



Single Subject Design for Digital Assessment in Secondary Education: Exploring Opportunities and Challenges from Teachers' Perspectives

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ABSTRACT

Purpose of the study: This study aims to explore teachers' perspectives regarding the opportunities and challenges of implementing Single Subject Design (SSD) in digital assessment practices at the secondary education level and to identify the potential contribution of SSD to individualized and continuous assessment processes.

Methodology: This study employed a descriptive qualitative research design. Data were collected through observation and semi-structured interviews using observation sheets and interview guidelines. Purposive sampling was used to select participants. Digital tools such as Google Classroom, Quizizz, Microsoft Excel, and digital portfolios were identified during the study. Data were analyzed using the Miles and Huberman interactive model consisting of data reduction, data display, and conclusion drawing and verification.

Main Findings: The findings indicated that digital assessment had been implemented through various platforms to support assessment activities in secondary education. Teachers perceived that Single Subject Design offered opportunities for repeated measurements, individualized monitoring, and systematic documentation of learning progress. However, several challenges were identified, including limited understanding of SSD, time constraints, workload, differences in digital literacy, and technological limitations. Teachers also demonstrated positive attitudes toward the potential integration of SSD into digital assessment practices.

Novelty/Originality of this study: This study provides a qualitative perspective on the opportunities and challenges of integrating Single Subject Design into digital assessment from teachers' viewpoints in secondary education. Unlike previous studies focusing mainly on intervention outcomes, this research emphasizes practical experiences and contextual factors influencing implementation, thereby contributing new insights into evidence-based and student-centered assessment practices.

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1. INTRODUCTION

The rapid advancement of educational technology has transformed assessment practices in secondary education. Digital assessment offers various advantages, including efficiency, flexibility, and the ability to

collect students' learning data in a more systematic manner [1], [2]. In addition, technology-assisted assessment enables teachers to monitor learning progress and provide timely feedback to students. Such developments have encouraged educators to adopt more evidence-based approaches to assessment [3], [4]. Consequently, digital assessment has become an essential component of contemporary educational practices.

Despite these benefits, several challenges remain in implementing effective assessment practices in schools. Teachers often face difficulties in monitoring individual students' progress because of large class sizes, limited instructional time, and administrative responsibilities [5], [6]. Conventional assessment methods are generally focused on measuring final achievement rather than examining students' development over time [7], [8]. Furthermore, many teachers are still unfamiliar with approaches that emphasize repeated observations and individualized assessment [9], [10]. As a result, the potential of digital assessment to support continuous monitoring of learning progress has not been fully optimized.

Previous studies have highlighted the importance of digital assessment and individualized interventions in improving learning outcomes. Research on Single Subject Design (SSD) has demonstrated its usefulness in evaluating the effects of interventions through repeated measurements and detailed observations of individual performance [11], [12]. Other studies have also emphasized the contribution of digital technologies in facilitating assessment processes and data management. Nevertheless, most previous investigations have mainly focused on the effectiveness of interventions or the technical aspects of digital assessment [13], [14]. Comparatively little attention has been devoted to understanding teachers' experiences and perceptions regarding the practical implementation of SSD in school settings.

Although the existing literature provides valuable insights into Single Subject Design and digital assessment, several research gaps remain. Previous studies have rarely explored the opportunities and challenges associated with integrating SSD into digital assessment from the perspective of teachers [15], [16]. In addition, empirical evidence concerning teachers' readiness, constraints, and expectations toward this approach is still limited, particularly in secondary education contexts. Most available studies tend to emphasize quantitative outcomes rather than qualitative insights obtained from practitioners [17], [18]. Therefore, further investigation is required to obtain a more comprehensive understanding of the feasibility of implementing SSD in educational practice.

Exploring teachers' perspectives is important because teachers are directly involved in designing, implementing, and evaluating assessment activities in classrooms. Understanding their experiences and perceptions may provide valuable information regarding the factors that facilitate or hinder the adoption of innovative assessment approaches [19], [20]. Moreover, digital technologies have created new opportunities for conducting repeated measurements and documenting individual learning progress more efficiently. Insights obtained from teachers may also contribute to the development of evidence-based assessment practices that are more adaptive to students' needs [21], [22]. Hence, examining the opportunities and challenges of SSD in digital assessment is highly relevant to current educational contexts.

