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Lifting the Lid on Mathematics Grinds at Secondary Level in Ireland: Graduates' Perceptions of the Impact of Private Supplementary Tutoring

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Lifting the Lid on Mathematics Grinds at Secondary Level in Ireland: Graduates' Perceptions of the Impact of Private Supplementary Tutoring

In Ireland, 'grinds' is the term used for private supplementary tutoring (PT) outside of school, where a tutor teaches a particular subject in exchange for a financial gain. This practice has seen a global and national increase in recent years, mirroring trends in East Asia, particularly in the subject of mathematics. From an Irish perspective, despite its growing popularity, there is little evidence from the voice of the student and their experiences in relation to PT. This study explores the impact of grinds on secondary mathematics education from the viewpoint of Irish students who have finished school and progressed to higher education. An online survey conducted among first-year university students in three higher education institutions yielded 686 responses. The findings highlight the central position that mathematics grinds now occupy in Ireland, especially in the final year of secondary education. The research revealed mixed views regarding PT, with both positive and negative impacts identified. The secondary graduates appreciated the one-to-one support and improved confidence and grades that grinds could offer. Yet, they also criticized grinds for being costly, time-intensive, and contributing to educational disparities.

Keywords: private supplementary tutoring; grinds; secondary level; mathematics; impact; graduates' perceptions.

Background

The study aimed to 'lift the lid' and explore the viewpoints of school graduates on the impact of private supplementary tutoring (PT) (known locally as grinds) in mathematics at secondary level in Ireland. Grinds, as defined by Smyth (2009), are paid private lessons that supplement formal education. This practice, long established in East Asian nations due to cultural influences, has seen a rise in popularity across the globe (Bray 2023a). Shadow education, as it is known because much of its content mimics that in schooling, varies in prevalence and form across different cultures and countries (Bray 2023b). In some countries, like Greece (Tsiplakides 2018) and India (Choudhury et al. 2024), it is widespread, while in other countries

such as those in the Nordic region, it remains a modest yet growing sector (Laaksonen and Kosunen 2024). The increasing presence of PT has significant implications for mainstream education, influencing both teaching and learning (Zhang et al. 2022). Bray (2020) highlights that its expansion has brought to light the shortcomings of the formal educational system and it has now become too significant for policymakers to overlook.

However, while PT is increasingly recognised in educational discussions, there is a scarcity of empirical research on its impact, especially beyond the East Asian educational sphere, and particularly in Ireland. This study's foundations rest on Carroll's (1963) model of school learning, which proposes that learning efficiency is determined by the ratio of time devoted to learning versus the time required for learning. The multifaceted nature of 'time' within mathematics education, as highlighted in the work of O'Meara and Prendergast (2019), encompasses a range of aspects: allocated in-class time, 'hidden' out-of-class time, time spent on homework, and private tuition time. In line with Carroll's model, He et al. (2021) suggest that PT contributes additional time, thereby offering the potential to augment student learning. Nevertheless, this study posits that the relationship between PT and learning outcomes is not straightforward; while PT provides extra learning time, its impact can take different forms.

Impact of Private Supplementary Tutoring

Bray's (2014) inquiry into the efficacy of PT raises a complex issue that cannot be distilled into a simple yes-or-no answer due to its broad nature. However, the significance of PT's role in education, given its increasing global presence, warrants a thorough investigation into its impact. Zhang and Bray's (2016) analysis acknowledges the challenge in assessing PT's impact, attributing the difficulty to the myriads of variables involved. These variables include the diverse profiles of tutors, such as in-service teachers, retired educators, and university students. They also include the varied instructional settings ranging from individualised sessions to larger

groups, and the frequency of these sessions, which can vary from occasional to intensive, year-long engagements or concentrated periods preceding examinations (Hof 2014). Each of these factors can influence the outcomes of PT in unique ways. Despite the complexity of these variables, it is imperative to explore how PT can shape educational experiences and student achievement within schools, recognising that its influence can be both beneficial and detrimental. As such, a nuanced understanding of PT's multifaceted impact is essential for educators, policymakers, and stakeholders in the educational landscape.

He et al. (2021) highlight the integral role of PT as a complement to conventional schooling. The benefits of such supplementary education are manifold, encompassing not only catch-up sessions for missed learning opportunities but also the customisation of teaching methods and materials to meet individual needs (Zhang and Bray 2016). Specifically, one-on-one tutoring is particularly effective in adapting to a learner's unique requirements, enabling educators to gain a deep understanding of a student's abilities and areas for improvement, a point supported by both Ireson (2004) and Kim (2016). This tailored approach can significantly enhance the student's emotional and psychological engagement with the learning process and have a positive impact on the affective domain (Hajar 2018). For example, participants in a study by Gupta (2024) viewed shadow education during early schooling as important for fostering a positive attitude towards learning. It has also been suggested that when students spend extra time with a tutor on a particular subject, they tend to feel more comfortable and confident in that area (Walker and Zhang 2024). Such impact may be particularly pertinent in mathematics where students' attitudes towards the subject have been found to become more negative after they transition from primary to secondary school (Prendergast et al. 2019). Consequently, many view PT as invaluable in extending the amount of learning time and in realising an attitudinal shift towards learning, both of which have the potential to contribute to a student's academic success. This perspective underscores the positive impacts of PT.

However, PT may not always yield the intended benefits and can sometimes be detrimental. The core intention of PT is to augment students' learning time, yet it can inadvertently encroach upon their leisure and study time, potentially leading to exhaustion and a lack of engagement in regular school or social activities (Bray 2021). Furthermore, the academic literature presents a mixed picture regarding PT's efficacy in boosting academic performance. There is evidence that remedial tutoring is associated with positive academic outcomes (Hof 2014). In such instances, it can be argued that tutoring complements schooling by increasing the overall effectiveness of learning (Bray 2023b). However, Zhang et al. (2024) carried out a longitudinal study in China with over 1500 secondary school students to track the effects of PT on their mathematics achievements over a year. The research examined how participation in regular mathematics PT varied in effectiveness for students at different achievement levels. It was found that students in lower achievement quantiles experienced positive outcomes from PT, specifically in tasks requiring less complex cognitive skills. Conversely, PT did not show a significant impact on the higher-level cognitive achievements of these students or on students from higher achievement quantiles. Zhang et al. (2024) concluded that participation in PT might even lead to a reduction in mathematics achievement for high-achieving students, particularly at an advanced cognitive level. These findings underscore the need for further investigation to determine the conditions under which PT is most beneficial. Despite the potential for knowledge enhancement, the current body of research indicates that additional tutoring does not necessarily translate into improved academic results.

