Personalised Formative Assessment Strategies for Inclusive Education: a Case Study on Cognitive and Social Skills Development in Special Educational Needs

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Abstract

This research aims to evaluate the effectiveness of personalised formative strategies in enhancing the cognitive and socio-relational skills of a student with Special Educational Needs (SEN). Through an A-B-A experimental design, supported by tools such as observation grids, questionnaires, interviews, and a teacher's logbook, it was possible to rigorously and multidimensionally monitor the student's progress. The project highlighted significant improvements in attention (+45%), working memory (+66.7%), and problem-solving skills, with an increase in success rates from 20% to 70% during the intervention. The adopted approach demonstrated its validity in fostering the student's engagement and strengthening their participation and self-esteem, confirming that formative strategies can be effectively integrated into inclusive education. However, the study revealed certain critical issues, such as the autonomous management of errors and the stabilization of progress over time, indicating the need for further maintenance interventions. This project not only demonstrates the potential of personalized strategies for SEN students but also provides a solid foundation for future developments, emphasising the possibility of improving the school experience and promoting genuine educational inclusion.

Keywords: *formative assessment, special educational needs, cognitive development, social skills*

1. Introduction

Inclusive education represents a pivotal transformation from traditional instructional models toward learner-centred pedagogies that respect individual student differences. In this context, formative assessment — particularly in its personalized form — emerges as a crucial component within this paradigm, particularly for students with Special Educational Needs (SEN). It facilitates continuous and adaptive educational feedback tailored to individual requirements [1], [2]. Feedback, as identified by Hattie, significantly impacts student achievement when it is clear, precise, and actionable, enabling both teachers and students to identify and address learning gaps effectively [1]. Black and Wiliam further emphasise formative assessment as instrumental in adapting teaching methods to meet learners' specific needs, enhancing overall educational experiences through improved metacognitive skills [2].

The inclusion of students with cognitive and socio-relational difficulties requires targeted strategies to ensure their active participation and success in inclusive classroom settings. Personalized formative strategies — including individualized feedback, peer-assisted learning, visual scaffolding, and structured self-assessment — have proven effective in supporting both academic performance and social development [2], [3].

The theoretical framework underpinning this study is informed by influential educational thinkers such as Montessori, Dewey, and Vygotsky. Montessori emphasised observation as a method for tailoring the learning environment to children's needs [4], while Dewey championed experiential and reflective learning [6]. Vygotsky's concept of the Zone of Proximal Development (ZPD) highlights the importance of social interaction and teacher mediation in fostering cognitive development [6].

Research problem: students with SEN often experience difficulties in sustaining attention, regulating learning processes, and maintaining meaningful social interactions in inclusive contexts. This raises the question of whether personalized formative assessment strategies can serve as an effective pedagogical tool to address these challenges.

Research questions:

- To what extent can personalized formative assessment strategies improve attention, working memory, and problem-solving skills in a student with SEN?

- Do such strategies enhance social participation and peer interaction in inclusive classroom settings?
- Are the observed improvements retained after the withdrawal of the intervention?

2. Literature Review

The effectiveness of personalized formative assessment strategies for students with Special Educational Needs (SEN) has gained increasing attention in recent educational research. In inclusive settings, formative assessment plays a critical role in enhancing cognitive and socio-relational skills — two areas that frequently present significant challenges for students with SEN.

Personalized formative strategies are crucial for inclusive education, aiming primarily to ensure that all learners, regardless of their abilities, can reach their fullest potential. Feedback is among the most influential elements affecting student outcomes, particularly when it is timely, specific, and constructive [1].

Within the formative assessment framework, such targeted feedback serves as a cornerstone, guiding learners toward effective self-regulation and enabling educators to dynamically adjust instructional practices to address individual and evolving learning needs [1], [4].

Formative assessment has been characterized as a systematic process through which both teachers and students utilise information to enhance teaching and learning outcomes [2]. This approach not only elevates instructional quality but also bridges the gap between students' current performance levels and desired learning objectives — an aspect especially critical for students with SEN.

