect accurate, real-time data for evidence-based instructional planning.

Problem Statement

The insufficient inclusion of diagnostic assessment in schools has been one of the hurdles to educational advancement. Many schools in Indonesia are having difficulty with diagnostic assessments that are aligned with the Merdeka Curriculum. Conventional approaches, such as paper-based testing, manual scoring, and expensive external psychometric services, are inefficient, error-prone, and often inaccessible for large groups of students (Nuraini et al., 2022; Wahyuningsih, 2022).

A survey found that only 45.45% of teachers had ever conducted diagnostic assessments. The percentage of teachers who did not understand the process at all was 40.91%, while 77.27% claimed they had never received any guidance and/or training for diagnostic assessments (Sanjaya et al., 2023). This is supported by Anggrayni et al. (2023), who related the lack of implementation of diagnostic assessments in schools to teachers' lack of understanding and training about them. Although the policy has been issued, diagnostic assessment processes should constantly be revised. In particular, this involves raising teachers' overall level of understanding and teaching them about how diagnostic assessments can help students' learning (Rakhmi et al., 2023).

It is challenging for teachers to allocate time to design and implement comprehensive assessments due to heavy teaching loads; approximately 70.83% of teachers experience time constraints in conducting diagnostic assessments (Yusyfia et al., 2025). Teachers also feel trapped in teaching methods that are not in line with the Merdeka Curriculum diagnostic assessment because they do not receive training, socialisation, and support from the government and educational institutions (Nur Fadhilah et al., 2023).

An investigation based on questionnaires and governmental reports indicates that the difficulties in implementing diagnostic assessments under the Merdeka Curriculum are mainly related to the lack of understanding, training opportunities, time and facilities. Compared with the past, teachers have placed much more emphasis on the diagnosis of learning problems. To ensure the success of diagnostic assessments and their positive impact on learning, teachers' ability and support materials must be improved (Oryandarini & Munir, 2024).

Without systematic data on whether learners are ready to learn, what their interests are, or how they are faring as individuals, instructions are likely to disregard individual needs. A scalable innovation, optimising validated instruments and easy technology, is necessary to enable schools to plan and deliver guided or evidence-based teaching. Senostik was thus developed in response to this void, providing a user-friendly and evidence-based diagnostic tool, suitable and accessible to a wider educational audience.

Objectives

The main objectives of Senostik include:

1. To make the diagnostic assessment easier and digital-based for teachers and schools.
2. To obtain accurate and reliable information concerning cognitive (verbal, numerical, spatial abilities) and non-cognitive (learning styles, psychological and social conditions, family support, study habits, learning interest) characteristics of students.
3. To create a more personalised lesson planning and evidence-based interventions.

4. To facilitate the coordination between teachers, counsellors, and parents by offering practical advice using diagnostic results.

PRODUCT DESCRIPTION & METHODOLOGY

Senostik is an Android application built using open-source technologies: Flutter 3.0, PHP for the user interface, MySQL for database management, Firebase, Laravel 9.0, and FPDF for creating PDF reports available for download (Nuraini et al., 2022). It even performs well on some older Androids. The step-by-step guides for using the app are shown in Figure 1 (Senostik Usage Flowchart).

The application combines three fundamental assessment types:

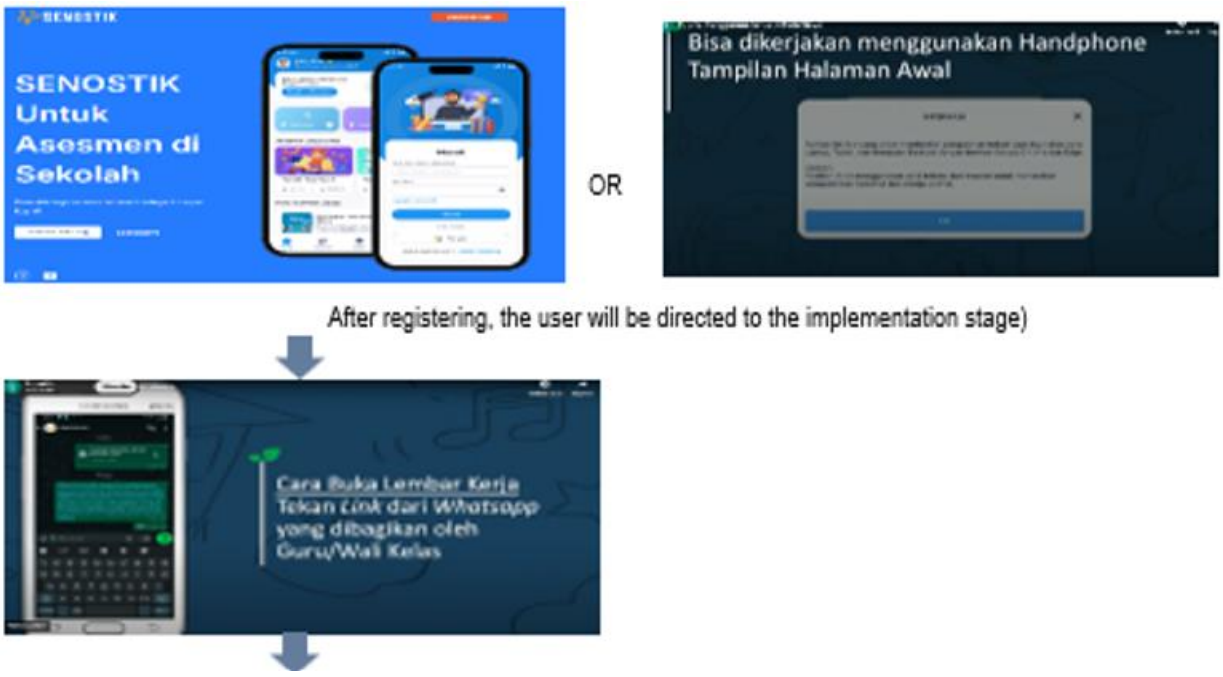
1. Preliminary Assessment, in which the readiness before instruction is identified.
2. Process Assessment, for tracking progress and offering formative feedback during learning.
3. Interest and Academic/Career Exploration, to help learners choose appropriate subjects, pathways, and career paths.

The tests were mediated by psychologists to maintain the validity and reliability of the results. Cognitive questions were adapted from the Intelligence Structure Test (Winarti, 1998), while non-cognitive ones were developed by psychologists to reflect socio-emotional well-being in the Merdeka Curriculum.

The methodology is grounded in Educational Diagnostic Theory and Data-Driven Decision-Making (DDDM) frameworks, which posit that effective teaching stems from systematic identification of learner characteristics and the application of empirical data to guide instruction (Bejar, 1982; Davis, 2024; Shamsuddin & Razak, 2023). These theoretical foundations justify the use of diagnostic instruments and iterative validation processes, reinforcing the educational value of Senostik.

Using a Research and Development (R&D) process, construct validity was tested by Exploratory Factor Analysis (EFA), and reliability was ensured by Cronbach's Alpha, indicating satisfactory psychometric quality. The trials involved junior and senior secondary schools to ascertain suitability for a wide range of student samples. The app generates reports both on the student and group level (including suggestions for teachers and counsellors to offer focused assistance to students).

Figure 1. Senostik Usage Flowchart



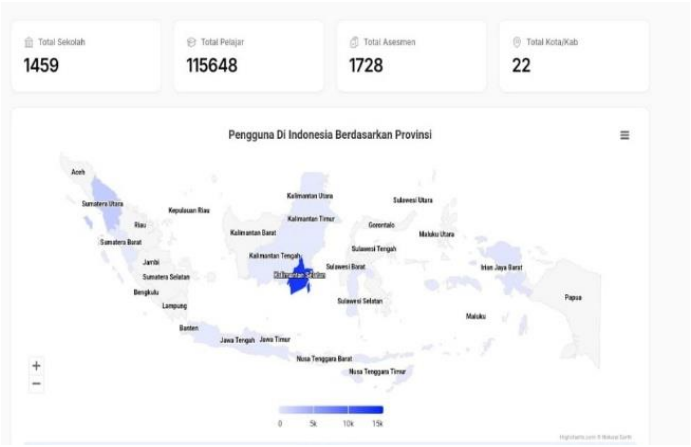
To measure students' competencies comprehensively and avoid excessive fatigue, this assessment is designed with a proportional number of questions and adjusted to the level of difficulty and assessment objectives. At the beginning of the assessment, information about the number of questions and the estimated time required is provided, allowing students to strategise and prepare for the test. Thus, prior to implementation, users of the assessment can assess the level of assessment load.