Certainly, the dynamics of shadow education are complex and multifaceted. While individual traits of tutors and learners play a significant role, there are additional factors that can influence the impact of PT. These factors may include inconsistencies between tutors' and regular teachers' pedagogical approaches (He et al. 2021; Zhang and Bray 2016). Such discrepancies can alter the learning dynamics within the classroom, affecting what students

learn and the timing and coherence of their learning experiences. Although different teaching methods can be equally valid, variations in mathematical approaches can cause confusion for some students. Moreover, private tutoring may prioritise academic performance over a student's comprehensive development, focusing on examination preparation rather than a deep understanding of the subject matter (Ireson 2004). This approach may lead to a mastery of test-taking techniques at the expense of conceptual learning (Zhang and Bray 2016).

Perhaps one of the core impacts of PT is that it can contribute to educational disparities. Despite the provision of ostensibly free education in early years, primary, and secondary levels in many nations, including Ireland, to ensure equal opportunities, the rise of PT challenges this notion. Bray and Ventura (2022) and Hajar and Karakus (2023) suggest that the primary motivation behind shadow education is societal competition. Although tutoring can benefit students lagging in their studies, it is predominantly sought by academically strong students from affluent backgrounds (Zhang and Bray 2016). Bray (2020) further observes that shadow education is often less about aiding those in genuine need who lack school support, and more about preserving the competitive edge of students who are already successful and well-off. In essence, as pointed out by Bray and Hajar (2023), the advantages of PT are not universally accessible due to financial cost, and it may worsen rather than mitigate social inequalities.

Private Supplementary Tutoring in Mathematics

The prevalence of PT spans various disciplines, yet it is particularly pronounced in mathematics. Research by Zhang et al. (2022) highlights that mathematics has become the dominant subject within the realm of shadow education. This is echoed by a study from the UK by Ireson and Rushforth (2005), which revealed a higher demand for PT in mathematics compared to other subjects. Specifically, 19% of Year 13 students (ages 17-18) were receiving PT in mathematics, in contrast to the 8% receiving PT in English, the second most sought-after

subject. Moreover, the study indicated that PT for other academic subjects was less common, with less than 3% of students participating across other curricular areas. These observations are corroborated by the findings of Kim and Jung (2019) in South Korea and Zhang et al. (2022) in China who noted a particularly strong demand for PT in mathematics.

Such heightened demand for additional mathematics instruction can be attributed to a multitude of interconnected factors. Mathematics holds a distinguished place in education and is universally acknowledged as a foundational discipline, essential for the development of other academic subjects. The domains significance also extends beyond the classroom, being a vital prerequisite for a wide range of employment opportunities and advanced studies (O'Meara et al. 2023). In Ireland, for instance, mathematics is a core subject, with students engaging in its study during both the Junior and Senior Cycle. However, there are many challenges with the breadth of these courses, particularly at the advanced level, and many students struggle to balance the amount of time and workload required (Treacy et al. 2023). Students in McCoy and Byrne's (2024) study drew attention to the role of PT in revising content in a subject where teachers struggle to complete the course by the end of term. Furthermore, the subject's global reputation for difficulty, as highlighted by Smyth et al. (2011) and Coe et al. (2008), underscores the necessity for additional instruction. Consequently, the phenomenon of shadow education has a pronounced impact on the teaching and learning of mathematical concepts, potentially more so than content in any other school subject.

An Irish Perspective

In Ireland, 'grinds' is the local term used for PT. It was previously noted that the provision of PT has expanded internationally, and the case is no different in Ireland. In a study from 2009, Smyth observed a rise in the number of students receiving grinds, with 45% of surveyed students in their final year of secondary education in 2003 participating, up from 32% ten years

prior. More recent data from the 'Growing up in Ireland' study by McCoy and Byrne (2024) suggests this trend has continued, with nearly 60% of students in their final year engaging in shadow education. The emphasis on mathematics grinds was particularly notable, reflecting a broader international trend towards prioritising this subject due to its difficultly, workload, and significance in educational outcomes.

The importance of the Leaving Certificate (LC) as a determinant for higher education entry cannot be overstated, with Smyth and Banks (2012) emphasising its critical impact on the prospects of young individuals. The high stakes nature of this examination system has been a catalyst for the surge in grinds in Ireland, especially in mathematics, where a passing grade in the subject is a requisite for many university courses. The introduction of a Bonus Points initiative (25 extra points for achieving a pass grade in Higher Level (HL) mathematics) was intended to encourage higher participation in the subject at an advanced level. However, this policy has not been without criticism. Many mathematics teachers feel it has inadvertently fostered a culture where financial investment in grinds is seen as a solution to academic challenges. For example, in a study by Prendergast et al. (2020), some responding teachers voiced concerns that the awarding of Bonus Points is promoting a "grind culture" in the subject where if "a parent throws enough money at the problem, the problem will be solved…" (Teacher response in Prendergast et al. 2020, 760). This consequence echo's Bray's (2021) findings on the mixed effects of shadow education, and suggests a complex interplay between educational policies, societal expectations, and the realities of academic achievement in Ireland.

The scarcity of studies examining the impact of PT, especially beyond the East Asian sphere, has been noted. This paper's research was designed to 'lift the lid' and delve into the perspectives of Irish school graduates regarding the impact of the 'grinds culture' within secondary level mathematics. The objective was to examine this issue more closely by

addressing the following research question; What are school graduates' perceptions of the impact of mathematics grinds at secondary level?