Several key strategies have been identified to maximize formative assessment effectiveness: clarifying learning intentions, eliciting evidence of student understanding, providing precise and targeted feedback, leveraging peers as supportive learning resources, and cultivating students' ownership and autonomy over their educational processes [9].

Studies have shown that training teachers in dialogic, evidence-based practices significantly enhances the quality of personalized formative assessment [2]. Such practices involve ongoing exchanges of feedback between teachers and students, which facilitate deeper learning experiences and foster metacognitive reflection.

The literature also emphasises the critical importance of teacher preparedness and commitment in successfully implementing formative assessment within inclusive settings [3].

The intrinsic relationship between formative assessment and differentiated instruction has been underscored, highlighting that both aim to tailor instruction to individual learner needs [10].

Further research demonstrates that students with SEN benefit from formative feedback that specifically addresses social engagement and emotional competencies [12]. It has also been emphasised that formative feedback must not only clarify goals but help students recognize performance gaps and provide actionable steps [11].

A comprehensive vision of inclusive education must balance academic and social development [8], and inclusive outcomes depend not only on classroom practices but also on institutional policies and teacher attitudes toward diversity [8].

3. Methodology

This study adopts a single-case design—a methodological approach allowing for in-depth analysis of behavioural and performance changes in an individual participant over time. The research comprises three distinct phases: baseline, intervention, and follow-up, systematically monitoring the impact of educational strategies. This methodology was selected to enable intra-subjective comparisons across phases, which is particularly suitable for assessing targeted educational interventions in students with Special Educational Needs (SEN) [12], [13].

A mixed-methods approach, integrating both quantitative and qualitative data collection tools, was employed to offer a multidimensional view of the phenomena. The instruments used included:

- **systematic observation grids**: these tools objectively monitored specific student behaviours, such as attention, engagement, and participation, during authentic classroom activities;
- **authentic tasks**: exercises designed to assess core cognitive abilities — namely attention, working memory, and problem-solving — through contextually relevant assignments;
- **self-assessment rubrics**: structured instruments enabling the student to reflect periodically on personal learning performance and autonomy;
- **questionnaires and semi-structured interviews**: addressed to parents and peers, these tools provided comprehensive perspectives on the student's academic and socio-relational development.

Additionally, several pedagogical strategies were implemented, including:

- **error-based learning**: the student was supported in viewing errors as part of the learning process, with iterative feedback promoting skill refinement and fostering resilience [11];
- **continuous feedback**: provided consistently and tailored to the student's learning goals, this strategy encouraged motivation and improved self-regulation [1];
- **self-reflection and metacognition**: encouraged through daily practices, enhancing the student's ability to identify learning strengths and areas for improvement [4].

3.1 Context and Participant

The research was carried out at "Vincenzo Moretti Secondary School" in Roseto degli Abruzzi, Italy, which adopts an inclusive education framework. The participant was a 16-year-old student in their second year of school with a formally diagnosed mild intellectual disability (IQ ≈ 70), certified by the local health authority (ASL).
The student's Individualized Education Plan (IEP**)** highlighted the following functional challenges:
- difficulties with attention and working memory;
- slow information processing;
- reduced planning autonomy;
- limited social interaction in group settings;
- high dependency on adult mediation.

The student exhibited a visual learning style, responding more effectively to step-by-step visual instructions and cooperative tasks with clearly defined roles.
Support included 12 weekly hours from a special education teacher and use of compensatory tools (e.g., mind maps, extended time) in accordance with Law no.104/92.
The intervention covered seven weeks, structured as follows:
- **A1 – Baseline phase (two weeks)**: initial observation without intervention.
- **B – Intervention phase (three weeks)**: implementation of the personalised formative strategies.
- **A2 – Follow-up phase (two weeks)**: monitoring for retention and autonomous application of skills.