The novelty of this study lies in its qualitative exploration of teachers' perspectives on the application of Single Subject Design in digital assessment at the secondary education level. Unlike previous studies that predominantly focused on intervention outcomes or technological features, this study emphasizes the practical opportunities and challenges encountered by teachers in real educational settings [23]. Furthermore, the study highlights how digital tools may support repeated observations and individualized assessment processes associated with SSD. By integrating perspectives from practitioners, this research contributes to expanding the discussion on evidence-based and student-centered assessment approaches [24]. Therefore, the findings are expected to provide new insights into the potential role of Single Subject Design in advancing digital assessment practices in secondary education.

2. RESEARCH METHOD

2.1. Research Design

This study employed a descriptive qualitative research design to explore teachers' perspectives regarding the opportunities and challenges of implementing Single Subject Design (SSD) in digital assessment within secondary education [25]. A qualitative approach was selected because it enables researchers to obtain in-depth information concerning participants' experiences, perceptions, and expectations [26], [27]. The study focused on understanding how teachers perceive the feasibility of integrating SSD with digital assessment practices. In addition, this approach allowed the researchers to identify contextual factors influencing the implementation of individualized assessment. Therefore, descriptive qualitative research was considered appropriate for addressing the objectives of the present study [28].

2.2. Research Participants and Setting

The study was conducted in a secondary school setting involving a physics teacher as the research participant. The participant was selected using purposive sampling based on teaching experience and familiarity with classroom assessment practices. Data collection was carried out through direct interaction with the participant to obtain detailed information regarding current assessment practices and perceptions toward SSD. The participant also shared experiences related to the use of digital technologies in assessment activities. Such information provided valuable insights into the practical realities of implementing continuous and individualized assessment in schools.

2.3 Data Collection Techniques

Data were collected through observation and semi-structured interviews to obtain comprehensive information related to digital assessment and Single Subject Design. Observation was conducted to understand the existing assessment practices implemented by teachers in classroom settings. Meanwhile, semi-structured interviews were employed to explore teachers' perceptions, experiences, opportunities, and challenges associated with the implementation of SSD. Interview guidelines and observation sheets were used as research instruments to ensure systematic data collection. The combination of these techniques enabled the researchers to obtain rich and meaningful qualitative data.

2.4 Data Analysis

The collected data were analyzed using the interactive model proposed by Miles and Huberman. The analysis process consisted of three stages, namely data reduction, data display, and conclusion drawing and verification. Data reduction was performed to identify relevant information related to the research objectives. Subsequently, the organized data were presented systematically to facilitate interpretation and understanding. Finally, conclusions were drawn and continuously verified to ensure the trustworthiness and consistency of the findings.

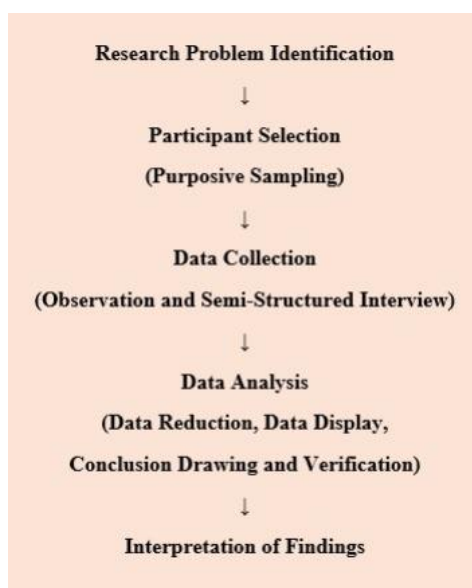


Figure 1. Research Procedure

Table 1. Summary of Research Methodology

Aspect	Description
Research Approach	Qualitative approach
Research Design	Descriptive qualitative research
Research Participant	One physics teacher
Sampling Technique	Purposive sampling
Research Setting	Secondary school
Data Collection Techniques	Observation and semi-structured interview
Research Instruments	Observation sheet and interview guideline
Data Analysis Technique	Miles and Huberman interactive model
Focus of the Study	Exploring opportunities and challenges of implementing Single Subject Design in digital assessment from teachers' perspectives

