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Research Article

Investigating the status of highly able students through the lens of the Lebanese national policy and the mathematics and science centralized curricula and textbooks

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ABSTRACT

Very few Lebanese students have been able to perform at the highest level in mathematics and science in TIMSS, leading to the belief that current curricula and/or pedagogies are not supporting our highly able students to realize their potentials. In this research, we investigate how the national Policy documents and the mathematics and science centralized curricula, and textbooks address the needs of highly able students. Teachers' perceptions and role in providing for the educational needs of highly able is also examined. Through qualitative methods, the following data sources were used to address the research aim: policy document analysis, curriculum analysis, and teacher interviews. Findings indicated no specific policy for highly able students in Lebanon and little evidence of curricular provisions and attention to the needs of highly able learners in the mathematics and science national curricula and textbooks. The resultant data also provided important insights into the limited knowledge of teachers in the area of supporting highly able learners. The findings of the current study will inform the efforts of the policy makers and the Ministry of Education faced with the challenge of effectively educating their most able students.

Keywords: TIMSS, teacher perceptions, gifted provision, highly able students, curriculum, policy

INTRODUCTION

Background to the Study

Highly able students require differentiated educational services to enable them to excel and reach their full potential (Henderson, 2006; Kaplan, 2009; Ozdemir & Bostan, 2021). In addition, many researchers have forewarned about the consequences of not providing them with enough educational challenge (Maker & Shiever, 2010; Pfeiffer, 2013). Little has occurred within Lebanon to improve the educational provision for this group of learners (Al-Hroub, 2022; Al-Hroub & El Khoury, 2018; Antoun, 2022; David, 2018). Across the years, very few Lebanese students have been able to perform at the highest level in mathematics and science in TIMSS, which leads to the belief that current Lebanese curricula and/or teaching and learning methods might

be failing our highly able students. Although Lebanon has been experiencing social and political turbulence over an extended period of time, the country, with a culture that rewards effort and achievement, places a high value on education, particularly in the academic arena (Antoun et al., 2020). Considering the TIMSS results in the backdrop of the Lebanese educational culture, it is important to closely examine possible explanations of the consistent low performance of Lebanese highly able students in mathematics and science. Since addressing diverse students' needs is a complex issue, it is important to explore how highly able students are supported at the various levels of an educational system: educational policy, national curriculum and curricular materials, and teacher perceptions. As such, possible reasons of highly able students' low performance can inform policy and curricular reform on one hand, and teachers' professional development needs and classroom practices on the other.

The Research Aim

The purpose of this study was to investigate:

(a) if policies exist in terms of catering for highly able students,

(b) how the national mathematics and science centralized curricula and textbooks address the needs of highly able students, and

(c) how teachers in different Lebanese schools perceive and may provide for the educational needs of highly able students.

Policy document analysis, national mathematics and science textbook analysis and teacher interviews were used to address the research aim.

LITERATURE REVIEW

The international research focuses on the importance of providing highly able/gifted students a curriculum program with learning concepts that focus on higher level, critical thinking, and problem-solving experiences for gifted students (Callahan et al., 2020; Rimm et al., 2018; VanTassel-Baska et al., 2020). The term 'gifted' will be used interchangeably with 'highly able' and the various derivatives to indicate high ability or potential. Generally, gifted students are defined as those who have extraordinary ability to understand abstract concepts, learn more rapidly and in greater depth, and perform beyond the familiar and at high levels when compared with same-aged peers (Harrison, 2004; Taylor & Milton, 2008). In order for gifted students to thrive, they require opportunities for in depth exploration in areas of interest either independently or with like-minded peers (VanTassel-Baska, 2021).

Educational Policy

Lebanon has established a policy (Law No 220/2000) and practices to support children with disabilities (CRDP, 2013). Yet, in terms of the existence of educational policies that cater to the needs of the highly able/gifted students, Lebanon lacks a formal system for educating gifted students and emphasis on the education of gifted students is relatively new to the country and therefore needs to be established on a solid basis (Antoun, 2022; Sarouphim, 2015).

As Lebanon does not have any legal educational framework referring specifically to gifted provision, the responsibility for such education lies on individual schools and teachers to make special provision for their gifted students. In Lebanon, very little research has been conducted into giftedness or gifted education (Antoun et al., 2020; David, 2018; Al-Hroub & El Khoury, 2018; Saraphouin, 2015), and there is a particular dearth of studies examining curricular provisions and the role of teachers in providing for gifted students.

Curricular Provisions for Highly Able Learners

Curricula provide a roadmap for teaching and learning, describing both process and product, and come embedded with both explicit and hidden values (Kelly, 2009). Moreover, no curriculum can be integrated at a distance from the changing society and the learners needs, and so a necessary shift from content-centered curriculum to a learner-centered is indispensable (Ornstein & Hunskins, 2014). In fact, the aim of the latest curricular reform in Lebanon was moving teaching from teacher-centered to student-centered (CERD, 1997). Yet research in Lebanon has illuminated a number of issues and challenges towards realizing these goals.

According to Ayyash-Abdo et al. (2009), there is a focus on achievement as an end product, rather than a process, in Lebanese culture, a view supported by Antoun et al. (2020). The common pedagogical approaches are test-centered and mostly utilize traditional instruction and rote learning (Frayha, 2009), with limited attention to interactive and inquiry-based learning practices, especially in the mathematics and science classrooms (BouJaoude & El-Hage 2016; Salloum & BouJaoude, 2019). Most models for educating the highly able advocate a constructivist approach to teaching and learning, whereby problem-solving, creativity and discovery are underscored (Maker et al., 2006; Ozdemir & Bostan, 2021). Alternatively, traditional learning environments could be 'restrictive' and may suppress students' further inquiry, motivation, and desire to learn. McCoach and Siegle (2007) argue that gifted students may actually underachieve as a result of a lack of motivation, and negative attitudes towards school and subject.

According to Tomlinson (2017), best practices in curriculum and instruction serve all learners including the highly abled, where a high-quality curriculum is student-centered and acknowledges that learners are diverse in their learning process, pace, and interests. Tomlinson (2017) recommended that curricula responsive for highly able learners involve appropriate pacing, different degrees of and types of challenges, and opportunities for learners to develop passions and strengths. In order for gifted students to thrive, they require opportunities for in depth exploration in areas of interest either independently or with like-minded peers (VanTassel-Baska, 2021). For highly able students, provisions of a differentiated curriculum program with learning concepts need to focus on higher level, critical thinking, and problem-solving experiences so as to cater for their needs (Callahan et al., 2020; Rimm et al., 2018, VanTassel-Baska, 2021).