The Study

This paper is a part of a larger study in which the authors designed an online survey to explore school graduates' perspectives on the extent, characteristics, motivations, and impact of the prevalent tutoring practices in Ireland's secondary level mathematics education. An online survey was structured to yield both quantitative and qualitative data, incorporating binary options, multiple-choice items, Likert-type scales, and open-ended questions. It was adapted from the authors' previous research investigating mathematics teachers' perceptions on the grinds culture (see Prendergast et al. 2022), and one of the sections focused specifically on the impact of grinds. Graduates who had received PT in mathematics while in secondary school, were asked to indicate their level of agreement with a series of seven statements on the impact of grinds on various domains using a five-point Likert scale (see Table 1). The seven statements focused on distinct items (e.g., students' assessment performance, conceptual understanding, attitudes, etc.) that were previously identified by the authors as important in gauging the impact of PT. Four of the statements related directly to the impact of grinds on students' knowledge, understanding, and performance in mathematics. For example, 'In general, receiving grinds increases students' understanding of mathematical concepts'. Two of the remaining three statements were associated with the impact of grinds on the affective domain. For example, 'In general, receiving grinds improves students' attitudes towards mathematics'. The last statement focused on the impact on students' behaviour in the classroom. In the finalised instrument, these Likert scale statements were followed by an open-ended question where all respondents were asked for comment on their perspective regarding the impact of grinds in secondary mathematics.

Table 1. Likert Scale on the Impact of Grinds

In general, receiving grinds…….	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
Increases students' performance in mathematical assessments					
Increases students' overall knowledge of mathematics					
Increases students' understanding of mathematical concepts					
Increases students' problem-solving capabilities					
Increases students' confidence in mathematics					
Improves students' attitudes towards mathematics					
Positively alters students' behaviour in the classroom					

The target sample for this study was graduates who had studied mathematics at secondary level in Ireland. With this in mind, the authors decided to circulate the survey to first year students in three higher education institutes (HEIs). These institutes were selected using purposive sampling and included two universities and one technological university. The online Qualtrics survey link was emailed to first-year course directors in each of the three HEIs and they were asked to share it with their students. The online link was left open over a three-week period in November 2022 and 686 students responded to the survey. Data from the Higher Education Authority (HEA) (2023) show that there were 46,020 new entrants to undergraduate study across 18 HEIs in the 2022/23 academic year. In the three HEIs selected for our study there were 9,760 first-year undergraduate students, which indicates a low response rate of approximately 7% for our survey. There are likely to be varying reasons for this. For example, international students make up 13.7% of the student population in Ireland (HEA, 2023). While the highest proportion of these are enrolled at postgraduate level, within the 9,760 students, there will have been many international students for whom the survey was not relevant. Additionally, it's possible that some course directors may not have shared the link with their

students, and many students who did receive the link will have chosen not to participate for a variety of reasons. However, despite the low response rate, there was a high item response rate across the survey by those who did participate. For example, after the raw data was cleaned and missing data had been assigned an omitted value, 310 out of 350 (89%) responses to the Likert Scale Statements were deemed valid data values. Bowling (2005) notes that a higher item response rate is one of the advantages of self-administered electronic surveys in comparison to traditional pen and paper methods.

The quantitative data for this paper, which provided information on graduates' level of agreement on the impact of grinds on various aspects, was recorded in SPSS (Version 26.0). These responses were only sought from participants who identified as having received grinds in mathematics at secondary level (n = 350). The set of seven Likert scale statements were not designed by the authors to combine into a summated rating scale and responses to each item were analysed individually using descriptive statistics. Beyond the descriptive statistics, there was also some basic comparative analysis of responses to identical survey questions that were part of the authors' previous research which looked at mathematics teachers' perceptions of the impact of PT.

The data from the open-ended question was transcribed into a Microsoft Word document and Braun and Clarke's (2021) thematic analysis framework was used to analyse the data. An inductive "bottom up" orientation guided the analysis and was used to identify themes generated through the perceptions of participants in this study. Implementing Braun and Clarke's (2021) six phases in the process of thematic analysis provided a framework for data engagement, coding, and theme development. Both authors engaged in the analysis, and this ensured a collaborative and flexible process, with repeated movement back and forth as initial codes were generated from individual transcripts and grouped into preliminary themes. The theme development, review, and refining phases involved several iterations of regrouping and

renaming themes until both authors felt the final themes and sub-themes uniquely captured participants perceptions regarding the impact of grinds from both a positive and negative perspective.

Findings

As noted, 686 first-year higher education students responded to the survey, 61% of whom identified as female and 38% as male. While this gender disparity is more pronounced, it is in-line with a consistent gender imbalance in higher education in Ireland. For example, the HEA (2023) reported that females account for 54.5% of the overall student population in Ireland. The respondents were enrolled on a wide range of courses across the three HEI's in the areas of Arts, Engineering, Health, Business, Science, and Education. Of the responding students, 350 (51%) identified as having received grinds in mathematics while in secondary school. However, the numbers varied widely depending on the year of study in which they received grinds. For example, of those who received grinds in mathematics, 3% and 8% reported receiving grinds in First and Second Year respectively. The Junior Cycle culminates with a state examination in all subjects at the end of year three, and so, it is unsurprising that the percentage of those who received mathematics grinds in Third Year jumped to 33% (or 17% of all survey respondents). The percentage of students receiving extra mathematics tuition increased throughout the two-year Senior Cycle, with 36% in Fifth Year (or 19% of all respondents) and 89% in Sixth Year (or 46% of all respondents), as students prepared for the high stakes LC examination. For this examination, 75% of respondents in this study opted for mathematics at HL. Notably, this figure was consistent across those who had received and those who had not received mathematics grinds. It also deviates significantly from the national percentage of students (37%) who took the LC HL mathematics examination in 2022 (SEC 2024).

In terms of structure, typically the tutoring sessions involved individualised attention, with 57% of sessions being one-on-one and the remainder being small groups. The majority of these sessions, 81%, occurred weekly. Furthermore, a considerable portion, 41%, were conducted face-to-face. It is noteworthy that one in four grinds took place virtually, while the remainder were a mixture of both face-to-face and online.

Graduates who had received mathematics grinds were asked to indicate their levels of agreement with each of the seven statements regarding the impact. As evidenced from Figure 1, 279 (90%) of those who responded to this question (n = 310) agreed that receiving grinds increases understanding in mathematics.