3. RESULTS AND DISCUSSION

3.1. Existing Practices of Digital Assessment in Secondary Education

Interview findings revealed that digital assessment had been implemented by the participant through several platforms, including Google Classroom, Quizizz, Microsoft Excel, and digital portfolios. These technologies were primarily used to administer quizzes, record students' scores, and manage learning documentation. The participant acknowledged that digital tools facilitated assessment activities and improved efficiency in data management. Nevertheless, the collected data were mainly utilized to determine students' achievement rather than to monitor individual learning progress continuously. Consequently, digital assessment practices had not yet fully supported the principles of individualized and repeated assessment associated with Single Subject Design.

3.2. Opportunities for Implementing Single Subject Design in Digital Assessment

The participant perceived several opportunities for integrating Single Subject Design into digital assessment practices. Repeated measurements supported by digital technologies were considered beneficial for monitoring students' learning development more systematically. The participant also believed that individualized assessment could provide more detailed information regarding students' strengths and weaknesses. In addition, the availability of digital platforms was viewed as an advantage that could facilitate the collection and organization of assessment data. These conditions indicate that the educational environment provides promising opportunities for adopting SSD-based assessment approaches.

3.3. Challenges in Implementing Single Subject Design

Despite these opportunities, several challenges were identified during the interview. Limited understanding of Single Subject Design was considered one of the major obstacles preventing its implementation in classroom assessment. The participant also emphasized that time constraints and heavy administrative workloads reduced teachers' ability to conduct repeated observations. Furthermore, differences in teachers' digital literacy and students' access to technological resources created additional barriers. Such challenges suggest that successful implementation of SSD requires adequate preparation and institutional support.

3.4 Teachers' Perspectives on the Potential of Single Subject Design

Overall, the participant expressed positive perceptions regarding the potential contribution of Single Subject Design to assessment practices in secondary education. According to the participant, repeated observations could help teachers obtain a clearer picture of students' learning progress over time. Individualized assessment was also perceived as an approach capable of supporting evidence-based instructional decisions. Moreover, integrating SSD with digital technologies was believed to enhance the effectiveness and accuracy of assessment processes. Therefore, the participant considered SSD to be a promising alternative for developing more student-centered assessment practices.

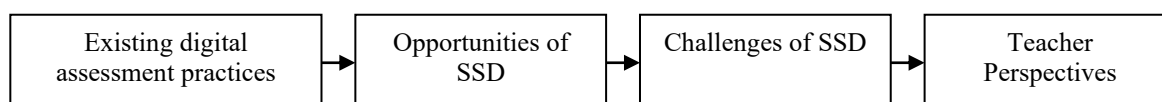


Figure 2. Main Findings of the Study

Table 2. Summary of Research Findings

Themes			Main Findings
Existing Digital Assessment Practices			Google Classroom, Quizizz, Microsoft Excel, and digital portfolios were used.
Opportunities of SSD			Repeated measurements and individualized monitoring.
Challenges of SSD			Limited understanding, workload, time constraints, and digital literacy.
Teachers' Perspectives			Positive perceptions toward SSD-based assessment.

Table 3. Opportunities and Challenges of Implementing Single Subject Design

Opportunities	Challenges
Continuous monitoring of learning progress	Limited knowledge about SSD
Individualized assessment	Heavy workload
Efficient data collection through digital tools	Limited time for repeated observations
Evidence-based instructional decisions	Variations in digital literacy
Better documentation of students' development	Technological constraints

The present study revealed that digital assessment has been increasingly integrated into secondary education through the use of various platforms such as Google Classroom, Quizizz, Microsoft Excel, and digital portfolios. These technologies have facilitated the administration and management of assessment activities, allowing teachers to collect and organize students' learning data more efficiently. Nevertheless, the collected information has primarily been used to determine students' achievement rather than to monitor their progress continuously. Such practices indicate that current digital assessment systems have not yet fully supported individualized and repeated measurements. Consequently, the potential benefits of data-driven assessment remain underutilized in classroom practice.