In spite of the significance of curriculum differentiation for gifted students in one form or another, this has not been found to be common practice in Lebanon (Al-Hroub & El Khoury, 2018; Antoun, 2022; Sarouphim 2015). In this paper, and to further explore how highly able students are supported (or not) by the national curricula, we found it important to closely examine the national curricula, especially for mathematics and science. Furthermore, since mathematics and science textbooks remain a significant vehicle for accomplishing curricular goals and standards and are a dominant pedagogical resource in the Arab countries (Aldahmash et al., 2016; BouJaoude & Noureddine, 2020; Salloum, 2021), these needed to be examined as well. Analyzing the Lebanese national textbooks can help illuminate for us, not only what and how students learn, but also what and how teachers teach (Aldahmash et al., 2016; Chiappetta & Fillman, 2007); accordingly, textbooks' role as supportive tools for highly abled learners to thrive and realize their potential is better scrutinized for future action.

Teachers' Perceptions of Gifted Students and Their Education

Numerous studies have illustrated that teachers' beliefs and preconceptions critically affect not only their teaching attitudes (Matheis et al., 2017, 2019; Plunkett & Kronborg, 2019) but also their practices and performances of their highly able/gifted students (Berman et al., 2012; Miller, 2009). According to Berman et al. (2012), teachers' preconceived ideas, usually acquired from cultural knowledge, guide their choices in the approaches they choose to use in their classroom.

Pfeiffer (2013) asserts that a gifted student demonstrates extraordinarily high potential with a thirst to excel in one or more specific culturally valued academic domains. Many researchers suggest that there is a common misconception that due to high intelligence, gifted students will succeed without special programs or effort from their teachers (Cooper, 2009; Moon, 2009; Peterson, 2009). Yet, research suggests that gifted students need teachers who can identify their potential and help them accordingly (Winebrenner, 2009). A related issue is the perception of gifted education as being discriminatory and inequitable (McCoach & Siegle, 2007). However, equity and equality are quite different concepts according to Kitano and Kirby (1986), who suggest "equality of educational opportunity refers not to providing the same education for every child, but to providing the means by which every child can strive to meet his or her individual potential" (p. 5). Finally, understanding Lebanese teachers' perceptions and attitudes is necessary in order to change the status quo because these perceptions "are thought to serve as predictors of behaviors" (Bai & Ertmer, 2008, p. 95), both in the classroom and at the level of policy development. Without adequate knowledge about giftedness, teachers appear to rely on their perceptions and myths about giftedness, which may negatively influence their attitudes and practices.

The Research Context

TIMSS latest results show Lebanese students' consistent low performance in mathematics and science (Mullis et al., 2020), which leads to the belief that current Lebanese curricula and/or teaching and learning methods might be failing Lebanese learners and, in particular, our highly able students. TIMSS has four international achievement benchmarks (advanced, high, intermediate, low) (Mullis et al., 2020). TIMSS 2003 till 2019 data reveal that only 10% of Lebanese students were able to perform at or above the High International Benchmark, with only 1% at or above the advanced international benchmark (Mullis et al., 2020). In the top achieving country (TIMSS 2015), Singapore, more than 30% of students scored higher than the advanced international benchmark and more than 66% scored above the high international benchmark (Mullis et al., 2016a, 2016b). For example, in mathematics, as shown in **Table 1**, Turkey, Lebanon, and UAE had comparable percentages of students scoring at or above the low international benchmark in TIMSS 2011 and 2015. However, both UAE and Turkey have more students scoring at/above the high and advanced international benchmark (Mullis et al., 2016b).

Table 1. Percentage of students reaching each benchmark in mathematics in TIMSS 2011 and 2015

Country	Advanced		High		Low	
	2011	2015	2011	2015	2011	2015
Lebanon	1	0	9	8	67	70
UAE	5	2	14	20	73	73
Turkey	7	6	20	20	73	71

These results reflect that our most able students seem neglected and are not supported enough to perform at advanced levels. Accordingly, this research investigates possible reasons behind the low achievement of highly able students at different levels: policy, national curricula and teacher perceptions, and practices.

METHODOLOGY

A case study approach provided a suitable framework for the study (Yin, 2017). This approach appeared suitable as it provided a method to explain, illustrate, describe, and gain insight into the Lebanese educational system, the curricula, and the perceptions of the teachers of highly able students as well as their beliefs of best educational practices. The Lebanese educational system is considered as a case under study in terms of provisions for highly able students in mathematics and science.

Data Sources

As per a case study research approach multiple sources of data were used to address the research aim and explore the provisions and supports the Lebanese curricula and educational system offer highly able students in mathematics and science.

Document analysis of Lebanese mathematics and science core curriculum and textbooks

Curricula in Lebanon are centralized, where according to the latest educational reform in Lebanon, initiated in 1994 and revised briefly in 2010, an important goal of science and mathematics education is to emphasize that science and mathematics manifest themselves in all aspects of human activity, including the domains of health, environment, technology, and ethics (CERD, 1997). At the pedagogy level, and as mentioned above, the reformed curricula emphasized a movement from a teacher-centered approach to a learner-centered one that encourages and develops the spirit of inquiry (Zeitoun & Hajo, 2015). In order for us to explore how these goals are manifested in the national mathematics and science, specifically in terms of them catering for high ability learners (HALs), document analysis was used to discern provisions for HALs within the latest reform documents by CERD (1997) and the Ministry of Education (MEHE), the National mathematics and science core curricula, and the national mathematics and science textbooks.

Grade 5 curriculum documents and textbooks were selected purposefully in light of the following considerations. To begin with, while learners demonstrate a strong interest and positive attitudes toward mathematics and science in primary grades, these start to decline in middle grades (ages 10 and up) (Savelsbergh et al., 2016; Tyler & Osborne, 2012). A decline in interest and attitudes has implications for

students developing their STEM identity at this critical age and later going into STEM careers, and so it would be less effective to wait till the upper grades to cater for high ability students and provide them with opportunities to realize their potential in STEM. Moreover, the abovementioned decline has been attributed to concepts becoming more abstract and less relatable in the middle grades (Potvin & Hasni, 2014); accordingly, and even as abstract concepts and principles may pose challenges to diverse learners at this level, they can also be harnessed for opportunities for HALs to engage in solving **authentic** problems, detecting patterns, and using multiple abstractions.

