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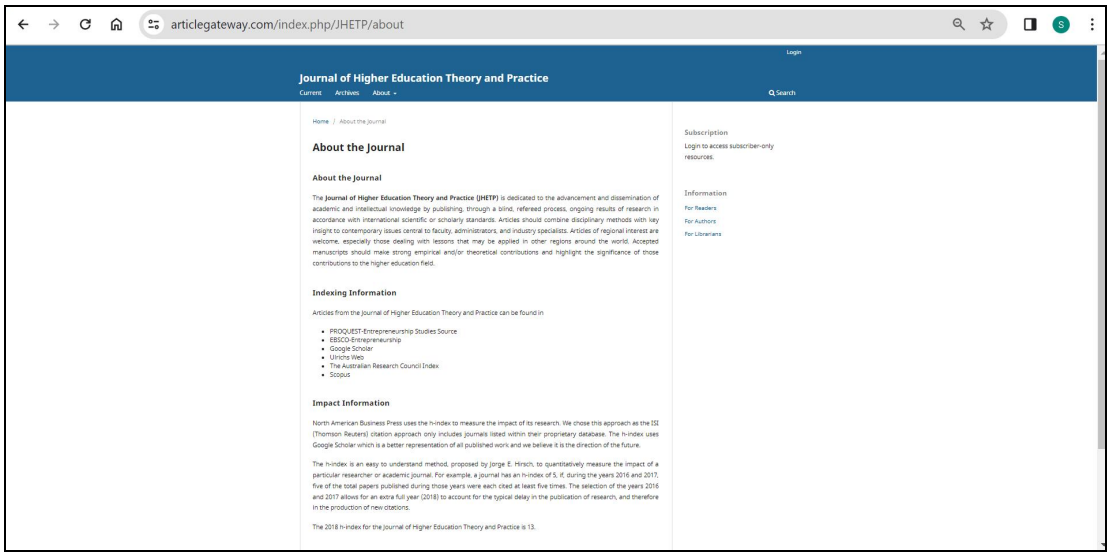