3.2 Tools and Strategies

The intervention involved formative strategies aligned with current educational research, tailored to the student's profile and seamlessly embedded into daily routines [5],[9]. Goals included promoting participation, autonomy, and competence in both cognitive and socio-emotional areas.
Key strategies:
- **negotiated learning goals**: co-designed with the student, using visuals and simplified language to ensure comprehension and engagement;
- **daily feedback grids**: used to track behaviours and encourage persistence in applying learning strategies;
- **peer tutoring**: structured sessions to foster verbalisation and problem-solving, mediated through guided dialogue and role assignment;
- **simplified self-assessment rubrics**: visual and accessible tools (emotional scales, checklists) for metacognitive reflection.

Additional practices:
- **error-based learning**: emphasising the educational value of mistakes to build confidence and adaptability [11];
- **constructive feedback**: provided immediately and oriented towards actionable improvements [1];
- **metacognitive support**: students were guided to reflect on strengths, identify gaps, and formulate personal improvement strategies [4].

All activities were scaffolded to match the student's level, maintaining coherence with the IEP and the general curriculum.

3.3 Data Collection and Analysis

A triangulated multi-method approach integrated quantitative and qualitative evidenceof progress:
A) Intra-subject analysis
Comparison across the three phases (A1, B, A2) used the following metrics:
- **descriptive statistics**: means and percentage differences for attention, working memory, problem-solving, and participation;
- **graphical representation**: line/bar charts visualised trends;

- **Likert encoding**: standardised 5-point scale for comparability.

B) Data triangulation

Validation occurred via convergence ofclassroom observations;student self-assessments;parent and peer interviews/questionnaires [5], [6].

C) Thematic qualitative analysis

Interview transcripts and teacher logs were analysed for patterns in error management, task independence, and social integration.

Statistical interpretation: mean (μ), standard deviation (σ), and coefficient of variation (CV) were used to measure performance change and consistency.

Performance improvements:

- **attention:** +45%;
- **working memory:** +66,7%;
- **problem solving:** from 20% to 70%;
- **social participation:** from 20% active to 70% active.

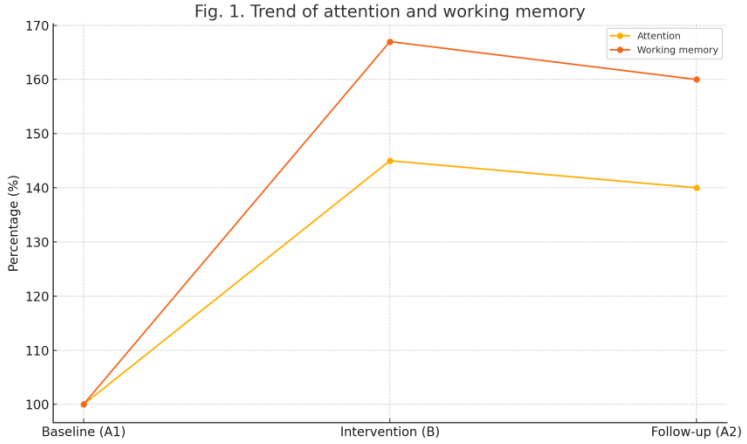
While most improvements were retained during follow-up, autonomous error management remained a fragile area [11].

4. Results and Discussion

The intervention yielded a substantial positive impact on both cognitive and socio-relational competencies of the student with Special Educational Needs (SEN). The most relevant improvements were observed in the following areas:

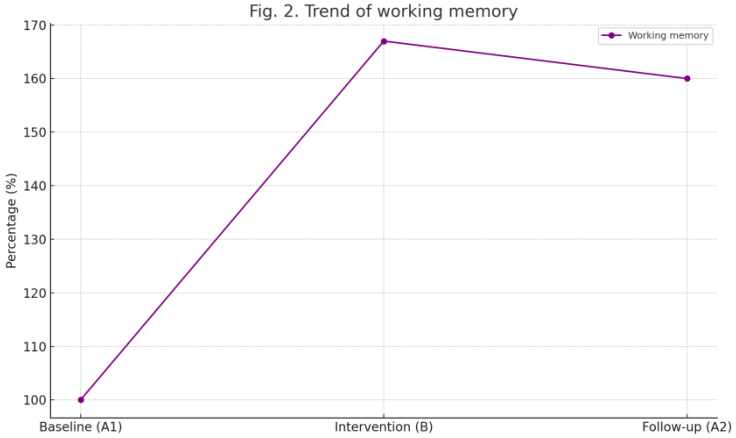
- **attention:** a 45% increase in the student's attention span was documented, as measured by improvements in sustained focus and task completion during structured classroom activities. These results were validated through observational grids and teacher records [1], [2], as shown in Fig. 1**.**