The Lebanese curriculum was analyzed at the level of 'curriculum decree and general targets,' 'content of curricula' and 'content details' for grades 5 (CERD, 1997[1]) (**Figure 1**). The 'curriculum decree and general targets' outlines in general, and for each program of study (e.g., elementary, middle school, etc.), the overall goals of education in Lebanon. Those goals reflect the *learner* and *content/knowledge* as sources of curriculum design in addition to *societal* goals concerned with promoting shared values and a strong sense of national pride in a post-war Lebanon (Shuyab, 2016). The 'content of curricula' and 'content details' are more specific to mathematics and science, whereby 'content of curricula' specifies the general goals for the subject area and then goes on to outlining the number of periods and scope of topics for each grade level. 'Content details' are pdf documents that outline for each grade level, the scope and sequence of the topics and sub-topics, the number of periods for each topic, specific learning objectives for each topic, and suggested general activities and materials to address these (e.g., classroom discussions, analyzing documents, etc.).

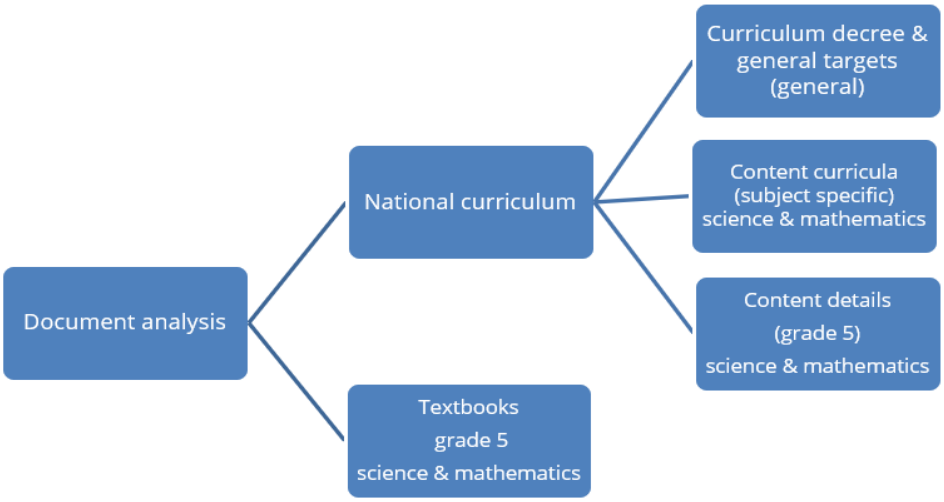


Figure 1. Lebanese curriculum levels of analysis (Source: Authors)

Teacher interviews

In order to gain an in-depth understanding of upper primary teachers' daily experience with gifted students in the classroom, participants for this study were deliberately selected through purposive sampling (based on a larger study that used surveys), to assist in understanding the problem better as well as provide information rich cases (Merriam, 2009). The sampling criteria for selecting participants for the interviews considered the following:

1. Teachers who indicated they either provided for or aimed to provide for gifted students' educational needs.
2. Teachers who worked in schools known for providing for gifted students.

A total of 12 teachers were selected from public and private schools. Interviews provided additional insight into participants' perspectives and attitudes towards the offered provision and the educational needs of highly able students.

[1] https://www.crdp.org/curriculum?f=2&la=en

Data Analysis

Curriculum document

Document analysis was conducted on the Lebanese mathematics and science core curriculum consisting of the national curriculum decree, the content curricula (grade 5), the content details (grade 5), and the national textbooks (CERD, 1999a, 1999b). We developed an analytic framework for the document analysis based on Tomlinson's (2017) guideline for quality curriculum and instruction for HALs. Tomlinson (2017) outlined three broad areas that relate to providing responsive curriculum and instruction to HALs: appropriateness of pacing, degree of challenge, and pursuit of passion. We focused on aspects within 'appropriate pacing' and 'degree of challenge' to examine the grade 5 mathematics and science core curriculum document and national textbooks (**Figure 2**). To analyze the curricular document, we used a three-point checklist (evident, partially evident, not evident) to check evidence for curricular provisions for highly able students. The published curricular documents were analyzed in their entirety.

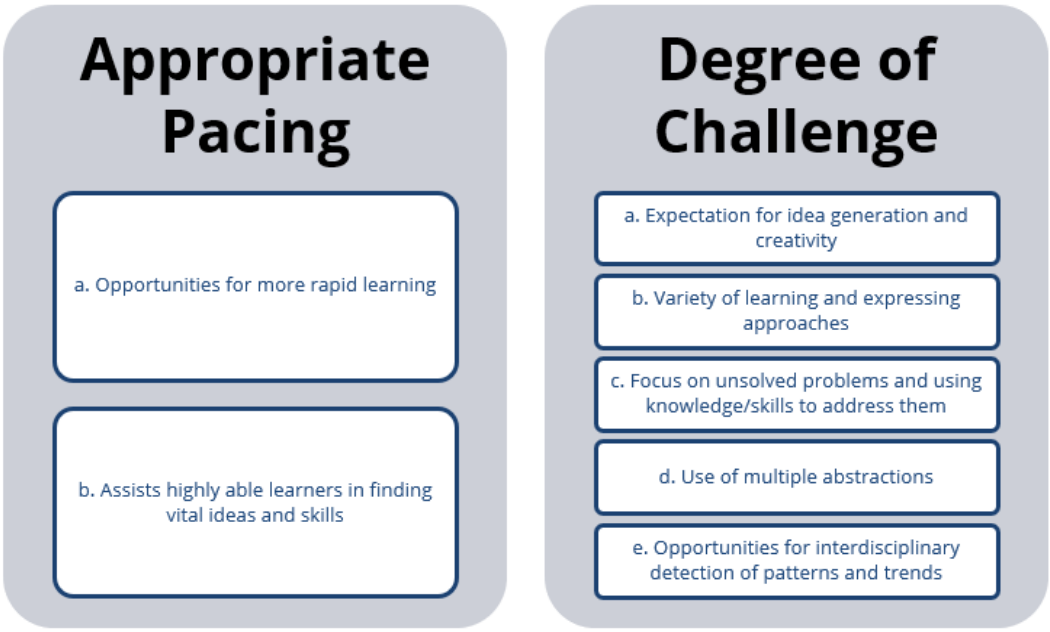


Figure 2. Curricular provisions for highly able learners (Source: Adopted from Tomlinson, 2017)

For the mathematics textbook, we analyzed every third chapter. Therefore, one third of the book was analyzed. For example, we analyzed chapters, 3, 6, 9, and so on. Similarly, for science, a third of the book was analyzed, but the sampling process used was a bit different since the topics in the science textbook are organized under units and chapters within them. A third of the chapters within each unit was analyzed, but we purposefully either started with chapter 1 for one unit, then chapter 2 in another, and so on to attain more variety. The chapters were broken down into segments, where each segment is defined as the lowest level subheading of a concept. In mathematics, each segment consisted of either an activity, an exercise, or an explanation. In science, a segment was a stand-alone part within a chapter under a sub-heading, such as "Decomposers: Tiny but important" or "photosynthesis" segments could also be investigations, e.g., "how to test for lipids." By using the criteria from Tomlinson (2017), we looked within each segment at whether the specific segment addressed the needs of the highly able students in Lebanon and the level at which the needs were addressed. For textbooks, a five-point checklist (highly evident, moderately evident, somewhat evident, not evident, not applicable), was used to check how often each criterion was evident and at which level. A description of each level can be found in **Table 2**.