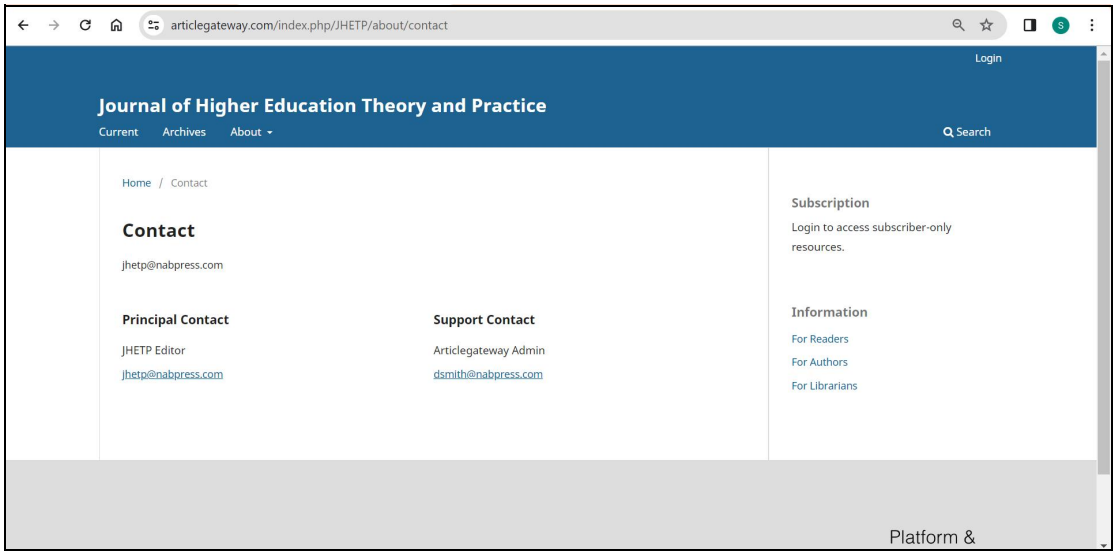

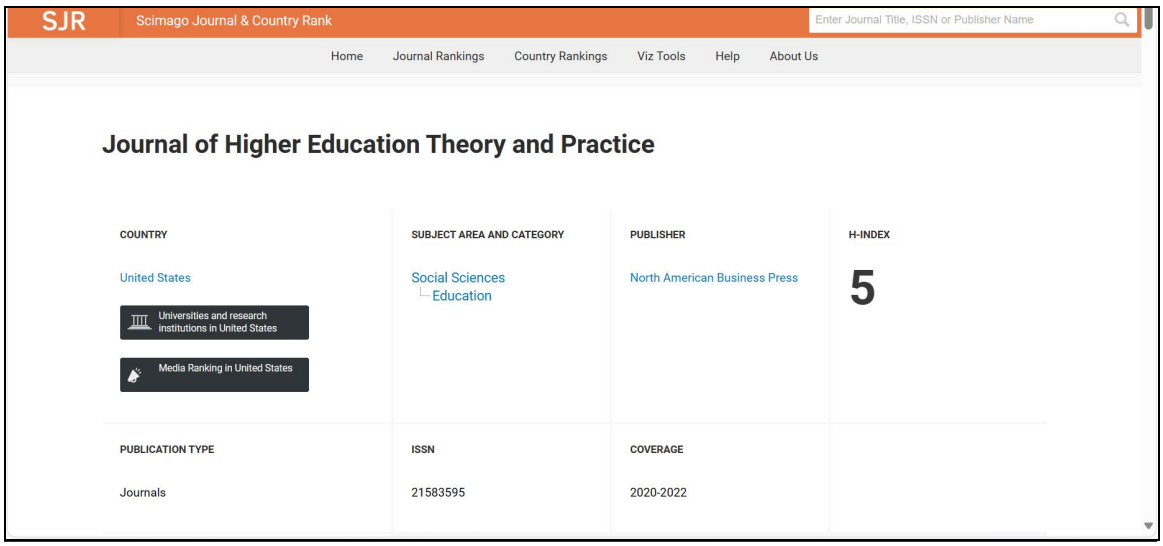
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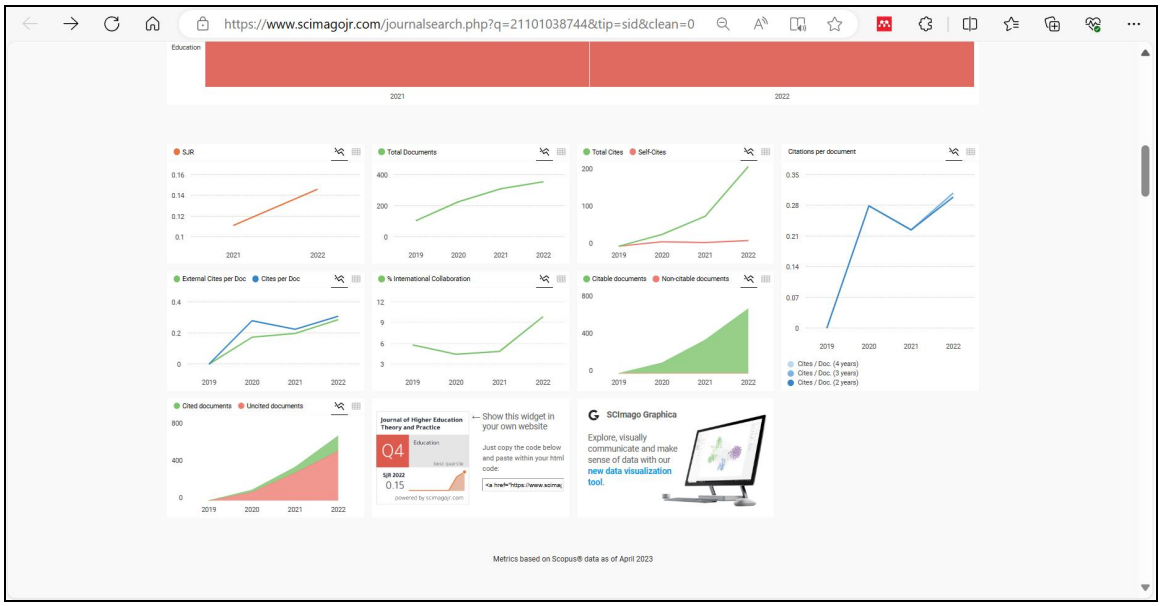
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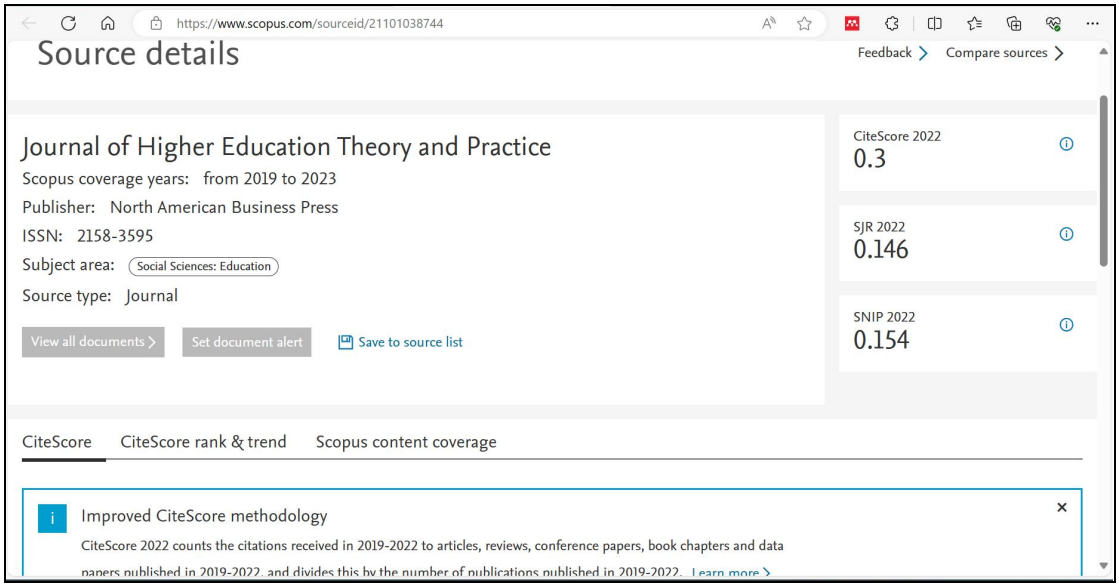
