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Difficulties with Recognizing Mathematical Giftedness Among SEDGs: Conceptual Blockers, False Detection, and Inclusion Vehicles

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Abstract: Mathematical giftedness has remained one of the most challenging issues to identify especially among students in social economic disadvantaged groups (SEDGs) who have remained underrepresented in gifted sports education interventions in many countries around the world. Mathematically gifted learning is perceived in many different ways, but confined to the conceptual clarity and assessment instruments and methods of recognizing gifted learners, the most advanced mathematical potential remains to be viewed as complex and culturally situated. In this paper, a critical analysis of the conceptualized barriers and structural injustices that have led to the misidentification of mathematical giftedness among SEDG learners is critically analyzed. Relying on recent and classic peer-reviewed literature, the discussion points out the ambiguities in definition, biases involved in standardized and language-specific evaluations, and the gatekeeping aspect of the teacher judgments. Patterns of misidentification, such as the masking of giftedness among twice-exceptional students and students with limited academic exposure are examined as well as a long-term academic and psychosocial impact of being excluded in gifted pathways. The paper suggests inclusive, multidimensional methods of identification, which are based on culturally responsive assessment, multi-source compilation, dynamic evaluation of learning potential, and integration with the community in the school. Policy guidelines in fair identification systems are also expressed. The critique highlights the necessity of the systemic redesign, claiming that the fair identification of mathematical giftedness is not only an assessment problem but a justice-oriented necessity which requires the maintenance of structural and pedagogical change.

Keywords: *Mathematical Giftedness, Equitable Identification, Socio-Economically Disadvantaged Groups (SEDGs), Culturally Responsive Assessment, Structural Inequalities in Education.*

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I. INTRODUCTION

The concept of mathematical giftedness is widely acknowledged as the key factor in promoting high-level STEM performance and long-term academic success, but the mechanisms of identifying it are uneven and ineffective. In the case of socio-economically disadvantaged groups (SEDGs), the obstacles to recognition are especially strong among students. It has continuously been shown that gifted programs tend to benefit students with more advantaged socio-economic and cultural backgrounds, instead of minimizing structural educational inequalities (Borland, 2000; Callahan, 2005; Long, 2023). Mathematics, in particular, is one of the areas where there is a strong tendency toward early exposure, accessing enriched learning and culturally relevant assessment tools that play a huge role in identifying outcomes (Assmus et al., 2022; Sipahi, 2025). The problem is not that SEDG learners do not have mathematical talent but the fact that the current systems of identifying gifted children are not efficient to recognize mathematical talent in the context of culturally and linguistically diverse setting. The use of standardized tests, teacher referral, and normative definitions of giftedness do not usually represent the diverse nature of mathematical ability manifestations among sociocultural groups (Bahar and Maker, 2020; Delgado-Valencia, 2025). Through this, mathematically flexible SEDG students are often neglected or misrepresented, solidifying the imbalanced access to higher programs, mentoring, and sustained academic growth. This conceptual paper will aim at synthesizing current research on the issues that lie in determining mathematical giftedness in SEDGs. It addresses conceptual, methodological, and structural limitations of the existing identification practices and addresses the way misidentification is possible and the effects it has on the learners. The paper suggests inclusion avenues toward

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equity-based support and identification practice through a critical review of peer-reviewed literature. It is a literature-based, conceptually purposive scope to elaborate knowledge and guide future policy, research, and practice without gathering empirical data.