Table 2. Qualifiers for extent of evidence of the different provisions

Extent	Qualifier
Highly evident (HE)	Criteria evident in its entirety with clear focus/emphasis and guidelines to realize it
Moderately evident (ME)	Criteria is somewhat evident with adequate focus/emphasis, but with little guidelines and follow-up to realize it
Somewhat evident (SE)	Criteria is implied rather than explicit
Not evident (NE)	Criteria not evident nor implied in the segment
Not applicable (NA)	Considering the nature of the segment (e.g., chapter introduction), criteria does not apply

Interrater reliability and investigator triangulation were utilized to enhance the trustworthiness of the curricula and textbook analysis, where co-authors conducted the analysis collaboratively (Lincoln & Guba, 1985; Nowell et al., 2017). We first discussed Tomlinson's (2017) quality criteria for curriculum for highly able learner to come up with an analytic framework that outline specific indicators that can be observed and analyzed in the curricular material under the two larger aspects of appropriate pacing' and 'degree of challenge' (**Figure 2**).

The indicators were tested, where two of the authors examined together sections of the mathematics and science textbooks and discussed what can be examples and counter examples of the indicators. We then both conducted analysis on two samples separately to further verify our use of the analytic framework. We compared and discussed our findings, which showed more than 85% agreement, till we reached a consensus of what each indicator would entail. We then conducted the analysis of our respective samples with frequent debriefing and scrutiny among each other, which in fact entailed at times re-analyzing segments for agreement.

Teacher interviews

The qualitative data was organized around themes that emerged from the inductive thematic analysis of the interview transcripts. Inductive thematic analysis has a descriptive orientation, and according to Guest et al. (2011) is "most useful in capturing the complexities of meaning within a textual data set" (p. 11). It allows for pattern identification within data, where emerging themes become the categories for analysis and reporting (Clarke & Braun, 2013). The analysis does not assume that the researcher knows what the important categories would be prior to analysis.

In addition, the use of thematic analysis ensured that the open coding system and categorization of data were conducted in a rigorous manner. The involvement of the different authors in the interview analysis was essential to ensure the data analysis process was conducted with integrity. To aid in the process of determining trustworthiness, frequency tables and participants' words were used to highlight the main features of the qualitative data. Furthermore, the multiple sources of data ensured a high degree of triangulation.

FINDINGS

Core Curriculum

We found only one statement, under the 'curriculum decree and general targets' (cycle 3–grades 4 through 6) that displays attention to the needs of diverse learners and/or highly able learners; it states the following '*recognize individual abilities and preferences and support them to enable the learner in proceeding in consistent study and integrating in public life and economy*.'

As for 'content of curricula' and 'content detail,' through close reading, we highlighted statements that align with the curricular provisions mentioned in **Figure 2**, even if it was not mentioned explicitly that these are targeting highly able learners. These statements were chosen mainly because they displayed partial evidence of aspects around 'degree of challenge' such as "expectation for idea generation and creativity" and "variety of learning and expressing approaches".

Curriculum analysis–Science

Both the webpage of the 'content of curricula' and the pdf 'content detail' document were examined in depth using the checklist (**Table 2**). In 'content of curricula,' or the general goals of science education, the

sample verbatim statements below indicate partial evidence of provisions for highly able learners as they highlight the importance of mastery and transfer of knowledge into novel situations and promoting learners' ability to problem-solve both independently and cooperatively (CERD, 1997):

1. The adopted pedagogical innovation favors the mastering of the scientific method, the technics of communication and the transfer of knowledge.
2. Encourage learners to use scientific knowledge and skills in novel situations especially in everyday life.
3. Encourage learners to work independently and cooperatively in solving scientific problems (CERD, 1997).

The 'content detail' document contains more explicit information with specific learning objectives, activities, and 'remarks,' and all of these were analyzed to discern evidence of provisions for HALs. Results of the analysis are summarized and presented in **Table 3** with illustrative examples. The physical science curriculum displayed almost no evidence of all provision aspects, except for the aspect of "*variety of learning and expressing approaches,*" which was partially evident due to the mention of using multiple activities for learning, e.g., discussion, demonstrations and hands-on. The life science core curriculum displayed more evidence particularly in the aspects of "*assisting highly able learners in finding vital ideas and skills"* as compared to the physical science curriculum.

Table 3. Analysis of the of grade 5 physical and life science national curricula (content detail)

	Curricular provisions for highly able learners	PS	LS	Justification
Appropriate pacing	a. Opportunities for more rapid learning	–	–	Variations in pacing based on student characteristics is not explicitly tackled in the curriculum document.
	b. Assists highly able learners in finding vital ideas & skills	–	±	LS: 'Learning objectives,' & 'activities,' included some suggestions for development of deeper knowledge, for example on p. 117 learners are required to 'infer' connections & complementarity among the functions of the different body system in LO. It was suggested in the 'remarks' to invite health professionals for students to extend their knowledge.
Degree of challenge	a. Expectation for idea generation & creativity	–	–	'Learning objectives' & 'activities' mostly tackled understanding and directly 'applying' levels based on Bloom's taxonomy, with less evidence of the 'creating' 'analyzing' & evaluating levels. For example, even though there were several 'infer' LO, these were mostly from verification demonstrations & experiments.
	b. Variety of learning & expressing approaches	±	±	Variety of learning activities was evident, but not of expressing learning.
	c. Focus on unsolved problems & using knowledge/skills to address them	–	–	No evidence, please see justification of 2a.
	d. Use of multiple abstractions	–	–	No evidence, please see justification of 2a.
	e. Opportunities for interdisciplinary detection of patterns & trends	–	±	LS: Little evidence pertaining to students 'concluding' methods, principles, & documentation for food preservation (p. 118).