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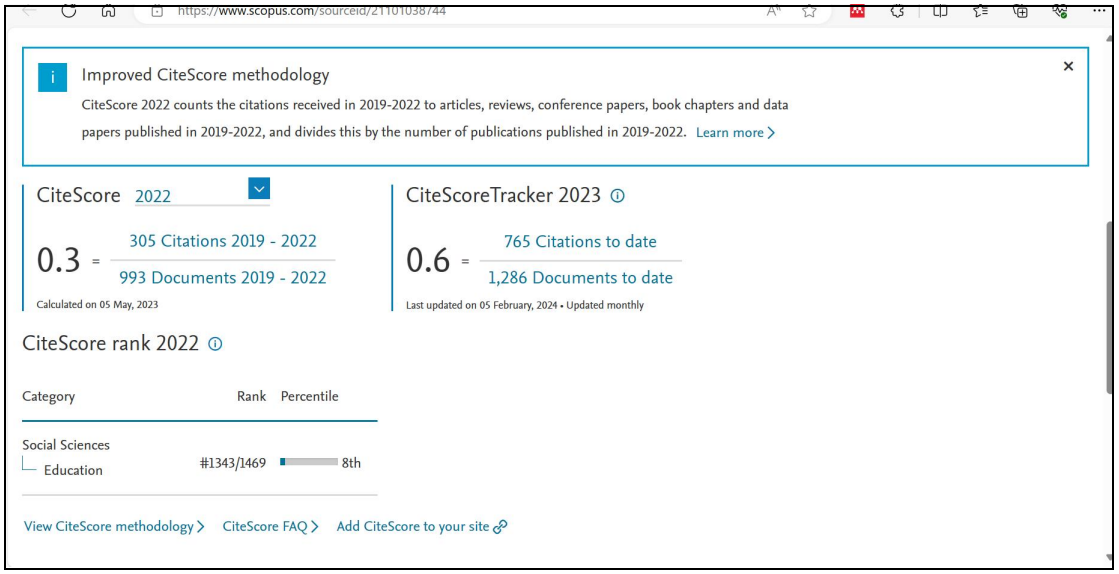
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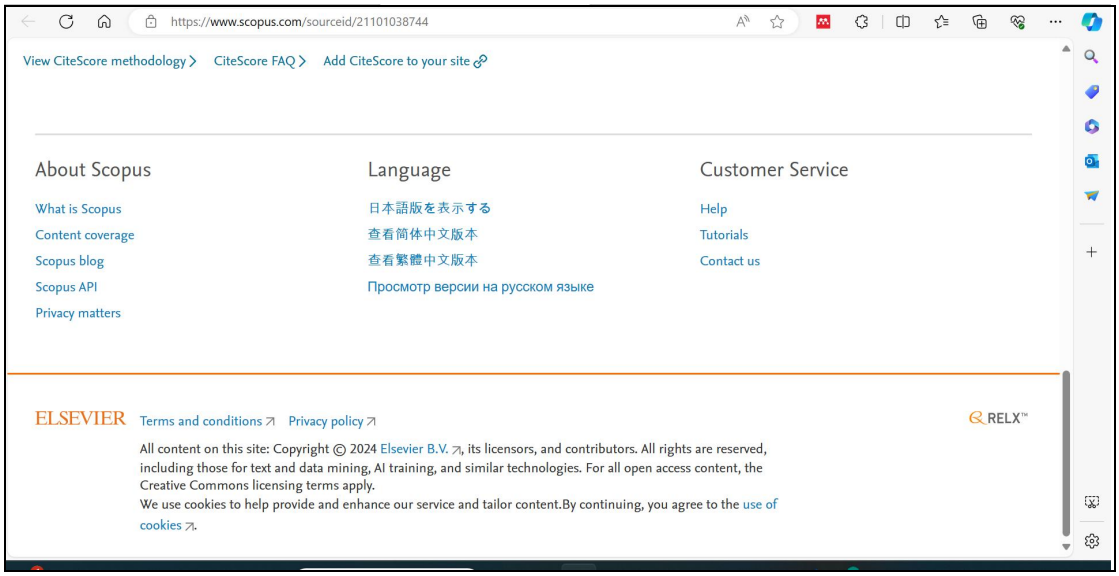
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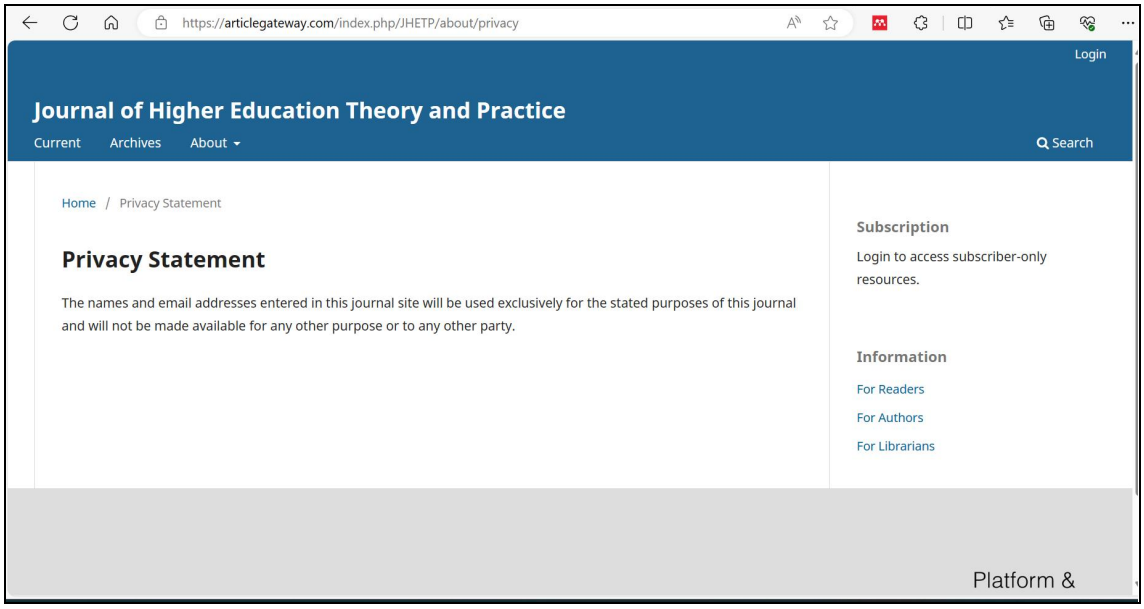