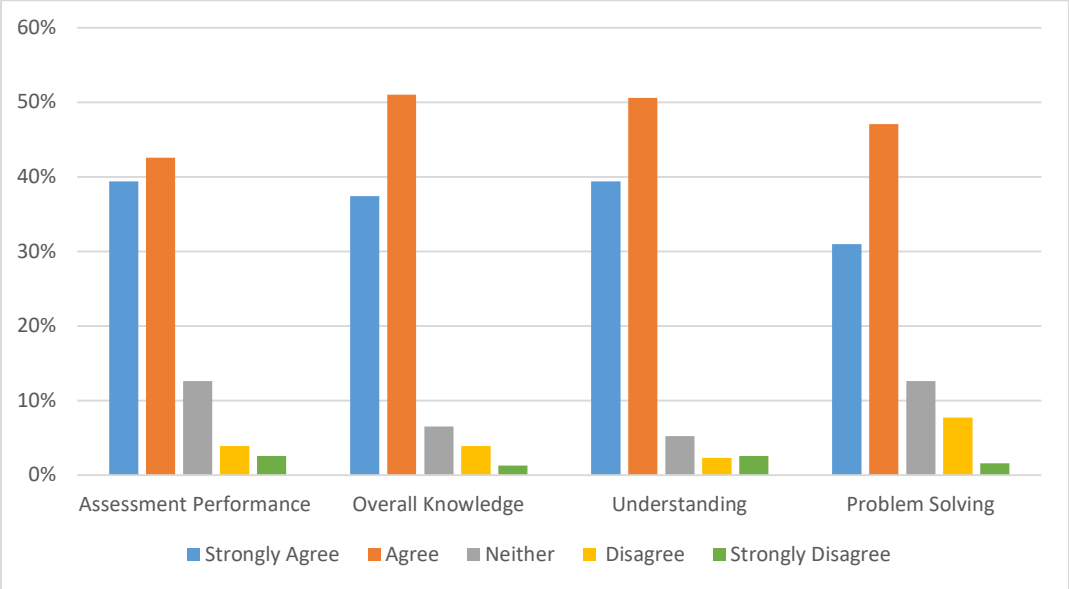


Figure 1. Graduates' Levels of Agreement as to the Impact of Grinds on Improving Various Domains

Regarding the affective domain and classroom behaviour, 260 (84%) graduates were in agreement that receiving grinds increases students' confidence in mathematics. 164 (53%) agreed that receiving grinds positively alters behaviour in the classroom.

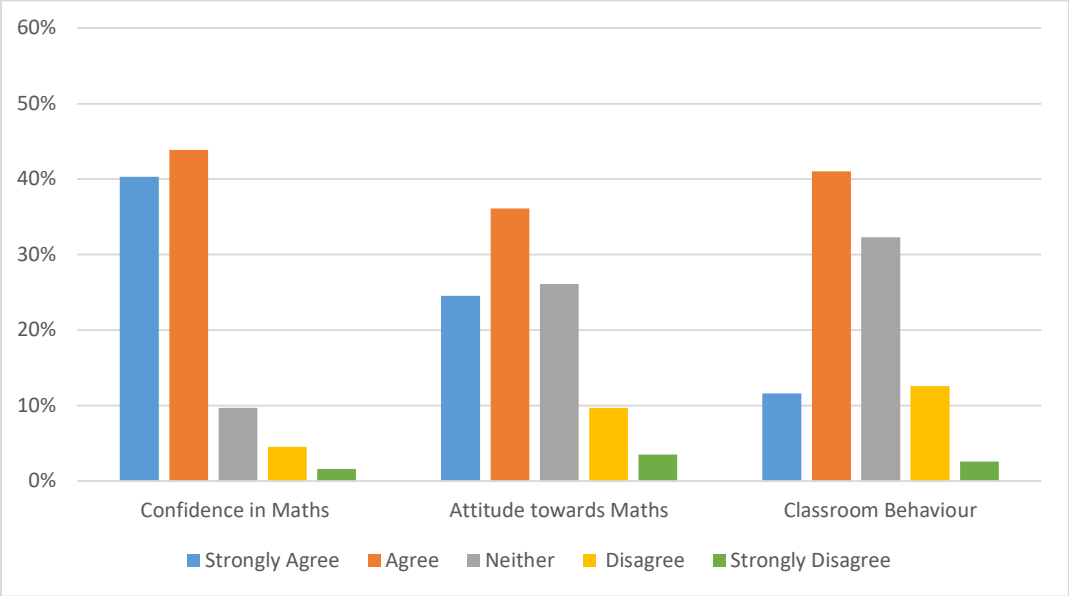


Figure 2. Graduates' Levels of Agreement as to the Impact of Grinds on Improving the Affective Domain and Classroom Behaviour

The authors also carried out a cross-tabulation comparing each of these seven statements against the responses of teachers who identified as giving/ not giving grinds from Prendergast et al.'s (2022) study. In some cases, as evidenced in Table 2, there were minor differences in the levels of agreement between the three groups. For example, in relation to grinds increasing students' confidence in mathematics. However, there were also some noteworthy differences evident in the comparisons, particularly between the graduates (who had all received grinds) and teachers, particularly those who did not give grinds. For example, 78% of responding graduates agreed that receiving grinds improves problem-solving capabilities. Conversely, only 46% of teachers who identified as giving grinds agreed with the same statement. This figure fell to 26% for teachers who did not give grinds.

Table 2. Comparing Responses of Graduates and Teachers who Agreed/ Strongly Agreed with each Statement (%)

In general, receiving grinds…….	Graduates who received Grinds (%)	Teachers who gave Grinds (%)	Teachers who did not give Grinds (%)
Increases students' performance in mathematical assessments	82	84	70
Increases students' overall knowledge of mathematics	88	75	64
Increases students' understanding of mathematical concepts	90	59	41
Increases students' problem-solving capabilities	78	46	26
Increases students' confidence in mathematics	84	89	78
Improves students' attitudes towards mathematics.	61	51	28
Positively alters students' behaviour in the classroom	53	47	28

These quantitative findings were further supported through the open-ended question where school graduates who had both received and not received mathematics grinds in their secondary education were asked for comment on their perspectives regarding the impact of PT. Analysis of this data highlights the mixed views of graduates with both positive and negative impacts identified.