Note. +Evident; ±Partially evident; –Not evident; PS: Physical science; & LF: Life science

Curriculum analysis–Mathematics

In the creation of the new Lebanese mathematics curricula in 1997, the focus was primarily on making mathematics accessible to all students. Opportunities for highly abled students were even reduced: "Every theoretical overuse was abolished, every virtuosity in the accomplishment of the tasks was omitted" (CERD, 1997). However, a few sentences later CERD (1997) adds "our essential aim is to form a citizen capable of critical thinking and intellectual autonomy." Despite efforts to make mathematics more accessible to everybody, there are still some provisions for the highly abled, although not explicit, such as argument creation, critical thinking, imagination, and creativity. Learning mathematics using various approached was encouraged: "observe, analyze, abstract, foresee, conjecture, generalize, synthesize, interpret, and demonstrate" (CERD, 1997).

In terms of content details, particularly for the second cycle, there is a trend to ask teachers to guide students to find answers rather than to ask students to memorize rules (this is not the case for older classes) (See **Table 4**). These methods of teaching give the highly abled students a chance to move faster or discover ideas on their own. Geometry is the exception in cycle 2: students are mainly asked to reproduce figures. In general, though most of the verbs of the objectives are on the lower end of bloom's taxonomy.

Table 4. Analysis of the of grade 5 mathematics national curricula (content detail)

	Curricular provisions for highly able learners	M	Justification
AP	a. Opportunities for more rapid learning	–	Not evident.
AP	b. Assists highly able learners in finding vital ideas & skills	±	Lead students to find answers rather than have them memorize found in the comments section of the content details but not how to do it & only in a few parts.
Degree of challenge	a. Expectation for idea generation & creativity	+	Expectations for students to do the below: -Making math -Formulating hypotheses -Construction of arguments -Developing critical thinking, & -Develop intuition, imagination, & creativity.
Degree of challenge	b. Variety of learning and expressing approaches	+	Observe, analyze, abstract, foresee, conjecture, generalize, synthesize, interpret, & demonstrate all were approaches mentioned in the content curricula.
Degree of challenge	c. Focus on unsolved problems & using knowledge/skills to address them	±	The was to some extent mention of problem solving skills but was not very evident in the content details.
Degree of challenge	d. Use of multiple abstractions	–	Not evident.
Degree of challenge	e. Opportunities for interdisciplinary detection of patterns & trends	±	There was an intentions for students to recognize relationships between mathematics & surroundings, but these intentions were not explicit.

Note. +Evident; ±Partially evident; –Not evident; AP: Appropriate pacing; & M: mathematics

Textbook analysis

For the textbook analysis, first, the number of segments within each chapter was calculated. Then, these segments were divided into two categories: segments, where the criteria was evident and ones where none of the criteria was evident (at any level). Segments, where *any* of criteria were evident, were reported based on the levels in which the highest-level criteria were present (e.g., high -H, moderate-M, and somewhat-S, etc., please see **Table 2**). If the levels (H, M, or S) were present for any of the criteria, we designated the segment as exhibiting this level. It has to be noted that this is based on our interpretation, as neither the book nor the teachers' guide explicitly make connections to the addressing the needs of HALs.

Table 5 shows the number of segments in each chapter and the percentage of segments in each chapter that addressed the needs of the highly able in mathematics. **Table 6** presents the same results for science.

As seen in **Table 5**, less than a sixth (16.66%) of the segments in each mathematics chapter address the needs of the highly abled (or on average less than 10%). The majority of the segments in mathematics (91.7%) do not address the highly abled. In the mathematics textbook, the majority of the segments consist of direct application problems with no opportunity to think further.

Table 5. Segments addressing the needs of the highly able learners–mathematics

Chapter	NoP	NoS	H	M	S	NCP	P (%)
3	5	23	1	1	1	20	13.0
6	4	16	0	0	2	14	12.5
9	8	32	1	1	1	29	9.4
12	4	12	0	1	1	10	16.7
15	6	32	0	3	0	29	9.4
18	6	36	0	2	0	34	5.6
21	6	29	0	2	0	27	6.9
24	6	24	0	1	0	23	4.2
27	6	27	2	0	0	25	7.4
30	5	21	1	0	0	20	4.8
Total	**56**	**252**	**5**	**11**	**5**	**231**	**8.3**
Percentage of segments in each level (H, M, & S)			1.98%	4.4%	1.98%	91.7%	

Note. NoP: Number of pages; NoS: Number of segments; H: High; M: Moderate; S: Somewhat; NCP: No criteria present; & P: Percentage of segments addressing the needs

In science, the percentage of the segments in the overall sample that exhibits *any* indicator of provisions for HAL at "somewhat" was close to 90% (88.3%) and around 42% of the segments moderately addressed the needs of the HAL (**Table 6**). However high levels were less evident (8.3%); meaning that all the chapters analyzed exhibited certain attempts, albeit not high, for more complex tasks that can stimulate or address

the learning needs of the highly abled. Only two out of the 60 segments in sciences did not exhibit any criteria for the highly abled learners. In science, some segments addressed more than one need of the HAL.

Table 6. Segments addressing the needs of the highly able learners–science

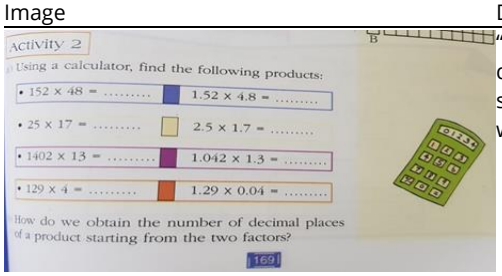
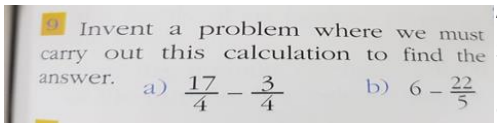
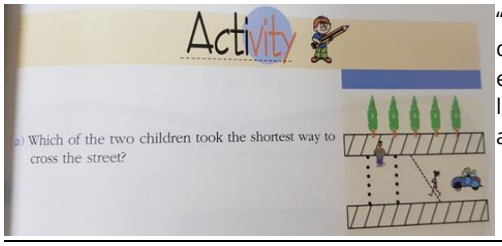
Chapter	NoP	NoS	H	M	S	NCP	P (%)
Unit 1-Ch. 1 Plants	17	13	0	8	13	0	100.0
Unit 1-Ch. 4 Plants	11	7	2	3	5	0	100.0
Unit 2-Ch. 2 Animals	6	7	0	6	7	0	100.0
Unit 3-Ch. 1 Health	17	8	2	5	5	0	100.0
Unit 3-Ch. 5 Health	11	6	1	2	6	0	100.0
Unit 4-Ch. 4 M&E: Electricity	8	7	0	1	7	0	100.0
Unit 5-Ch. 2 Earth	10	12	0	0	10	2	83.3
Total	**80**	**60**	**5**	**25**	**53**	**2**	**96.7**
Percentage of segments in each level (H, M, & S)			8.3%	41.7%	88.3%	3.3%	

Note. NoP: Number of pages; NoS: Number of segments; H: High; M: Moderate; S: Somewhat; NCP: No criteria present; & P: Percentage of segments addressing the needs

Table 7 and **Table 8** provide illustrative textbook examples that exhibited a number of the indicators from the mathematics and science textbooks, respectively.