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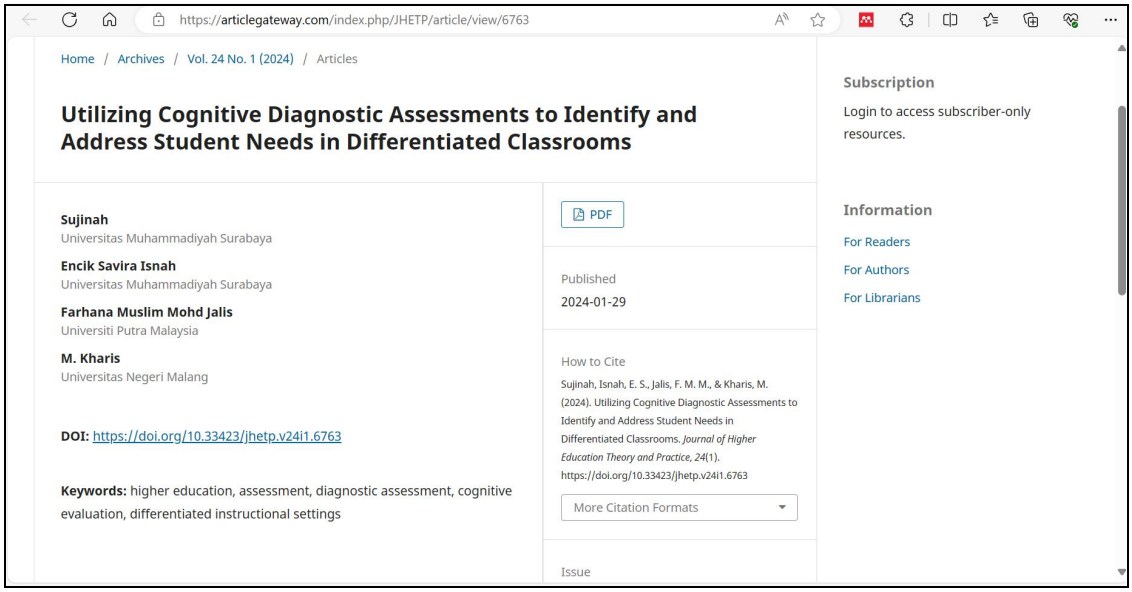
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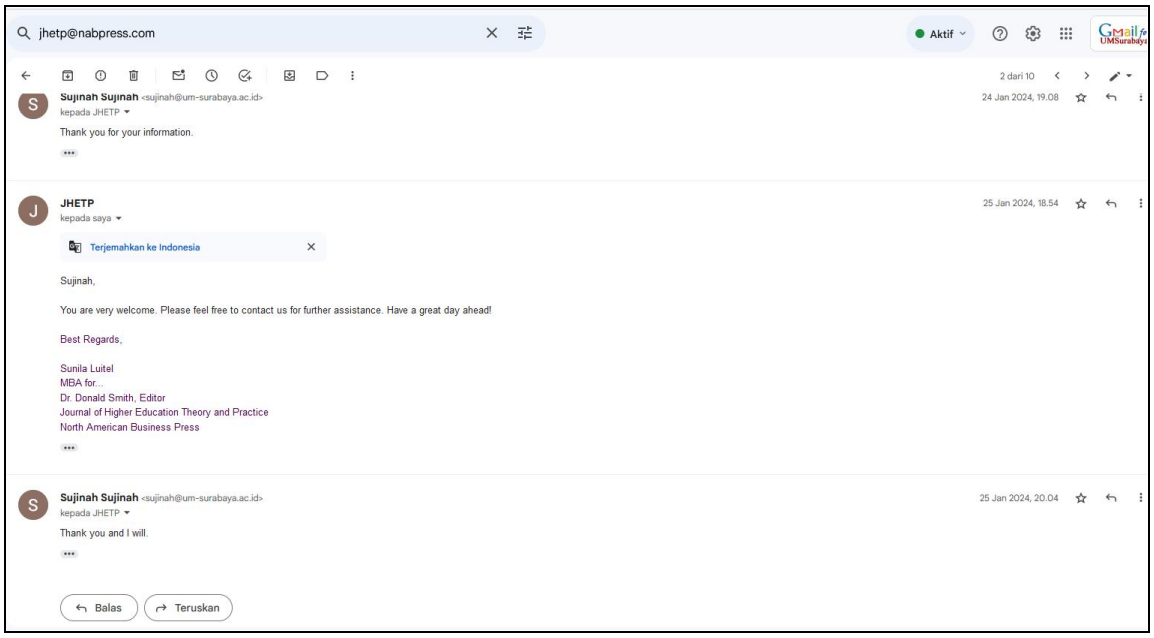
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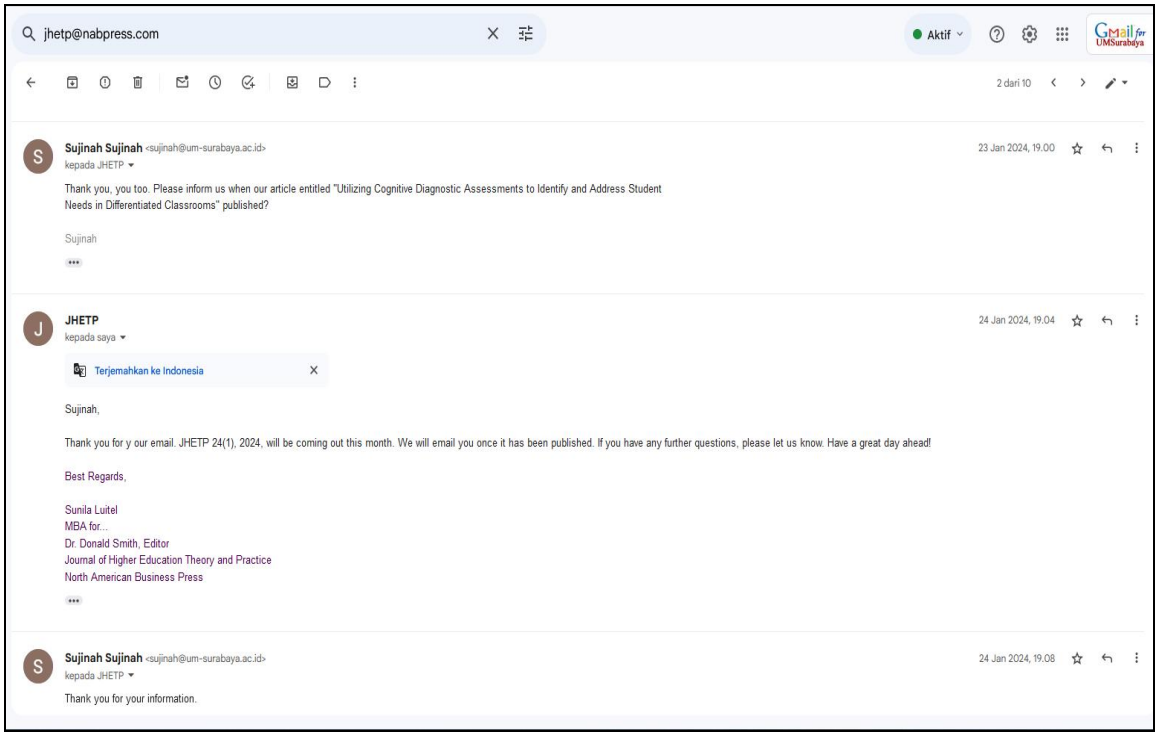