II. MATHEMATICAL GIFTEDNESS CONCEPTUALISATION

The process of defining mathematical giftedness is a complicated process that is characterized by several decades of theoretical discussion and changing conceptualizations. Conventional definitions are more inclined to focus on high level of thinking ability, learning at a fast pace, and high performance in standardized mathematical tests. But it may be considered that, according to scholars, mathematical giftedness is characterized by a more extended complex of features, such as creativity, intuitiveness, the ability to recognize patterns, and accepting flexibility in the approach to problem-solving (Mann, 2009; Sipahi, 2025). Such aspects cannot always be detected by use of the traditional evaluation tools which tend to gauge procedural skills instead of deep conceptual knowledge. As Assmus et al. (2022) observe, mathematical giftedness is often described by the capacity to find some generalized system, general reasoning, and unconventional approaches to solutions. These traits, though, might not be in line with the school-based mathematics expectations that a teacher may presume developed reason to be off-task behavior or non-compliance. Such lack of alignment between student expression and institutional demands can be especially harmful to SEDG students, whose patterns of communication and cultural orientations might not fit the mainstream. The traditional, fixed-ability conceptualization of giftedness is also criticized by the socio-cultural perspectives. The BEM-e model developed by Arnstein (2023) has the thesis that giftedness is mediated by environment and is context-specific and is shaped by the available opportunities, experiences, and cultural capital children have. In this perspective, giftedness does not inherently exist but is a dynamical process whereby the potential of the learner and the present learning environments interact. This realization holds significant repercussions on the SEDG learner who in most cases do not have the opportunity to demonstrate or nurture the high-order mathematical potential because of the systemic inequities. The frameworks of cultural responsiveness have the assumption that mathematical giftedness should be interpreted within the social cultural backgrounds of talent appearance (Bahar and Maker, 2020). These framings broaden the frame even further than the conventional signs do, since giftedness can present itself in a wide variety of ways- many of which the conventional systems of identifying giftedness ignore.

III. ABSENCE OF STRUCTURAL AND CONCEPTUAL VEHICLES TO DISCERN MATHEMATICAL GIFTEDNESS AMONG SEDGS

Definitional ambiguity has proved to be one of the underpinnings of the impediments to the recognition of mathematically gifted SEDG learners. Narrow definitions take giftedness to be equal to a high-grade record, which ignores students who can think at a higher level but do not have formal exposure and opportunity to achieve high grades (Borland, 2000; Gubbins, 2021). Achievement is also very much dependent on socio-economic context and since identification frameworks are based on achievement alone, it turns out to favour privileged students in a systematic way (Long, 2023). These differences are caused by standardized tools of identification. Language-based mathematics test, cognitive assessments, and IQ testing are usually cultural and linguistic biases that support the norms of the middle class (Harris, 2009; Bahar and Maker, 2020). In the case of a great number of SEDG students, the ability does not have the power to influence performance in such measures; rather, the lack of familiarity with test formats, cultural reference points, and academic language affects performance. According to Mun (2020), English learners and low-SES students are misidentified disproportionally because of the language-based assessment items that cloud clear mathematical thinking. Another important source of bias comes with teacher referral systems where they are commonly used in gifted identification. The perceptions of giftedness among teachers are highly dependent on behavioural aspects, language proficiency and adherence to classroom expectations by the students-which can be influenced by socio-economic experience (Smeets et al., 2024). The studies indicate that the teachers often undervalue the abilities of the SEDG student because of the implicit deficit discourse or lack of knowledge of culturally different forms of giftedness or different cognitive profiles (Harris, 2009). This kind of gatekeeping does not allow most of the mathematically competent SEDG learners to even come to undergo formal screening. The opportunity to identify is further limited in identification by structural inequities. Disadvantaged schools have very little advanced math programs, enrichment and literacies to assess teachers (Arnstein, 2023; Callahan, 2005). These structural obstacles do not only cause the problem of underrepresentation in identification, but also inhibit the growth of mathematical giftedness in the long term further developing and perpetuating the cycle of underrepresentation.

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IV. THE MISIDENTIFICATION IN PATTERNS, MECHANISMS AND CONSEQUENCES.

False identification may be done in various ways: under-identifying privileged learners, over-identifying such learners, and misidentifying twice-exceptional students. The most outstanding problem of SEDG learners is under-identification. The standardized tests overrepresent students who have enriched living conditions, formal academic experience, and knowledge of the test-taking-familiarity-characteristics- attributes associated with at least a higher socio-economic status (Delgado-Valencia, 2025). As a result, the high performance of students with advantaged backgrounds is classified as gifted as opposed to students with underdeveloped or latent profiles. A highly vulnerable subpopulation is that of twice-exceptional (2e) learners. Learning disabled, attention, or socio-emotionally challenged students who have highly developed mathematical reasoning may show it behind the discrepancies in performance or behavioural problems. The systematic review by Ozturk (2025) supports the fact that twice- exceptional students, particularly with disadvantaged backgrounds, are hardly identified under the standard practices as their weaknesses and strengths overshadow one another. The same conclusion can also be made by Al-Hroub (2019), who proves that mathematical talent can be identified in low-achievers who struggle to pass the static tests. False identification is also due to misinterpretation of culturally affected problem-solving strategies. Non-dominant students can find non-linear or alternative approaches that the traditional methods of mathematical problems are intuitive. The lack of these methods by the teachers can lead to a mislabelling of such a reasoning as wrong or inattentive and leave a chance to acknowledge high quality thinking (Bahar and Maker, 2020). The result of misidentification is severe. Left out of higher courses limits STEM careers down the road (Shaheen, 2025). Mentally, mistaken students could absorb negative attitudes to their capabilities, which lowers their educational self-esteem and academic strength. These implications may have a perpetual effect of educational marginalization in the long run.