Fig. 1. Trend of attention and working memory



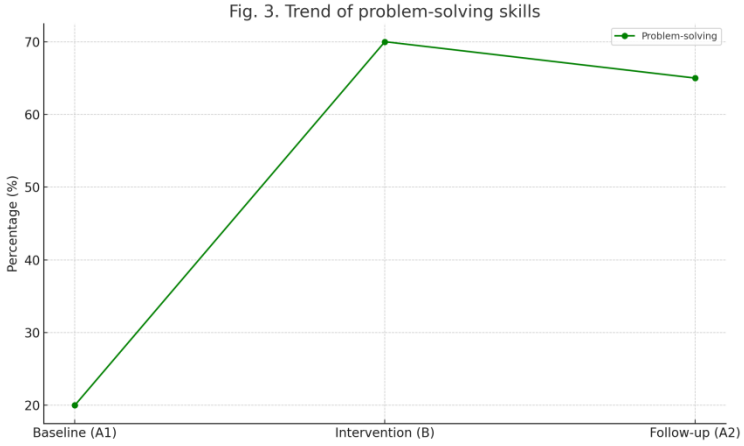
- Working memory: a significant 66.7% enhancement in working memory was observed. This was evidenced by the student's improved ability to recall sequences, follow multi-step instructions, and complete cognitively demanding tasks. During the follow-up phase, performance remained stable at around 70%, indicating partial retention of the acquired skills [1], [4], as shown in Fig. 2.

Fig. 2. Trend of working memory



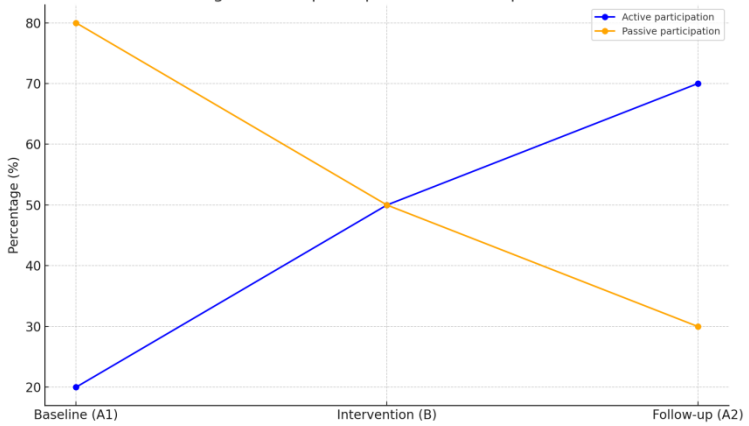
- **Problem solving**: problem-solving abilities rose from 20% to 70% during the intervention phase, with a slight regression to 65% in the follow-up. This regression highlights the need for reinforcement to consolidate higher-order thinking skills. Performance was assessed using authentic tasks and teacher evaluations [4], [9], as shown in Fig. 3.

Fig. 3. Trend of problem-solving skills



- **Social interaction**: the student exhibited a pronounced improvement in social engagement. Initially, passive behaviour was dominant (80%), while active interaction was limited (20%). During the intervention, active participation rose to 50%, and further increased to 70% in the follow-up. This change was corroborated by peer and teacher feedback, as well as triangulated qualitative data [8], [10], as shown in Fig. 4.

Fig. 4. Social participation: active vs passive



These visual and numerical indicators provide robust evidence that the personalised formative strategies positively influenced both cognitive and relational domains. Notably, the most stable improvements were observed in attention and social engagement. Conversely, skills like working memory and problem-solving demonstrated some regression post-intervention**,** underscoring the necessity for long-term support to sustain gains. These outcomes align with previous research emphasising the importance of continuity and scaffolding in inclusive educational interventions [4], [9].