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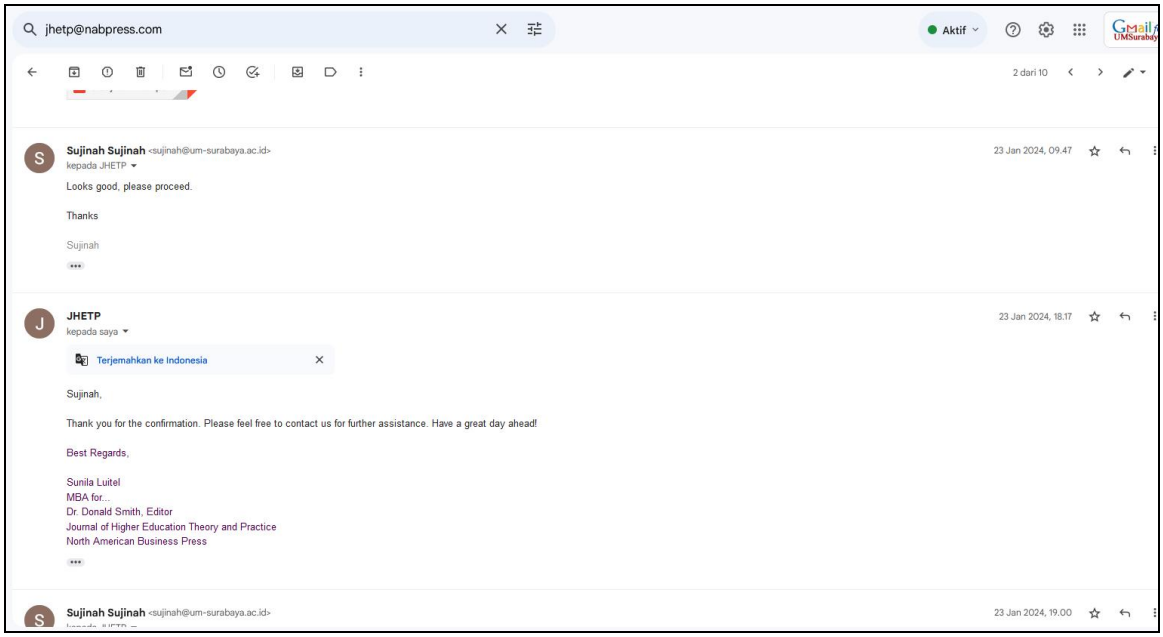
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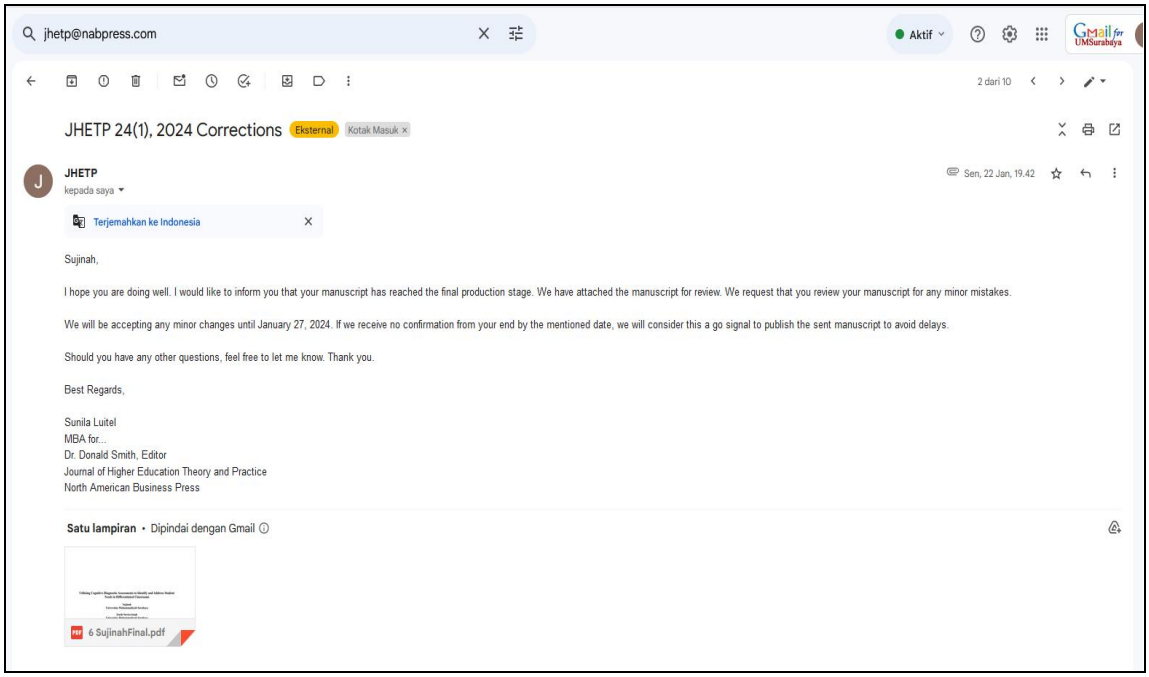
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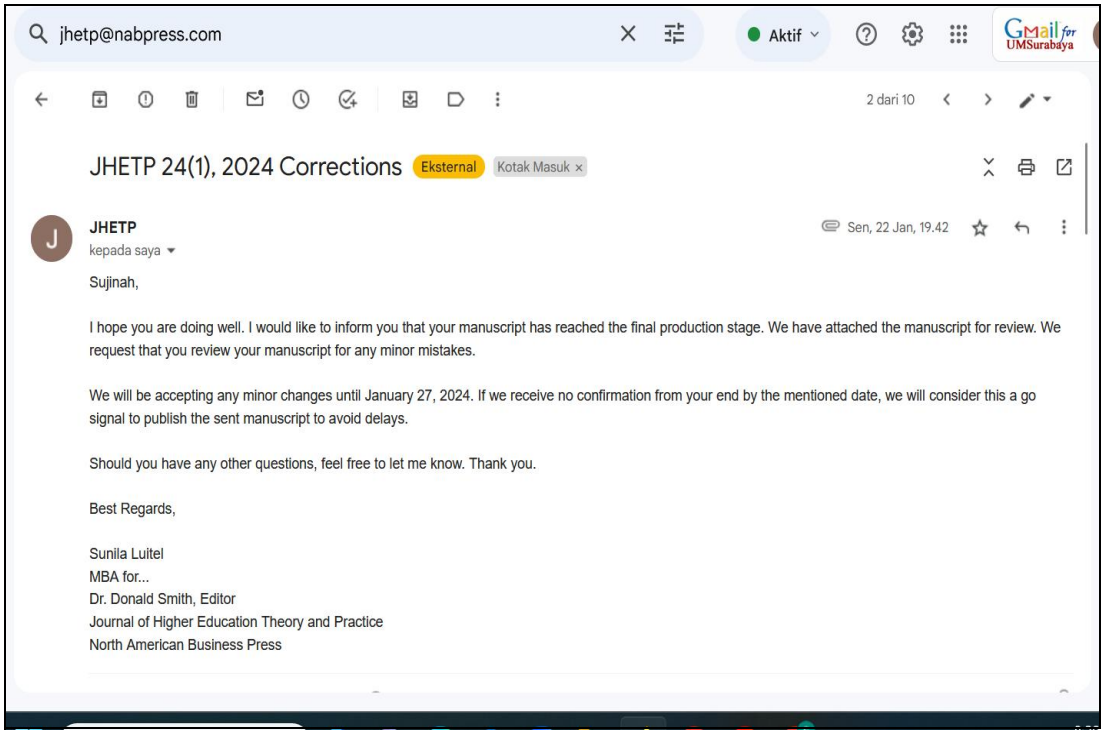