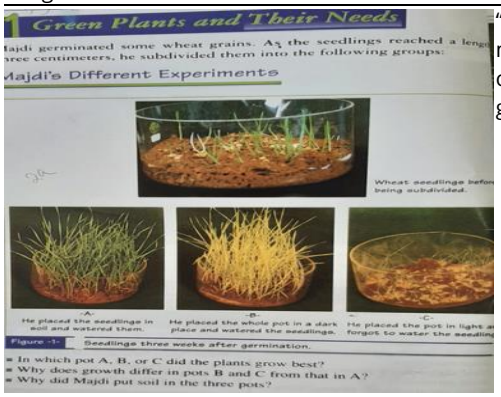
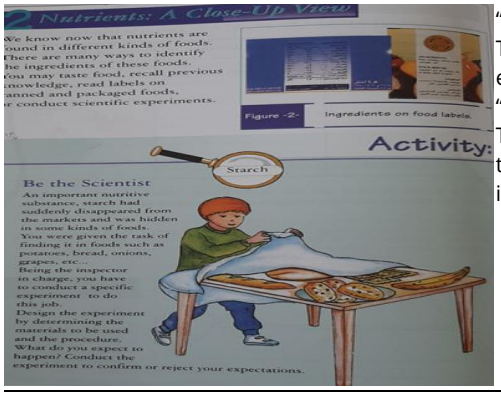
The first activity in **Table 7**, from the mathematics textbook, included ample opportunities for students to detect the patterns in where to place the decimal point when multiplying two decimal numbers. The second activity gives the highly abled chance to create problems on their own. The third activity helps the students discover the shortest distance between two points. However, follow up questions that will help the students discover the concept further or apply what they have discovered would have moved this activity to higher levels.

Table 7. Examples from the mathematics textbook (Source: CERD, 1999a)

Image	Description
	"Opportunities for detecting patterns and trends in materials, topics, disciplines, and across disciplines" is highly evident. In this segment the students are expected to find a pattern and discover how multiplying whole numbers and multiplying decimal numbers are related.
	"Expectation for idea generation & creativity" is moderately evident. Students are expected to come up with a problem. It was labelled moderate because students are not able to be very creative in this case.
	"Opportunities for detecting patterns and trends in materials, topics, disciplines, and across disciplines" was somewhat evident. Students are expected to discover that the straight line is the shortest distance. It is labeled as somewhat because the line are already drawn, and students are only supposed to compare between two lines.

Similarly, the examples in **Table 8** from the science textbook demonstrate how specific activities displayed certain criteria. In the first activity shown, 5th grade learner are asked to make observations and construct explanations about factors affecting plant growth, which demonstrates the criteria/aspect of "Assisting highly able learners in finding vital ideas and skills." The second activity, in which learners are asked to 'design an experiment,' provides them with opportunities for "idea generation and creativity (2a)." The third activity challenges learners to "focus on unsolved problems and using knowledge/skills to address them (2c)," where students need to 'infer' the relation between pressure and area. However, as with the mathematic textbooks, follow up questions that extend students' inquiry of concepts were rare.

Table 8. Examples from the science textbook (Source: CERD, 1999b)

Image	Description
	"Assists highly able learners in finding vital ideas and skills (1b)" is moderately evident: The segment asks 5th graders to make observations and construct explanations about factors affecting plant growth.
	"Expectation for idea generation and creativity (2a)" is highly evident: The 'activity' asks learner to 'design an experiment' or plan an experiment. "Variety of learning and expressing approaches (2b)" is highly evident: The introduction includes visuals of actual food labels with multilingual text, and the topic is connected in the activity to a hands-on investigation.

Percentage Across Criteria and Provisions

In addition, the level at which the needs were addressed was examined for each criterion to see whether some criteria were more prominent or more emphasized than others. **Table 9** and **Table 10** show the criteria, as well as the number of segments exhibiting them at each level in all the chapters analyzed for both mathematics and science, respectively.

As shown in **Table 9**, most of the criteria were minimally present in the mathematics chapters. However, the opportunity to use multiple abstractions was not evident in any of the analyzed chapters. Mostly the highly abled students had opportunities to detect and discover patterns and opportunities to generate ideas.

Table 9. Number of segments exhibiting each criteria–mathematics

		H	M	S	Total	P (%)
AP	a. Opportunities for more rapid learning	0	1	1	2	0.8
	b. Assists highly able learners in finding vital ideas and skills	0	1	0	1	0.4
DC	a. Expectation for idea generation and creativity	1	5	3	9	3.6
	b. Variety of learning and expressing approaches	0	4	0	4	1.6
	c. Focus on unsolved problems and using knowledge/skills to address them	0	1	0	1	0.4
	d. Use of multiple abstractions	0	0	0	0	0.0
	e. Opportunities for detecting patterns and trends in materials, topics, disciplines, & across disciplines	4	4	1	9	3.6

Note. AP: Appropriate pacing; DC: Degree of challenge; H: High; M: Moderate; S: Somewhat; & P: Percentage

As **Table 10** shows for science textbooks, "opportunities for more rapid learning" was the only non-present criteria in the science textbooks. All other provisions appeared, but to varying degrees as shown in Table 10, with the respective indicators showing at least 'some evidence.'

Table 10. Number of segments exhibiting each criteria–science

		H	M	S	Total	P (%)
AP	c. Opportunities for more rapid learning	0	0	0	0	0.0
	d. Assists highly able learners in finding vital ideas and skills	2	15	31	48	**80.0**
DC	f. Expectation for idea generation and creativity	2	6	22	30	50.0
	g. Variety of learning and expressing approaches	4	4	38	46	**76.7**
	h. Focus on unsolved problems and using knowledge/skills to address them	1	8	32	41	**68.3**
	i. Use of multiple abstractions	1	6	29	29	48.3
	j. Opportunities for detecting patterns and trends in materials, topics, disciplines, & across disciplines	4	4	13	21	35.0

Note. AP: Appropriate pacing; DC: Degree of challenge; H: High; M: Moderate; S: Somewhat; & P: Percentage

Interview analysis

For the purposes of this article, findings from the analysis of responses to the interview questions regarding the teachers' perceptions of appropriate provision and their educational practices are presented. For each of these topics, two major themes emerged.