Another important finding concerns teachers' perceptions regarding the implementation of Single Subject Design in digital assessment. The participant recognized that repeated measurements and individualized observations could provide more detailed information about students' learning development. However, several barriers were identified, including limited knowledge of SSD, heavy workloads, time constraints, and differences in digital literacy. These challenges suggest that the successful implementation of SSD requires not only technological support but also adequate professional preparation. Despite these limitations, teachers demonstrated positive attitudes toward the possibility of adopting SSD-based assessment approaches in the future.

Similar tendencies have been reported in previous studies emphasizing the importance of digital assessment and individualized evaluation. Earlier investigations have shown that repeated observations can provide richer information regarding students' learning development and support evidence-based instructional decisions [29], [30]. Studies on Single Subject Design have also highlighted its effectiveness in documenting behavioral and academic changes over time. However, most previous research has focused primarily on intervention outcomes and methodological procedures rather than on teachers' experiences and perceptions [31], [32]. Therefore, the current findings are consistent with existing literature while simultaneously extending the discussion to practical considerations encountered by teachers.

One distinctive contribution of this study lies in its emphasis on teachers' perspectives concerning the integration of Single Subject Design into digital assessment in secondary education. Unlike many previous studies that concentrated on the effectiveness of interventions or technological features, this research explored both opportunities and challenges encountered in actual educational settings [33], [34]. The study also highlights how digital technologies may facilitate repeated measurements and individualized assessment processes associated with SSD. By focusing on practitioners' experiences, the research provides a more contextual understanding of the feasibility of implementing SSD in schools [35], [36]. Such an approach offers a new perspective for advancing evidence-based and student-centered assessment practices.

The findings of this study have several implications for educational practice and future development. Strengthening teachers' understanding of Single Subject Design through professional development programs may enhance their ability to implement individualized assessment effectively [37], [38]. Furthermore, integrating digital technologies with repeated measurements could help teachers monitor students' learning progress more systematically and make instructional decisions based on empirical evidence. Educational institutions may also benefit from providing technological infrastructure and institutional support to facilitate the adoption of innovative assessment approaches [39]. Therefore, collaboration among teachers, schools, and policymakers is essential for promoting more meaningful and sustainable assessment practices.

Several limitations should be considered when interpreting the findings of this study. The research involved only one participant and was conducted within a limited educational context, which may restrict the transferability of the findings to other settings [40]. In addition, the study focused solely on teachers' perceptions and did not include the direct implementation of Single Subject Design in classroom practice. As a result, the effectiveness of SSD in improving students' learning outcomes could not be empirically examined. Future studies are recommended to involve larger samples and investigate the practical application of SSD-based digital assessment across diverse educational environments.

4. CONCLUSION

This study concludes that the opportunities and challenges associated with the implementation of Single Subject Design (SSD) in digital assessment can be understood more comprehensively through teachers' perspectives in secondary education. The findings indicate that existing digital assessment practices provide considerable potential for supporting repeated measurements and individualized monitoring, which are fundamental characteristics of SSD. Nevertheless, several challenges, including limited understanding of SSD, time constraints, workload, and differences in digital literacy, remain important factors influencing its practical implementation. These results demonstrate that the expectations outlined in the introduction regarding the potential contribution of SSD to evidence-based and student-centered assessment are consistent with the findings obtained from the results and discussion. Furthermore, the study highlights the importance of strengthening teachers' professional competencies and institutional support to facilitate the integration of innovative

assessment approaches in schools. Future studies are recommended to investigate the practical implementation of SSD-based digital assessment involving larger samples and diverse educational contexts to provide broader empirical evidence regarding its effectiveness and applicability.

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