Positive Impact of Grinds

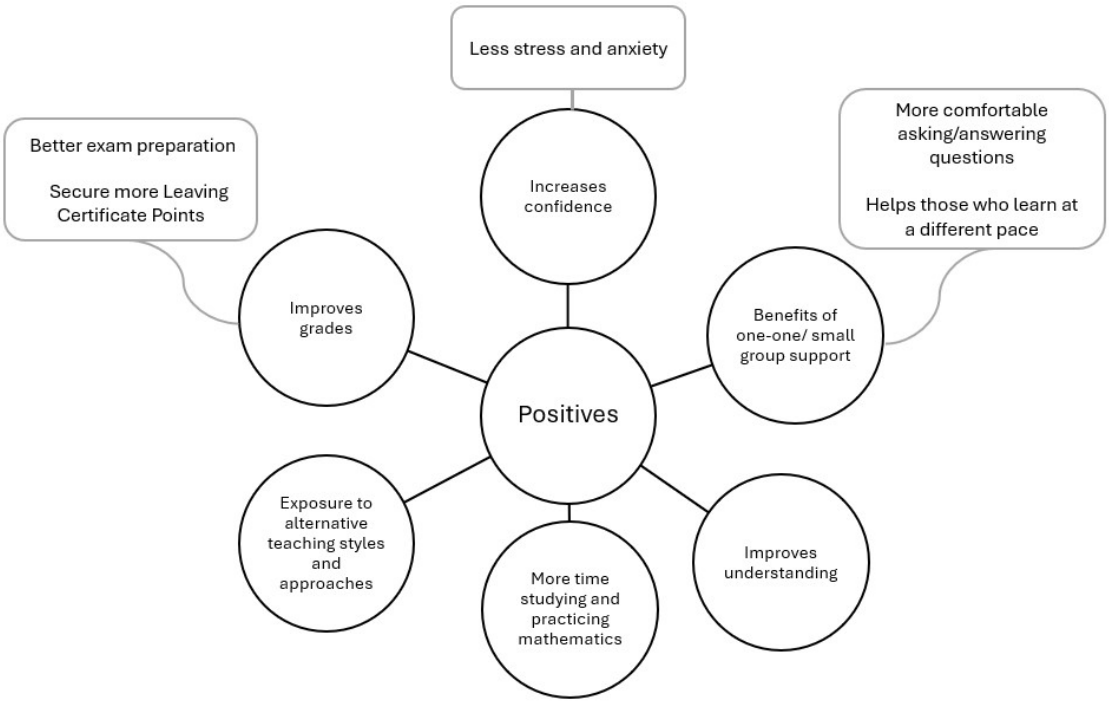


Figure 3. Positive Impact of Grinds

From a positive perspective, there were six core themes, and five sub-themes identified from the data. Each of these themes were evident in the data of both sets of graduates i.e., those who had received mathematics grinds and those who had not while in secondary school. Four of these themes were also evident in the findings of Prendergast et al.'s (2022) study in relation to teachers' perspectives of grinds, namely the 'Benefits of one-one/ small group support', 'Improves grades', 'Increases confidence', and 'Improves understanding'.

The three themes positioned in the top half of Figure 3 were the dominant positive impacts generated from the data. The theme of 'Improves grades' generally related to performance in the LC mathematics examination which students must take at the end of secondary education. Many respondents felt that PT helps performance in this high stake's examination.

S101: Doing better in the leaving cert and receiving a better grade that I definitely would not have achieved without the grind.

A common sub-theme within 'Improves grades' was 'Better exam preparation'. Respondents felt that the extra help from tutors is useful in terms of examination revision and in knowing what to do in an examination situation (e.g., "Exam answering techniques are developed further" [S4] and "More knowledgeable about the paper layout and patterns in the questions every year" [S17]). The other sub-theme within 'Improves grades' was 'Secure more Leaving Cert points'. The responses in relation to this sub-theme were mainly related to the extra Bonus Points that students can secure if they achieve a passing grade in HL LC mathematics.

S280: It allows for higher points to be achieved as students that previously would have failed higher level mathematics will be granted 25 bonus points through passing the subject.

In line with the quantitative data, many graduates also mentioned 'Increases confidence' as a positive impact (e.g., "Just overall confidence to better tackle the monster of a subject" [S302] and "Helps them be more confident in answering a maths question" [S3]). Within the 'Increases confidence' theme, a sub-theme in relation to 'Less stress and anxiety' was identified. One graduate noted that through grinds "Maths doesn't become as scary" [S20] and another remarked that grinds can "Improve the mental health of those students who would otherwise struggle with maths" [S184].

Similar to the findings from the authors previous study in relation to teachers' perspectives of grinds, the 'Benefits for one-one/ small group support' was a core theme. For example, one respondent highlighted how "being taught one-on-one or in smaller groups can make it easier to learn" [S247]. Within this theme, there were also two sub-themes generated from the data. Firstly, many felt students are 'More comfortable asking/answering questions' in one-one or small group settings. Respondent S176 remarked how "Sometimes it is

intimidating to ask a question or show you are struggling in a big class". Secondly, graduates believed that grinds 'Helps those who learn at a different pace'.

> S169: For those struggling with the speed in class they can go at a slower pace and focus just on what they find difficult. For those who do very well they can focus and much more challenging problems that a teacher may not be able to tackle with a whole class.

'Improves understanding' was another positive theme from the data in relation to the impact of grinds. As summed up by one graduate "It allows you to become more comfortable in answering questions and also allows you to gain a deeper understanding and knowledge of the subject " [S167].

As mentioned, the four themes presented thus far were also evident in the findings of Prendergast et al.'s (2022) study in relation to teachers' perspectives of grinds. The two themes that were distinct to the graduate data are 'Extra time doing and practising maths' and 'Exposure to alternative teaching styles and approaches'. It has been well documented that many stakeholders feel there is a shortage of class time for teaching mathematics in Irish secondary schools (O'Meara and Prendergast 2019). Some of the graduates in this study alluded to these time constraints and felt that grinds provide an opportunity to go over specific areas of mathematics that the schoolteacher might not have time to go through in class. As noted by respondent S216, grinds enable students to "Take the time needed to fully comprehend the subject rather than the rushed designated time in class". In terms of the 'Exposure to alternative teaching styles and approaches', respondents felt that grinds can help students approach problems from different perspectives and learn new methods that may be clearer to them. As articulated by respondent S7, grinds can help students to "See different and perhaps easier ways for them to approach and solve maths equations".