Theme 1: Teachers' perceptions of educational provision: Interviews were conducted with twelve schoolteachers from the public and private sector and covered a range of topics. Findings from the interview data indicated that teachers' perceptions of highly able/gifted children were generally positive. However, there was a degree of resistance to making specific educational provision due to widely held misconceptions relating to gifted education. most of the interviewees cited constraints affecting them from providing adequately for such students' gifted development. These included material constraints, such as lack of time and resources, philosophical constraints, such as the societal and curricula emphasis on academic performance for all. The notions of equity, focusing on one sector alone (the less able), and knowledge constraints, such as the lack of understanding about the gifted student as a whole person together with the ways of using differentiation to optimize experiences for all students. Sara, who had completed PD in gifted education, demonstrated dissatisfaction with the educational situation for the gifted, asserting that, "*we're trying to cut down their feathers*". Julie agreed that "*there should be more things offered specially for gifted… In my opinion, the government has to develop a special center for high ability students*". Julie laid the responsibility for providing for gifted students on the government, claiming that it was beyond the scope of individuals to do so, maintaining that she, "*is unable to help the gifted inside her class for two reasons: the presence of weak students and adherence to the national curriculum*. *We cannot change the curriculum. Sometimes we have a long curriculum, we have to finish it".* On the other hand, another interviewee also considered that giving a child different work in class could make other students feel devalued and described students as feeling "*envy of each other and jealousy*". It could easily be argued that some teachers did not provide for gifted students because of the fear of what other students might feel, or their parents or other teachers might believe. Fear of discrimination was also reported by another teacher participant who described ignorance as a reason why people linked differentiation with discrimination.

Some interviewed teachers shared a common misperception that gifted students do not require special services because they will "get it" on their own. On the other hand, one interviewed teacher highlighted that if the needs of gifted students are not met, "*they fall through the cracks of the educational system.*"

When teachers were asked in what ways the Lebanese curriculum could extend academically able students, nine participants agreed that the Lebanese curriculum does not fulfil this function. The remaining individuals were unsure about whether the Lebanese curriculum could extend highly able students as they stated that they had never taught it, due to being in private/international schools. The inflexibility of an overloaded curriculum, in participant's views, meant that adequate extension opportunities could not be offered to gifted students. Nine teachers described the Lebanese curriculum as limited and not flexible for gifted students. For instance, Ruba defined the Lebanese curriculum as very limited and stated that this is a major obstacle that teachers face, which makes them have to look for foreign resources such as North American resources. On the same note, Helene who was using North American books, affirmed the need to have a flexible and diverse Lebanese based curriculum. Helene perceived that the regular Lebanese curriculum did not provide for students with certain abilities or disabilities, claiming

> I do not think the regular Lebanese curriculum has much flexibility in consideration and I think that it does not tackle or address a certain milieu of students that have a certain ability. I do not think it's flexible enough to address the highly able or high achievers, even worse the underachievers. The kids that have learning difficulties and are struggling in certain areas then I think the Lebanese program crushes them.

Rana voiced a similar opinion and indicated "*we're very lucky, when I think about the same kids in a traditional Lebanese program, or in a different school, those kids are going to suffer.*"

In fact, all private school teachers interviewed stated that they use foreign curricula, such as the American, British, or French, to supplement the Lebanese curriculum. This suggests that private schools may perceive the Lebanese curriculum as insufficient in meeting the needs of their mainstream students, let alone the gifted. Some of these teachers admitted that their schools use the Lebanese curriculum only in middle school as they are preparing their students to sit for national exams in grade 9. Angelle maintained "*the Lebanese curriculum does not extend the Lebanese gifted, we do not follow the Lebanese curriculum, we do that only in grade 9 and 12 because of official exams; our books are American with different levels*". Angelle elaborated, maintaining that, unlike the Lebanese curriculum, American books have enrichment activities. Similarly, Janette stated that

> American books have a lot of critical thinking questions and a lot of integration with social studies and science. So, by nature the curriculum asks deeper questions which I think is better for the gifted students … mainstream students find creative questions a challenge while gifted students thrive in the creative questions.

Theme 2: Teachers' practices: Teachers were asked to describe the type of services offered to highly able students at their schools. While all twelve participants reported that no specific curriculum model for gifted students existed at their schools, six reported individual practices they carried out in their classrooms to try to meet the needs of their more advanced students. For example, Helene explained

> We do not have a special program that is designated for gifted, but we have a lot of linear ways in our classroom to push and challenge those who want to be challenged and those who are high achievers. So, I think multilevel teaching provides the way, and in our philosophy we have inquiry based learning, so we open the doors for them to want to know and to want to discover, we do not pour the information for them. I think this is a way that challenges everyone.

When asked to discuss the strategies they used to engage highly able students, there was general recognition of the need for such provision reported by nine of the teacher participants, but little evidence of the use of practices that are often utilized to meet the needs of advanced learners.

Only two participants (Janette and Rana) declared that they use acceleration with gifted students in their class. However, Janette acknowledged that she had practiced it very rarely. Rana pointed out how she "*had two students who were exceeding expectations in math and so I allowed them to go ahead with the program.*" However, one interviewee, Mark indicated his lack of support for acceleration due to his belief that students would miss important ideas if accelerated.

Only four of the teacher interviewees acknowledged that high ability students need a range of support catalysts to reach their full potential but were not available in their contexts. An explanation would be the very limited specific education or professional development to which these teachers have been exposed, in regard to giftedness. Giftedness is a field of research that is still quite new in Lebanon, and for this reason, a widespread understanding of the research-based practices were not part of the educational literacy of the country.