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Utilizing Cognitive Diagnostic Assessments to Identify and Address Student Needs in Differentiated Classrooms

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Diagnostic assessment serves as a tool employed to assess students' mastery levels, measuring both their progress and the effectiveness of the educational program. This study aims to delineate the preliminary diagnostic assessment conducted across five educational institutions. 139 students from five different educational institutions participated in data collection, who were tested using five distinct genres: procedure text, fantasy fairy tale text, description text, folk poetry text, and explanation text. Each class accommodates students exhibiting diverse levels of proficiency: high, moderate, and low. Data were gathered through standardized testing and subjected to quantitative descriptive analysis. The data show that the cognitive diagnostic evaluation within each classroom conforms to a normal distribution. Data analyses indicate that a profound understanding of students' initial potential forms the cornerstone for tailoring pertinent pedagogical materials and strategies, thereby facilitating the creation of differentiated instructional settings. Through the implementation of diagnostic assessments, educators will be adept at identifying potential scholastic challenges among students at an early stage and consequently institute proactive measures to address them effectively.

Keywords: assessment, diagnostic assessment, cognitive evaluation, differentiated instructional settings

INTRODUCTION

In general, every classroom consists of students with a high level of diversity, including various cultural backgrounds, diverse mental processes, and a range of academic and non-academic qualities. Many teachers develop a number of learning alternatives to meet students' various degrees of preparedness, interest, and learning preferences. While this strategy may appear appealing since it streamlines teacher thought, administrator feedback, and professional development design, it is ultimately useless and perhaps

dangerous (C. Tomlinson & Imbeau, 2013). Numerous other studies have illuminated the connections among these variables, research involving multiple educational institutions in this realm is still uncommon.

In fact, educators often formulate their learning objectives without taking into account students' initial abilities. This constitutes a weakness in the education system, as educators frequently neglect to consider students' prior knowledge. Instead, they focus solely on delivering the curriculum with the aim of achieving the desired competence. Consequently, numerous students encounter challenges due to the lack of requisite foundational skills (Suryadi & Husna, 2022). Students exhibit heterogeneity in their abilities owing to variations in IQ, learning styles, interests, and socioeconomic backgrounds. This diversity gives rise to a broad spectrum of competences, with some students demonstrating proficiency while others face challenges. Consequently, catering to this divergence necessitates the careful arrangement of instructional materials. Intelligence significantly shapes these abilities, thereby indicating that a greater range of intelligence inevitably yields a correspondingly wider array of aptitudes (Sousa, 2011).

The emergence of test scales, such as diagnostic assessments, can be perceived as a reaction to the evolving landscape of education, necessitating adaptations and reforms. This progression entails, among various considerations, the imperative of meticulous content selection, termed cognitive diagnostic assessment. In Indonesia, this assessment framework has been incorporated into the educational system, particularly via the adoption of an independent curriculum. A consequential outcome of this implementation is the heightened demand for differentiated learning, aimed at addressing individualized learning requirements of students.

Hence, an essential tool is required to aid educators in pinpointing the distinct learning needs of their students. This serves the purpose of identifying the individual strengths and weaknesses of each student, thereby enabling educators to fine-tune their teaching methods accordingly. Furthermore, cognitive diagnostic assessment can also assist educators in determining the most suitable learning strategy for each student. Deborah Ruf (2005) emphasized that cognitive diagnostic assessment can contribute to nurturing students' selfconfidence, as they receive tailored instruction aligned with their abilities and needs (Ruf, 2005).