All students' personal data collected during the assessment is stored in encrypted form and can only be accessed by authorised parties to ensure data security and privacy. Without written consent from the school or student guardian, data may not be shared with third parties. To prevent data misuse, participants' identities will be anonymised during the assessment results analysis process. This mechanism is designed to keep all student data secure in accordance with applicable data protection principles.

POTENTIAL FINDINGS AND COMMERCIALISATION

Field trials demonstrated that Senostik simplifies assessment procedures and provides clear, actionable reports (Nuraini et al., 2022). Validation studies confirmed Senostik's capability to produce valid and reliable diagnostic data in accordance with the education standards for assessment. Its affordability and compatibility with older devices allow adoption by resource-limited schools. Its pedagogical potential is its low cost and flexibility to be integrated into various school environments, fitting with Indonesia's digital education agenda.

Figure 2. Senostik's Expansion Across Indonesia



Currently, Senostik has been adopted by 1,459 schools across 22 provinces in Indonesia, serving a total of 115,648 students. The platform has facilitated 1,728 diagnostic assessments, with the highest concentration of users in South Kalimantan, followed by Central Kalimantan, East Kalimantan, and other regions across the archipelago (Senostik's Database, September 2025), demonstrating its scale and practical acceptance.

The development and utilisation of Senostik in other Southeast Asian countries grappling with the same issues in diagnostic testing and learner profiling can also be explored. Its inclusion of both individual, group, and school-wide representations of data allows for a level of policy decision-making that is unparalleled.

Senostik is designed to function as an innovative digital education product and diagnostic assessment tool. With a Software as a Service (SaaS) business model, schools, educational institutions, and local governments can subscribe to Senostik services on a regular basis. Feature updates, automatic data analysis, and ongoing technical support are made possible by this scheme to maintain service quality and ensure revenue sustainability.

To increase its reach, Senostik can work strategically with the government, particularly in programmes to improve the quality of education and early detection of learning difficulties. This collaboration may include integration into the national curriculum or assessment, national licensing, and joint funding for the development of features tailored to regional needs. In addition, to support the dissemination and training of Senostik use in various educational institutions, collaborations will be developed with private parties such as educational technology (edtech) companies and teacher training institutions.

NOVELTY

Unveiled for the first time in Banjarmasin, Indonesia, the novelty of Senostik is rooted in its pioneer combination of expert-validated psychological measures and user-friendly digital technology. In contrast to traditional paper-based tests or tests that must be conducted by an on-site psychologist, the Senostik automated process issues a digital report, either for one individual or in summary for a group. These reports offer pragmatic guidelines for teachers and counsellors that can be easily incorporated into classroom instructions.

CONCLUSION

Senostik achieves its objectives of simplifying diagnostic assessment, producing accurate and reliable data on students' cognitive and non-cognitive characteristics, and supporting evidence-based teaching and counselling. Validation through Exploratory Factor Analysis (EFA) and Cronbach's Alpha confirms the tool's psychometric soundness, while field implementation across Indonesia demonstrates its usability, affordability, and scalability.

The application's integration of psychological assessment principles with digital technology positions it as an innovative and practical solution to challenges faced under the Merdeka Curriculum. By providing teachers and counsellors with timely, data-driven insights, Senostik contributes to the realisation of Profil Pelajar Pancasila and advances Indonesia's digital education agenda.

RECOMMENDATION

Future efforts should focus on strengthening national partnerships, expanding the item banks, and integrating analytics for broader school and policy-level planning.

Senostik can expand to other Southeast Asian countries, such as Malaysia, Thailand, and the Philippines, which face similar problems in mapping student learning difficulties. It can be promoted as a regional product that assists in data-driven educational decision-making by adapting to local rules, languages, and cultures. This expansion will not only increase market share, but also increase Senostik's social impact in improving education in Southeast Asia.

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