Negative Impact of Grinds

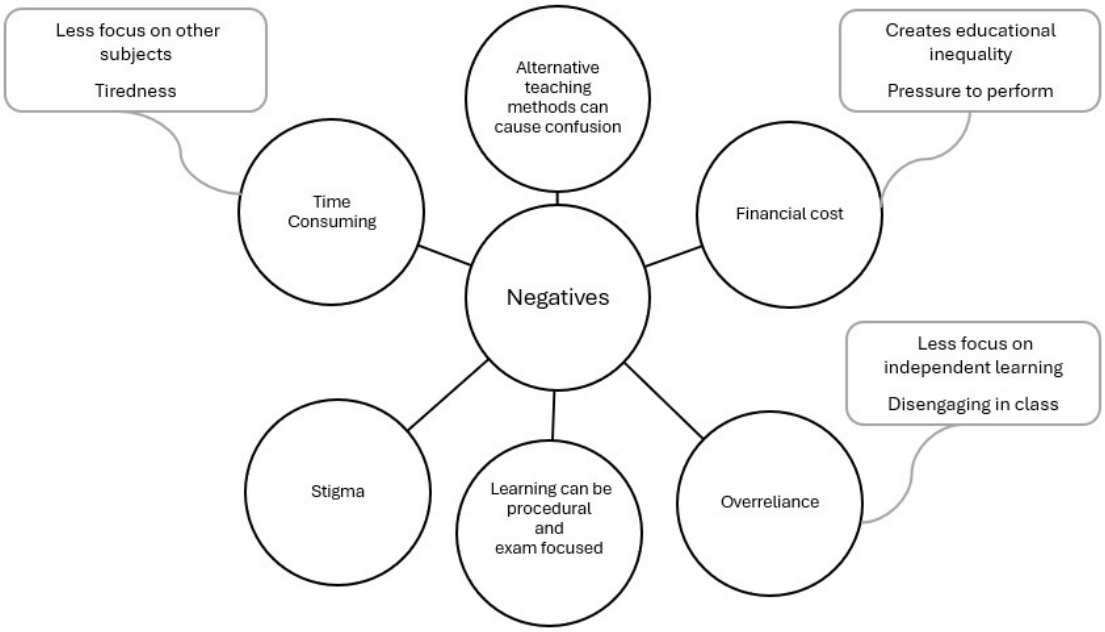


Figure 4. Negative Impact of Grinds

From a negative perspective, there were six core themes, and six sub-themes identified from the data of all graduates in the study who responded to this question. Similar to the positive impacts, four of these were also evident in the findings of the authors previous study in relation to teachers' perspectives of grinds, namely, 'Learning can be procedural and exam focused', 'Alternative teaching methods can cause confusion', 'Disengaging in class', and 'Creates education inequality'. However, the other themes and sub-themes identified through the analysis were specific to the graduate data.

Once again, the three themes positioned in the top half of Figure 4 were the dominant negative themes generated from the data. Many graduates referred to the 'Time consuming' nature of grinds as a negative impact in terms of how they "take up a lot of time outside of an already filled schedule" [S455]. As summed up by respondent S516:

S516: It is time consuming, and it can take time from a student that would otherwise be spent relaxing (e.g. in the weekend) or a time where they could be practicing questions themselves instead of listening to a teacher explain what they have already learnt in class.

A common sub-theme within this was that grinds allowed 'Less focus on other subjects'.

S540: It takes away from time being spent studying other subjects or alone time, which is crucial for students with the stress of exams.

This can often lead to students "falling behind in other subjects" [S354] and getting "hyper-focused on mathematics" [S618]. The other sub-theme identified regarding the 'Time consuming' nature of grinds was 'Tiredness'. This was generally related to the scheduling of PT. For example, respondent S09 referred to "exhaustion as they [grinds] usually took place in the evening so can make it hard to concentrate".

As well as mentioning time, many graduates also referred to the 'Financial Cost' and expensive nature of grinds.

S544: The cost - they're very expensive (40 euro a week) which is an extra unnecessary fee parents feel obliged to pay in order for their kids to gain the extra marks in their exams.

This 'Financial Cost' has a knock-on effect and 'Creates educational inequality'. It must be noted that this was a dominant sub-theme in the responses of both sets of graduates i.e., those who had received (e.g., S563) and those who had not received (e.g., S340) mathematics grinds in secondary school.

S340: Creates a system where those from a better off background achieve better results perpetuating the class system.

S563: Those who can afford grinds will generally do better than other students, which is an unequal way of constructing an education system.

Another knock-on effect of the 'Financial Cost' is the 'Pressure to perform'. Respondents felt that often students who were receiving grinds believed they "had to do well since they were receiving outside help and were paying a lot of money for grinds" [S378]. The pressure from some parents was also mentioned. For example:

> T275: Often students who receive grinds in mathematics are from wealthy education-obsessed backgrounds. The pressure to perform in education so early in life can have long-lasting damage. I feel education is great and powerful but that must be learned rather than enforced as receivers of mathematics grinds often experience.

The 'Exposure to alternative teaching styles and approaches' was highlighted as a positive impact of grinds in the previous section. However, similar to teachers in the Prendergast et al. study, many graduates also felt that such 'Alternative teaching methods can cause student confusion'. As summed up by one respondent, "Different people have different ways of teaching, and this can be confusing especially in a subject like maths" [S500]. Furthermore, respondent S405 stated:

> S405: In my case my schoolteacher had different methods of solving problems than my grinds teacher did. This sometimes became very confusing for me as I would get confused on what we were doing.

While not as dominant as other themes in the data, the theme of 'Stigma' is noteworthy. Several graduates felt there was a negative stigma associated with grinds and they gave examples of this from multiple perspectives. For example, there was the "shame" associated for needing extra help in mathematics, and how this was "looked down upon by some people" [S470]. On the other hand, there was the stigma of being able to pay for extra help while others might not be able to. The was best summed by respondent S306 who stated:

> S306: Stigma from people who aren't able to afford grinds. It can make you feel uncomfortable when you can afford it and people make you feel bad about it.

In terms of 'Learning being procedural and exam focused', some graduates felt that grinds often don't focus enough on promoting understanding and "can be very geared towards passing the exam rather than really comprehending the material" [S593]. With regard to 'Overreliance', some respondents felt that students "assume they don't have to put in any work themselves" [S480] and can become "over-dependent on extra help and on someone showing them how to do things" [S246]. This can lead to 'Less focus on independent learning' and

students can find it “hard to figure out problems themselves and complete questions on their own” [S442]. Such ‘Overreliance’ can also lead to ‘Disengaging in class’. As stated by respondent S490:

> S490: Sometimes people feel they do not need to try as hard in their mathematics classes in school as they know they will be covering the topic in grinds as well.