It has been a common practice for students in a class to be grouped based on similar ages, disregarding their varying levels of competence because depending on the level of the class, grouping pupils by achievement level might result in changes in the scale and quality of teaching (Dupriez & Dupriez, 2010). As a result, differentiation of subject content is not given much attention, as the class is considered to be homogeneous. In this context, it is necessary to introduce a diagnostic test to determine the actual condition of the class, allowing the teacher to provide suitable materials. A diagnostic test does not assign grades but rather identifies the type of materials the students require. The test serves as a guide for educators to enhance their work by offering appropriate content. Similar to medical practice, a diagnosis functions to identify problems in a patient's health. In education, it serves to determine the crucial subject content that might be challenging for the students.

Educators must hold certain assumptions when performing their role as facilitators of student-centered learning. For example, they can demonstrate an educator-facilitated active, student-centered learning approach in which students are held accountable for their active involvement and self-directed learning while balancing a facilitator role to further enrich the learning process (Sharoff, 2019). Based on the purpose of the diagnostic tool, it is expected that the needs of each child in the class can be relatively met, as it assesses the level of subject content, learning models, and evaluations to be prepared. The teacher's duty is not solely to deliver material to children, but to tailor how teaching material should be planned for each child. As a learning facilitator, the teacher must provide differentiated learning to each student. Assessment functions as an effort to align the learning materials with the students' needs. It can serve as a reflection to determine the development of students' needs and the required subject content. The implementation of diagnostic assessment will only be valuable and efficient in learning if it is scientifically designed (Szabo, 2012).

Differentiated classes are beneficial for students, especially those with above or below average abilities, as well as students with special needs or different learning styles, when properly applied (C. A. Tomlinson, 2014). Learning tailored to student needs is an alternative to differentiated classes, being inclusive,

responsive, and adaptive to meet the diverse needs of individual students. Differentiated classes can enhance learning effectiveness by considering students' varying abilities (C. A. Tomlinson, 2014). Differentiated learning can help enhance creativity and critical thinking skills, allowing abilities and intelligence to develop through consistent effort and practice (Dweck, 2006; Sternberg, 2018). Differentiation is not merely a set of learning strategies but a way of thinking about learning. Therefore, classes with children of different abilities should also incorporate differentiation. Differentiation involves determining instructional planning and implementation that accommodate students' diverse needs within a specific subject content (Tomlinson, 2003).

In implementing differentiated learning, conducting an initial diagnostic assessment is a crucial activity for teachers. To ascertain students' initial abilities and fundamental knowledge, especially in the Indonesian subject, an initial diagnostic assessment is necessary. Its purpose is to identify the challenges students face, which can then be addressed accordingly (Rachmawati & lestariningrum, 2022). This paper aims to determine whether cognitive diagnostic assessment is important, as it establishes whether students are inherently distinct individuals requiring differentiated approaches in their learning.

RESEARCH METHOD

This quantitative study is conducting descriptive research in order to gather study data. Data collection was conducted using a testing technique, specifically a cognitive diagnostic assessment test. The collected data were then analyzed to determine the students' competence levels. A total of 139 students from five different educational institutions participated in data collection, who were tested using five distinct genres: procedure text, fantasy fairy tale text, description text, folk poetry text, and explanation text. The sampling method used was area/conditional sampling and purposive random sampling was employed to choose the individual subjects. The data were analyzed using descriptive statistics, which involved calculating measures such as mean, mode, median, and standard deviation. Descriptive statistics were used to characterize the data without making generalizations.

RESULTS AND DISCUSSION

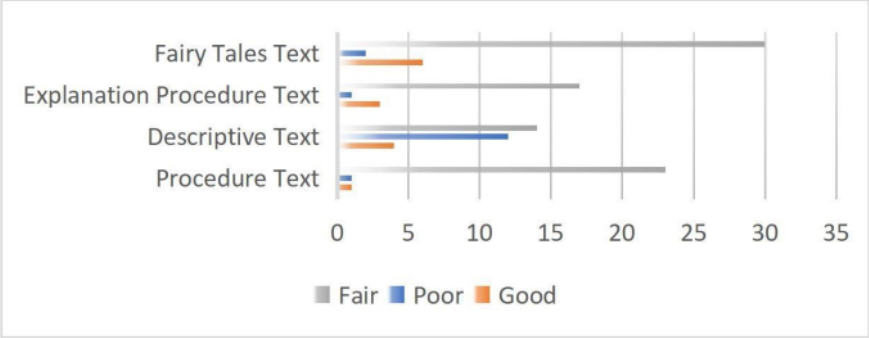
The analysis results for the cognitive diagnostic assessment of the Indonesian subject are presented in the subsequent tables.

TABLE 1
RESULTS OF COGNITIVE DIAGNOSTIC ASSESSMENT OF FOLK POETRY TEXT

Number of students	Score	Category	(in %)
15	81 - 100	Good	57,9
6	70 - 80	Fair	23,1
5	< 70	Poor	19

Table 1 illustrates diverse results within the class. It indicates that 60% of the students demonstrate good competence, 23% exhibit moderate competence, and the remaining 19% show poor competence. The analysis does not aim to identify the dominant group; instead, it serves to underscore the range of competence levels among the students. The outcomes validate the necessity of cognitive diagnostic assessment (Fan et al., 2021). Data pertaining to other genres of text, number of students and their category is presented in the form of the following diagram:

FIGURE 1
CATEGORY AND NUMBER OF STUDENTS WITH VARIOUS TEXTUAL GENRES



Based on the provided data it can be inferred that most students exhibit a limited level of proficiency in comprehending diverse text genres.