DISCUSSION

Curricula and educators have a significant responsibility in nurturing and providing opportunities for *all* students to develop their STEM talent, identity, and achievement (Collins et al., 2019; Heyd-Metzuyanim & Hess-Green, 2020). Evidence of curricular provisions and attention to the needs of highly able learners was not explicit in the different aspects of the mathematics and science national curriculum. Considering that the

national curricula represent what is considered as 'decrees' in educational systems and policy, our findings in this study show that highly able Lebanese learners are not receiving adequate opportunities, especially in mathematics, to thrive and realize their potential at the system and policy level. Moreover, the analyzed curricula showed that even though the science curricula displayed more provisions for HALs in terms of assisting highly able learners in finding important concept and a 'focus on unsolved problems and using knowledge/skills to address them,' these provisions did not necessarily entail purposeful activities for HALs to use multiple abstractions and detect patterns and trends across disciplines. Indeed, our results are consistent with earlier research on mathematics and science education in Lebanon that has revealed the dominance of basic skills, procedural knowledge, and memorization over higher order integrated skills (Osta, 2007; Zeitoun & Hajo, 2015). Moreover, in both the mathematics and science curricula and textbooks, opportunities for more rapid and enriched learning were non-existent, which raises serious concerns akin to the ones raised by Western researchers on addressing educational disadvantages of highly able learners in rural and poor areas in the West (e.g., Morris et al., 2021).

The interview data revealed that teacher participants in this study all agreed that gifted students have exceptional abilities that are not found in age peers. However, a diversity amongst the teachers' perceptions was prevalent, more specifically in the way teacher participants viewed suitable provisions for gifted students. Teachers in this study appeared to revert to more traditional teaching methods, because of the school's culture and expectation to cover content for testing purposes, and the values of an educational system, which supports standardization rather than diversity.

Educators in grade 5 need to be proactive in nurturing confidence, interests, and skills before middle school, as early achievement in mathematics and science is essential to foster STEM literacy and success (Collins et al., 2019; Morris et al., 2021). Yet the absence of well-designed curricula and instructional materials, mainly textbooks, that provide educators with pedagogical tools, would hinder educators' proactive role in supporting HALs. All learners, and more so highly able learners, need science and mathematics curricula that challenge and extend their STEM knowledge through relevant practical experiences: STEM needs to be highlighted as human a endeavor essential for improving learners communities (Morris et al., 2021). Moreover, in this highly technological day and age, nurturing mathematical and scientific talents that will contribute to innovations in science and technology for a better future is important: such talents are nurtured through high-quality and specialized mathematics and science education that promotes self-directed learning and autonomous inquiry (al Aliyawinata et al., 2021; Jeon et al., 2019). For example, mathematics activities designed for highly able students need to challenge, interesting, and require higher level thinking. Content needs to present to highly able students through problem situations with interdisciplinary and technology-rich dimensions (Ozdemir & Bostan, 2021).

We saw in this study that a significant challenge reported to affect the implementation of suitable provision was the constraints placed on teachers in terms of curriculum, time, and resources. As participants in this study revealed these as major barriers to implementing special provision, policymakers and educators should take account of these in making informed decisions about support requirements for gifted students. Issues of an overcrowded curriculum, lack of resources, limited time, high class sizes and insufficient support by the school were also reported in a study about issues that constrain Lebanese teachers from adopting active learning instructions in schools (Jabbour, 2013). In other international studies, Adlam (2007), Moon et al. (2002) and Rodriguez (2012), also reported reluctance on the part of teachers to offer special provision, mainly stemming from perceived administrative barriers such as a lack of resources and difficulties with planning and preparation. Moreover, In Lebanon, the national textbooks are used mostly in public schools and free private schools that serve lower middle to lower SES learners. Teachers in more affluent schools use foreign and updated textbooks, and so a contextual concern emerges, whereby HALs exposure to high quality curricula is also dependent on their SES (Morris et al., 2021). As such, diverse HALs can miss out on early experiences and opportunities to engage and solve authentic and relevant problems; experiences that have been found essential for promoting positive STEM identities among diverse learners (Collins & Roberson, 2020). To counter such issues, structures that support gifted education need to be put in place to identify and support highly able learners through in-depth and long-term approaches that, not only focus on accelerative learning, but also develop students' talents and abilities and foster their problem-solving and creative thinking (Burrell et al., 2017; Kang, 2019). For example, a model for implementing gifted education utilizes and

cultivates university partnerships, particularly in poor contexts (Kang, 2019; Morris et al., 2021): highly able learners work with scientists and researchers on real problems connected to sustainability, health, and/or other community matters.

Interviewed teacher supported the contention that gifted students were a valuable resource, this did not translate into overcoming particular misconceptions. Some interviewed teachers shared a few misperceptions with regards to elitism and that gifted students do not require special attention (Cooper, 2009; Moon, 2009; Peterson, 2009). Other studies examining the attitudes of teachers towards academically gifted students had similar results, suggesting fear of elitism as one reason for resisting special provision for gifted students (Curtis, 2005; Gallagher, 2007; McCoach & Siegle, 2007). Teacher perceptions regarding prioritization of less able students as outlined in this study are not at odds with other international research where priority is given to average and below average students (Colangelo & Davis, 2003; Fiedler et al., 2002; Tirri et al., 2002). Gallagher (2007) and McCoach and Siegle (2007) also suggest that teachers' attitudes generally fluctuate between striving for excellence and their fear of student elitism. Thus, the desire for equity has led to the "one-size-fits-all" approach in educational provision (Gross, 1999; Kaplan, 2009).

The findings reported in this study generally indicate that many gifted students in Lebanese classrooms are being overlooked or unchallenged. An effective way of managing the mentioned obstacles is to ensure that opportunities and resources are available for teachers to become educated about research based best practice for gifted students.

CONCLUSION

Gifted students share with all kinds of learners the need to be engaged and challenged at their own individual pace. In the current study, it appeared that the absence of clear policy and limited provisions in the national mathematics and science curricula played a role in whether gifted provisions were accepted or rejected. Understanding teacher participants' perceptions helped in understanding their circumstances and their preferences, which in turn affects how gifted students in the classrooms are accommodated. Consequently, the study would help predict that talent development is more effective when a law exists and when appropriate curricula and teacher's perceptions are considered. Teachers have the opportunity to transform the education of their gifted students; their critical pedagogy can transform the status quo of gifted education. Yet, there also needs to be a systemic commitment to offer curricula and resources for gifted students that will enhance their educational opportunities. At the same time, and to be able to appropriately provide for highly able learners, teachers need to be provided with adequate education and reformed curriculum on one hand, and with professional development opportunities, whereby they reflect and question their assumptions about HALs and how to serve them. As a basis for these measures, a sound Lebanese policy on gifted education would need to be developed by the policy makers and the Ministry of Education.

Limitations and Recommendations for Future Research

This study has been limited to the investigation of the issues involved in the education of academically gifted and talented students in mathematics and science subjects at the grade 5 level. As an expansion on this initial investigation, further research is therefore required in order to understand the specific issues involved in the teaching of gifted and talented students from a wider range of settings and ages.

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