Discussion

The findings of this study confirm the mixed views in relation to the impact of PT that is permeating mathematics at secondary level in Ireland. From the quantitative data, it is obvious that the majority of graduates who received grinds in secondary mathematics were in agreement regarding the positive impacts. However, while there were also many positives identified in the open-ended responses, there were also several negative impacts raised. Many of the findings are in line with international literature and emphasise that while there are positives aspects to PT, there are also very problematic ones (Bray 2021). From the qualitative data, it is important to note that each of the themes were generated from the data of both sets of graduates i.e., those who had received and those who had not received mathematics grinds in secondary school. The following discussion focuses on the leading themes that were identified in terms of the positive and negative impacts.

From a positive perspective, ‘Improves Grades’ was a central theme, and many respondents felt that students who received grinds were able to “attain better results than they would otherwise”. This finding was supported by the quantitative data, where 82% of graduates who had received PT agreed that it increases performance in mathematical assessments. This perception is at odds with some findings from the literature which question the effect of PT participation on secondary students’ mathematical achievement (e.g., Zhang et al. 2022; 2024). The main ‘assessment’ that was referred to in the qualitative data was the LC mathematics

examination which Irish students must take at the end of secondary education. As mentioned in the review of literature, the LC is a high stakes examination in terms of determining students' entry into higher education (Smyth and Banks 2012). Regardless of inconsistent evidence, the perception amongst respondents was that receiving grinds can help students "Improve their leaving cert result, giving them more points and therefore more academic options" [Respondent S270]. The rewards are even more pronounced in mathematics given the extra 25 'Bonus Points' that students are awarded in their overall LC examination results if they achieve ≥ 40% in HL mathematics. These Bonus Points were regularly referred to by respondents within the sub-theme of 'Secure more Leaving Cert points'. In terms of policy, these findings once again question the influence of the Bonus Points in promoting the uptake of grinds in mathematics and reducing the subject to a 'vehicle for points' (Teacher response in Prendergast et al. 2020, 759). It is noteworthy that there was a 142% increase (19% to 46%) in those who had received mathematics grinds in Sixth Year of secondary school as compared to Fifth Year. This is certainly different to the trend of shadow education in some Asian countries where students engage with PT throughout their education, and not just in their final year of schooling. For example, Bray (2023b) detailed some cross-national indicators which showed that 44% of students in China and 52% in Japan had received private tutoring during their lower secondary education.

The findings in this study showed that the PT sessions were generally structured to provide individualised attention, with 57% of sessions being one-on-one and the remainder being small groups. There is no doubting the 'Benefits of one-to-one/ small group support' that grinds can provide. As summed up by one respondent, "Grinds have a more personal approach to the student and only focus on the aspects of mathematics that the student struggles with" (S246). The benefits of such individualised instruction were highlighted by Hajar (2018) in a UK based study. A participant in the study expressed that one-on-one interaction with a tutor

who provides tailored advice for specific tasks, was particularly advantageous. This sentiment echoes the conclusions drawn by Kim (2016), highlighting that grinds are effective in catering to the unique needs, learning preferences, and educational objectives of each student. The review of literature review highlighted that tailored attention can significantly influence the affective domain of students (Hajar 2018, Gupta 2024). Addressing the unique needs and interests of each student can foster a more engaging and supportive learning environment, which in turn increases confidence. This was also a core theme generated in the qualitative data. For instance, one respondent (S280) stated that "Grinds allow students to feel more confident and self-assured". Furthermore, within the 'Increases confidence' theme, a sub-theme in relation to 'Less stress and anxiety' was identified. This is noteworthy given the well documented issues around the affective domain in mathematics, which for Irish secondary students is often associated with low confidence, low self-concept, and mathematics anxiety (Lane et al. 2014).

Bray (2020) stated that PT can sometimes be counterproductive. From a negative standpoint, the most mentioned impacts were in terms of cost, from both a time and a money perspective. In line with Carroll's (1963) model of school learning, He et al. (2021) suggest that PT contributes additional time, thereby offering the potential to augment student learning. However, many responding graduates referred to the 'Time consuming' nature of grinds as a negative impact in terms of how "Students have less free time in the evenings/weekends which can cause burnout." [S619]. Respondents felt the scheduling of PT often led to 'Tiredness'. For example, respondent S09 referred to "exhaustion as they [grinds] usually took place in the evening so can make it hard to concentrate". McCoy and Byrne (2024) found that, in general, Irish secondary students don't connect their participation in PT and their wellbeing. However, considering that engagement in grinds can consume a lot of a student's leisure time, it is important to further assess how this can impact their physical and mental health (Choudhury et

al. 2024). Another sub-theme within ‘Time Consuming’ was that grinds allowed ‘Less focus on other subjects’. This can be related to an issue highlighted in an article by Lynch and McGarr (2016) in which they raised questions regarding subject hierarchies that exit in Irish secondary level education. The Irish Government’s promotion of advanced mathematics through the Bonus Points initiative suggests a certain preference for graduates with strong mathematical skills. This, along with the ensuing grind culture in the subject, has led some students to get “hyper-focused on mathematics” [S618]. As summed up by respondent S582, mathematics grinds can “take away time you can spend on other subjects you're good at, thus putting all your grades at risk”.

The impact of grinds on social inequalities was a repeated concern in the review of literature and this was apparent in the graduate data through the theme of ‘Financial cost’, and particularly how it ‘Creates educational inequality’. The PT market is modestly estimated at €60 million at secondary level in Ireland (as noted in McCoy and Byrne 2024). It is obvious that wealthier families have the means to afford more regular and higher-quality tutoring compared to families with lower incomes (Bray and Hajar 2023). This creates a gradient of educational advantage that correlates with family wealth. Such advantage is even more pronounced in Ireland given the high stakes nature of the LC examinations in determining entry to higher education. As noted in the literature review, the impact of PT in maintaining and exacerbating social inequalities challenges the basic assumptions about the egalitarian and fee-free nature of the Irish education system.

While ‘Exposure to alternative teaching styles and approaches’ was identified was a positive impact of grinds by some, many respondents believed ‘Alternative teaching methods can cause confusion’. It is well documented in the literature that there can often be a pedagogical conflict and lack of coherence in the approaches of the tutor and the class teacher (He et al.

2021; Zhang and Bray 2020). From the class teacher's perspective, "it changes who in their classrooms learns what, when, and where" (Bray 2022, 73). From a student's perspective, "it can cause confusion when being taught in different way to school" [Respondent 558]. As articulated by Bray and Hajar (2023), this issue highlights that PT is not simply a neutral shadow; rather, it can have a backwash on the system that it imitates.