5. Criticisms and Limitations

Despite the promising results of the intervention, several limitations emerged that may affect the generalizability, validity, and long-term applicability of the study's findings. These critical issues must be considered to contextualize the outcomes and to inform future research efforts.

- **Sample size and generalizability**: the study was conducted using a single-case research design involving only one student with Special Educational Needs (SEN). Although this methodology allows for in-depth analysis and a detailed understanding of individual change over time, the limited sample size restricts the external validity of the findings. However, it is important to emphasise that single-case studies are methodologically appropriate for exploratory research, especially when the aim is to generate hypotheses or to evaluate interventions under real-world conditions [13].
- **Duration of the follow-up phase**: the follow-up phase spanned only four weeks, which is relatively short when attempting to assess the sustainability of cognitive and socio-relational improvements. While some skills were partially retained, others showed signs of regression — particularly in problem-solving and independent error management. This limited duration must be viewed as a methodological constraint that prevents an accurate evaluation of long-term retention. Future studies should plan extended follow-up periods to determine whether improvements are stable over time or fade without continued support.
- **Subjectivity in data collection**: although the study utilised systematic observation grids and structured rubrics to ensure objectivity, certain data sources — such as the teacher's reflective logbook and the student's self-assessment — introduced an element of subjectivity. These tools, while valuable for capturing qualitative insights, are inherently susceptible to bias. To address this limitation, future studies should consider integrating standardized cognitive assessments and norm-referenced instruments to enhance data reliability and minimize interpretive bias [14].
- **Implementation fidelity**: the consistency with which the intervention strategies were applied varied slightly across different sessions. External constraints such as schedule changes and classroom interruptions occasionally impacted the delivery of the intervention. This variability may have influenced the student's performance outcomes and poses a potential confounding factor. It is crucial for future implementations to adhere strictly to the planned protocols and to monitor fidelity through formal checklists or peer observations.
- **Absence of longitudinal impact assessment**: the intervention focused on immediate and short-term outcomes without extending into a longitudinal analysis. Consequently, it is unclear whether the observed gains will translate into long-term educational success, emotional regulation, or improved social integration. Subsequent research should include long-term tracking to better understand the extended effects of formative assessment strategies.

6. Conclusion and Recommendations

This study demonstrates the effectiveness of personalised formative assessment strategies in enhancing cognitive, emotional, and social development among students with Special Educational Needs (SEN). When these strategies are adapted to the learner's individual profile and consistently implemented, they can result in significant improvements in attention, working memory, problem-solving abilities, and social participation.
The collected data suggest that formative assessment is not only a means of evaluating learning outcomes but also a dynamic and adaptive pedagogical approach. By fostering metacognitive awareness, promoting learner agency, and facilitating peer interactions, formative assessment supports inclusive education models that address the diverse needs of all students.
However, the findings also highlight the importance of continuity and reinforcement. While the intervention yielded immediate and positive outcomes, certain regressions — particularly in problem-solving and autonomous error management — were noted during the follow-up phase. This suggests that longer-term, consistent support is required to stabilize and further develop the acquired competencies. Additionally, the short duration of the follow-up phase (four weeks) is a limitation that hinders the assessment of long-term effects. Future studies should include extended monitoring to verify the durability of these improvements over time.

6.1 Recommendations for Future Research

- Expand the sample size: future research should include a broader and more diverse sample of students with SEN, to improve the generalizability of findings and allow comparative analysis across various educational profiles.
- **Extend follow-up periods:** longitudinal studies are needed to evaluate the sustainability of cognitive and socio-relational gains over time, particularly when active interventions cease.
- **Employ standardized assessment tools:** integrating validated and norm-referenced tools for cognitive and behavioural evaluation can increase the reliability and objectivity of research data.
- Investigate long-term educational outcomes: future studies should explore how personalised formative assessment impacts long-term educational trajectories, including academic achievement, emotional self-regulation, social integration, and personal well-being.

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