TABLE 2
TOTAL OF DIAGNOSTIC ASSESSMENT RESULTS

Institutions	Category		
	Good	Fair	Poor
1.	15	6	5
2.	1	1	23
3.	12	4	14
4.	1	3	17
5.	2	6	29
Total	31	20	88
Mean	6	4	18

This table provides an assessment breakdown into the categories of good, fair, and poor for five different institutions. Each row represents one institution, and each column indicates the number of students falling into a specific assessment category within that institution. The table offers an overview of the distribution of student assessments across the respective categories within the five distinct institutions, alongside the overall total and average number of students in each assessment category.

A diagnostic assessment is a tool used to evaluate students' abilities or mastery levels. It measures students' progress and the effectiveness of educational programs. Its primary purpose is to identify students' weaknesses or strengths in specific areas to determine appropriate interventions. According to Armstrong (2011), employing cognitive diagnostic assessment in differentiated learning can help students feel more accepted and valued because their needs are accommodated. Gardner (1999) asserts that cognitive diagnostic assessment is pivotal in recognizing students' cognitive strengths (Armstrong, 2011; Gardner, 1999) Diagnostic assessment can be conducted using various methods, including standardized tests, interviews, observations, or portfolios (Benjamin Bloom - Bloom, 1956; David Ausubel - Ausubel, 1968; W. James Popham - Popham, 2011). Samueza (2016) suggests that diagnostic assessment can employ written tests, questionnaires, observations, self-evaluation, and co-evaluation (Angel et al., 2019). Hence, there are several diagnostic test models, including multiple-choice instruments, multiple-choice instruments

with reasons, multiple-choice instruments with explanations, multiple-choice instruments with descriptions, and descriptive instruments (Suwarto, 22013).

Diagnostic assessment aims to identify learners' strengths and weaknesses in relation to specific learning outcomes (Fan et al., 2021; Komalawati et al., 2020). It can be conducted on a broader scale (macro) known as educational diagnosis, as well as on a smaller scale (micro) for specific purposes, as demonstrated by Soeharto et al., who used it to pinpoint misconceptions in science concepts (A et al., 2016) (Soeharto et al., 2019). Additionally, it aims to identify strengths, weaknesses, potential, and prerequisite competencies. The results of diagnostic assessments can serve as the foundation for formulating learning objectives and strategies. In school practice, diagnostic assessment can be integrated to support differentiated learning through regular measurements and to provide tools for educators to conduct formative assessments (Molnár & Csapó, 2019). By considering data from diagnostic assessments, learning designs can be tailored to meet the needs of both individual learners and groups (Suryadi & Husna, 2022). These assessments can be ongoing to monitor processes, progress, and improvements in outcomes (Sulastri et al., 2018). Nasution (2021) emphasizes that diagnostic assessment's goal is to diagnose students' fundamental abilities and initial conditions (Nasution, 2022; Tri et al., 2013).

Diagnostic assessment can be conducted using various techniques and instruments, tailored to specific needs. These instruments can either be standardized or custom-designed by teachers for particular groups and purposes. The purpose of these diagnostic tests is to identify learning problems or difficulties experienced by students. Additionally, they assist educators in planning effective learning strategies. Acquiring comprehensive information about students, including their strengths and learning challenges, aids in establishing a foundation for subsequent learning processes (Kumar, 2017).

The findings of this study reveal that, among the five schools, students' competence tends to fall within the low or poor categories. Neglecting this fact could jeopardize the achievement of desired learning outcomes. Thus, a cognitive diagnostic assessment should initiate the learning process to ensure an implementation that aligns with their competence levels and learning needs.

The use of a diagnostic assessment model is gaining popularity due to its ability to provide detailed information about students' competency attainment. The ways in which diagnostic assessments function, how educators should employ them, and how to interpret and use the results can differ from assessments on different scales. In this study, cognitive diagnostic assessment results are utilized to demonstrate the variety of learners' competences.

According to research by Clark et al. (2022), educators must grasp the fundamentals of diagnostic assessments, comprehend how to use the results, and understand how these results influence instructional decision-making. Educators need to interpret and apply the results to plan subsequent instruction. However, there might be uncertainty regarding calculating students' mastery, as some instances of mastery were misinterpreted as representing correct percentages instead of probability values. Clark highlighted implications for those implementing large-scale diagnostic assessments or designing score reports for such systems (Clark et al., 2022).

Diagnostic assessment proves to be a more effective approach for providing instructionally valuable information compared to other testing and assessment methods that fail to differentiate strengths and weaknesses among students who achieve the same total score (Fan et al., 2021). It's an assessment that offers insightful feedback on students' cognitive strengths and weaknesses and can serve as a tool for formative assessments (Sia & Lim, 2018). The results it yields can offer preliminary evidence of the effectiveness of a developed test in capturing students' misconceptions and evaluating their understanding of science concepts (Soeharto, 2021). Diagnostic assessments also play a crucial role in identifying potential learning difficulties, particularly among learners in disadvantaged socioeconomic circumstances who are at a higher risk of academic underachievement (Pires et al., 2021). Moreover, diagnostic assessments alleviate the stress of the academic literacy acquisition process for many first-year students and underscore the potential benefits of incorporating such assessments for enhancing retention and engagement (Palmer et al., 2018).

Research that examines the accuracy and reliability of virtual cognitive assessments in comparison to in person cognitive assessments (considered reference standards) for diagnosing conditions like dementia

or mild cognitive impairment (MCI) have identified cut-offs in virtual cognitive test scores as indicative of dementia or MCI. Additionally, these studies discuss correlations between scores obtained through virtual and face-to-face cognitive tests in adults (Watt et al., 2021; Luo et al., 2022).

CONCLUSION

A cognitive diagnostic assessment should mark the beginning of the learning journey. As indicated by the analysis, students exhibit varying initial abilities and competences. This factor holds great significance for educators in discerning appropriate teaching materials and learning methodologies. The disparities give rise to distinct needs, demanding individualized approaches. These diverse approaches find optimal application within a differentiated classroom setting, tailored for learners with unique requirements, particularly those who possess special needs. It's noteworthy, however, that this study solely focuses on evaluating students' cognitive competence. For a more comprehensive understanding, it's also imperative to incorporate their profiles, talents, and interests.

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