V. MARGINS TO INCLUSIVE AND EQUITY IDENTIFICATION.

The inequity in identification will only be addressed when systems are changed so as to adopt culturally responsive, multidimensional assessment practices. A potential future would be to create tests that would be less biased in relation to language and culture. Bahar and Maker (2020) show that non-verbal performance-based tasks are effective to detect mathematical potential among different learners. Assmus et al. (2022) also indicate that advanced reasoning is reflected in figural pattern tasks that could be not assessed through standard school tests. Multi-criteria identification models are the ones that include dynamic assessment, their creativity measures, portfolios, and observational data, and they offer a more comprehensive view of student potential. Specifically, dynamic assessment can assess learning processes, as opposed to a static form of performance, which is highly suitable with SEDG learners, who might not have previously encountered sophisticated material (Al-Hroub, 2019). Students who are thinking in unconventional ways but in highly sophisticated ways can be determined by creativity measures like open-ended problem tasks (Mann, 2009). Teacher referral systems should also be changed. Assessment literacy, cultural responsiveness, and bias mitigation are aspects of professional development that can be regarded as highly important in enhancing the accuracy of referral (Smeets et al., 2024). Ordered nomination procedures and universal screening programs guarantee that identification is not based on exclusively the teacher perceptions (Mun, 2020). In addition to identification instruments, school and community-based assistance is crucial. The opportunity structures can be reinforced through family engagement programs and early exposure programs that will help in talent development (Callahan, 2005). Equity-oriented scheduling, like conscientious cutoffs, universal screening, and measures of responsibility in representation must be a mandatory policy (Delgado-Valencia, 2025). Finally, there is a need of structural reform in equity-based identification systems. These mechanisms of redesigning policies, investing in teacher capacity and embracing culturally responsive tools are some steps in acknowledgement and development of mathematical talent among all learners especially those of disadvantaged backgrounds.

VI. SYNTHESIS AND IMPLICATIONS

The considered literature demonstrates that the issue of defining mathematical giftedness among SEDGs is multidimensional in its nature and based on the problem of conceptual, methodological, and structural constriction. Many definitions of giftedness with very narrow scopes, culturally skewed assessment instruments as well as the teacher referral engine are some of the factors that underrepresent SEDGs in gifted programs. Misrecognition or Misidentification- whether by oversight or improper categorization - is long-term in terms of academic access, self-image and upward mobility. This synthesis, as far as practitioners are concerned, implies that they should use inclusive, evidenced-based systems of identification. To policymakers, the results demonstrate why it is important that universal screening, multi-method assessment, and equity monitoring get to be implemented. Researchers would require longitudinal studies of gifted demarcations, through the prism of culturally responsive metrics and tests of mathematical creativity and rational manifestations, in a variety of settings.

VII. CONCLUSION

Since the identification of mathematically gifted students of SEDG is not just an assessment challenge, but a system equity issue. The present-day identification models are not always effective to identify the diversity of mathematical talents, particularly when they are manifested in non-traditional or culturally diverse forms. Alter Ego Contributes to Inequality Sustaining inequities for the long-term denies academic and STEM access. To achieve inclusive identification, the conceptual clarity, culturally

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responsive practices, and structural reformation are required. Re-conceptualizing definitions and measurement of mathematical giftedness in schools can offer opportunities to the professionals and policy makers to develop strategies that effectively enhance and nurture learning opportunities of every student.

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