To conclude the discussion, the similar and contrasting views of graduates in this study with teachers in Prendergast et al.'s (2022) study were notable. For example, the vast majority of graduates and teachers agreed that grinds can increase students' confidence in mathematics. The positive impact on confidence was also prevalent in the responses of graduates and teachers to the open-ended questions. However, there were also notable differences in the perceptions particularly with teachers in Prendergast et al.'s study who identified as not giving grinds. For example, while 90% of graduates who had received mathematics grinds agreed that PT increases understanding of mathematical concepts, only 59% of teachers who identified as giving grinds agreed with the same statement. This figure fell to 41% for teachers in agreement who did not give grinds. Finally, it is noteworthy that one of the main impacts of tutoring that was identified in the literature and in the graduate data was that it 'Creates educational inequality'. However, this impact was only noted by 4 (2.5%) of the teachers who responded to the same question in the Prendergast et al. (2022) study. The teachers' perspectives on the impact tended to be micro-level and classroom related, such as students disengaging in class. On the other hand, the graduates were more cognisant of the macro-level impacts, particularly regarding the social stratification in the uptake of PT.

Conclusion

This research set out to explore school graduates' perceptions of the impact of the grinds culture in mathematics at secondary level in Ireland. While the findings may be of interest to educators

or researchers in the field of mathematics education, particularly in Ireland, they should be considered within the confines of the limitations of the research. The paper focuses on the impact of PT. However, the data is limited to graduates' perceptions of impact rather than empirical data on the actual impact. Future research on PT in Ireland should consider a longitudinal design which can track the impact of grinds on various measures (e.g., students' assessment performance, conceptual understanding, attitudes, etc.) over a prolonged period. The authors are also cognisant of the low response rate of approximately 7% and the fact that the 686 students who participated in the survey were recruited voluntarily using non-probability sampling. It's possible that these responding students were those with the most pronounced views on the impact of PT in mathematics, potentially leading to a bias in the findings. For example, 61% of respondents were female and McCoy and Byrne (2024) found that female students were 1.2 times more likely to engage with PT than males. Moreover, it is important to highlight that the respondents were recruited from a sample of first-year higher education students. While approximately 64% of each year's LC cohort progresses onto higher education (DES 2023), the sampling for this study did not allow for the perspectives of school-leavers who pursued pathways other than higher education. As mentioned previously, three-quarters of the respondents studied HL mathematics for the LC, a proportion that significantly deviates from the national average. Thus, for this sample, there is little surprise regarding the perceived importance of grinds for improving grades to pass the LC examination and achieve Bonus Points to meet the minimum entry requirements for many university courses. There may not have been the same focus on examination preparation and securing more LC points for a sample of graduates who pursued pathways other than higher education or who, in the majority, did not study LC HL mathematics. These graduates, whether they received or did not receive grinds in mathematics, may have held different perceptions of the impact of PT at secondary level.

Notwithstanding these limitations, the research outlined in this study is timely and makes an important contribution in highlighting the voices of a sample of secondary school graduates and their experiences in relation to PT. Although a large majority of respondents agreed that receiving grinds increases understanding and overall knowledge of mathematics, it is clear from the qualitative data that graduates felt that grinds can be costly, particularly in terms of time and money. Moreover, they can inadvertently perpetuate a system where only those with sufficient resources can afford the advantages, thereby exacerbating educational inequalities. These, along with the other positive and negative impacts identified, need to be carefully considered by all members of the tutoring triangle (tutors, students, and parents) before participating in shadow education. There is a delicate balance required to ensure PT serves as a complement to, rather than a substitute for, formal education, and enhances the learning experience without detracting from the foundational role of traditional schooling.

In Ireland, a confluence of factors is creating a challenging situation with regard to mathematics education and an increasingly prevalent grind culture in the subject . The attraction of Bonus Points is compelling even those students who struggle with mathematics to study it at advanced levels (Prendergast et al. 2020; Treacy et al. 2020; O'Meara et al 2023). For many, it is a question of whether the risk of passing the HL LC examination outweighs the risk of failing it. For example, a student who achieves 90-100% in the Ordinary-Level (OL) mathematics examination is awarded 56 LC points. If the same student achieves a passing grade in the HL paper (40-49%), they are awarded 46 points and the additional 25 Bonus Points, resulting in a total of 71 LC points. While there is a danger of failure, many students, parents, and indeed teachers see the uptake of PT as a necessity in mitigating such risk. However, although grinds have the potential to improve student confidence and performance in the LC, they also bring into question the depth of understanding they impart, often favouring rote procedures over a true grasp of mathematical concepts. This was highlighted by some graduates in this study who

observed a focus on examination techniques rather than fostering genuine comprehension of mathematical concepts.

To conclude, the phenomenon of PT is increasingly becoming a global norm, with its continued expansion seeming almost certain. Byun and Baker (2015) suggest that the practice of providing 'grinds' is deeply entrenched within formal education systems and is therefore not likely to be prohibited or become obsolete. Baker (2020) further emphasises the inevitable nature of this trend, predicting its escalation in the coming years. However, Benz et al. (2024) caution against “universal” policy implications regarding PT as it can differ across countries and across educational systems. This underscores the importance of national studies, such as this, on international issues and highlights the value of this paper in ‘lifting the lid’ and understanding the perceptions of Irish secondary school graduates on the grinds culture. In this case, while many of the findings regarding the perceived impact of PT may be familiar to those well-versed in international literature, it is still important to build this evidence base from a national perspective. Further still, it is imperative to interpret such findings in the context of Irish educational polices, such as the effect of the LC as a high stake’s examination or the awarding of Bonus Points for HL LC mathematics. Consequently, ongoing research is vital to further understand shadow education, both from a national and international perspective, and to theorise its growing prevalence, underlying forces, and policy implications, within mathematics education, as well as in other disciplines.

Data Availability. The participants of this study did not give written consent for their data to be shared, so supporting data are not available.

Ethics Approval. The research has received ethical approval from the EHS Ethics Committee at the University of Limerick (Reference number: 2022_10_11_EHS(ER)).

Conflicts of Interest. The authors declare no conflicts of interest.

Consent to Participate. Informed consent was obtained from all participants in the study.

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