Impact of language and curriculum on student international exam performances in the United Arab Emirates

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Abstract: International student assessments are used to measure the education system quality in many countries including the United Arab Emirates (UAE). However, student performances in these exams are influenced by a complex array of factors. This study collected interview data from six central officials, three school principals and vice principals, and 12 teachers and subject coordinators in the UAE and found that language and curriculum-related issues were adversely affecting student performances in the Trends in International Mathematics and Science Study (TIMSS) and Program for International Student Assessment (PISA) exams. The student understanding of the content in the exams was connected to their language abilities, and the lack of student ability to apply mathematics and science knowledge was owing to the modular-based curriculum and pedagogical methods used in the UAE. Therefore, UAE educational decision makers need to deal with these language and curriculum-related issues because they will continue to affect UAE student achievements, the country's international exam rankings, and the overall quality of the education system.

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PUBLIC INTEREST STATEMENT

This study was conducted in the United Arab Emirates with the purpose of investigating how language and curriculum-related issues might influence student performance in international exams such as Trends in International Mathematics and Science Study (TIMSS) and Program for International Student Assessment (PISA). The study collected interview data from teachers, school principals and vice principals, and central office officials. The study found that certain language and curriculum-related issues were negatively affecting student performance in TIMSS and PISA exams. Specifically, students' understanding of the exam content was connected to their English language abilities and students' abilities to apply mathematics and science knowledge was influenced by the modular-based curriculum and pedagogical methods. Therefore, UAE educational decision makers need to consider language and curriculum-related issues because of their adverse influence on student performance, the country's international exam rankings, and the overall quality of the education system.
1. Introduction
Governments, international organizations, and educators tend to view international student assessments—the International Association for the Evaluation of Educational Achievement’s Trends in International Mathematics and Science Study (TIMSS), the Progress in International Reading Literacy Study (PIRLS), and the Organization for Economic Co-operation and Development’s Program for International Student Assessment (PISA)—as education system quality indicators (Lingard et al., 2016; Meyer & Benavot, 2013). Furthermore, some economists and international organizations use these assessments as benchmarks or proxies for education system quality in the global economy (Hanushek & Woessmann, 2007; OECD, 2012; World Bank, 2008, 2013).

To measure the quality of the country’s educational system, the UAE education authorities consult multiple data sources, including the international student assessment results. At a national level, the UAE’s 2021 National Vision is to develop a “first-rate education system,” and the accompanying agenda states that “a complete transformation of the current education system and teaching methods” is required. One of the targets is to ensure that UAE students “rank among the best in the world in reading, mathematics, and science exams,” with the performance indicators for this goal being an increase in UAE’s rank to one of the top 15 countries for TIMSS and one of the top 20 countries for PISA (UAE Ministry of Cabinet Affairs, n.d.).

UAE student performances on both these global tests have been improving recently. For example, UAE 8th grade students’ average scale score for mathematics went up from 456 in TIMSS 2011 to 465 in TIMSS 2015 and, for science, went up from 465 in TIMSS 2011 to 477 in TIMSS 2015. The mean PISA score also improved from 411 in PISA 2012 to 437 in PISA 2015. Despite these improvements, UAE students performed below the TIMSS average in TIMSS 2011 and TIMSS 2015 and below the OECD average in PISA 2012 and PISA 2015. For example, the mean scores for Singapore, the top-performing country, were 562 in PISA 2012, 556 in PISA 2015, 606 in TIMSS 2011, and 618 in TIMSS 2015. Therefore, the UAE student performances are problematic given the considerable resources invested in education as these have not yet translated into strong outcomes or indicated that the UAE has developed a first-rate education system.

Drawing on qualitative data collected from interviews with six officials from the Abu Dhabi Education Council (ADEC), now called the Abu Dhabi Department of Education and Knowledge (ADEK), and 15 teachers, school principals, and vice principals, this study sought to determine the possible factors that might be impacting UAE student international exam achievements. Specifically, the focus was on the possible impact of language of instruction and curriculum issues. Despite ADEC’s attempts at improving student international exam performance, the respondents reported that issues related to language proficiency influenced student abilities to understand and apply their mathematics and science knowledge and skills and believed that the formal modular curriculum did not support international exam success.

2. UAE education system
As a rich oil- and gas-producing state, the UAE has invested in developing its economy and citizen welfare and expanding the education system, with the main national development foci being to improve citizen knowledge and skills and to shift to an energy sustainable, knowledge-based economy (Ahmed & Alfaki, 2013; Atalay et al., 2016).

UAE national and social development means that the country now has one of the best education systems in the Arab region; for example, the UAE pre-university and post-secondary education
systems are ranked first in all Arab countries in the UNDP Knowledge Index (UNDP and MBRAF, 2018). In 2019, the federal government approved a budget of AED 60.3 billion, over 60% of which was committed to social development (WAM, 2018): 42.3% for community development, 17% for education development (approximately US$ 2.8 billion), and 7.3% for healthcare services. The UAE government also seeks to ensure equity across all seven emirates noting that “it is important that schools in one emirate are of the same standard as schools in another, and that the quality of health care enjoyed by UAE citizens does not vary from place to place” (WAM, 2018).

As a federal department, the education authority is divided between the national government and the emirates (Ruban, 2012), with the three major bodies being the Ministry of Education (MoE), ADEC/ADEK, and Dubai’s Knowledge and Human Development Authority. In September 2017, ADEC merged with the MoE to bring the Emirate of Abu Dhabi education system under the federal system, thereby allowing both entities to unify their policies and actions, develop a comprehensive UAE school model, enhance efficiency, and optimize resources to improve the country’s education system (Ministry of Education [MoE], 2019).

The UAE participates in the TIMSS, PIRLS, and PISA international exams. The Emirate of Dubai participated in the TIMSS in 2007 as a benchmarking participant, and the UAE participated in TIMSS in 2011, 2015, and 2019 and in PIRLS in 2011 and 2016. The Emirate of Dubai first participated in PISA in 2009, with the rest of the emirates participating in 2010 in a PISA round called PISA 2009+ (MoE, n.d.). The UAE then participated in PISA in 2012, 2015, and 2018.

The UAE views these international student assessments as important benchmarking tools and credible and objective measures for the assessment of education improvements because the government uses the comparative PISA, TIMSS, and PIRLS data to compare its performance and curriculum with high-performing countries. This research was particularly focused on the issues related to the ADEC public school international exam student achievements. ADEC organizes its public schools in three cycles: Cycle 1 = Grades 1–5; Cycle 2 = Grades 6–9; and Cycle 3 = Grades 10–12. Bilingual literacy (Arabic and English) is a core component of ADEC’s New School Model, introduced in 2010 to all KG schools and Grades 1–3. In 2011, it was expanded to Grade 4; in 2012, to Grade 5; and in 2016, to Cycle 3 (ADEC, n.d.). ADEC employs mainly expatriate Arabic- and English-speaking teachers and a minority of Emirati teachers.

Although global assessments such as TIMSS, PIRLS, and PISA are valuable information sources, contextual issues including language abilities, mathematics and science knowledge and skills, curriculum content, and teaching and learning processes need to be considered as these significantly influence student international exam performances.

The remainder of this article is organized as follows. The subsequent section presents a literature review, after which the study methods are detailed. Then, the findings are summarized and discussed and guidance and proposals for change are given in the conclusion.

3. Literature review
To situate UAE’s experiences into a broader framework, this literature review examines the influence that language and curriculum have on L2 English language learners (ELLs) in international exams.

(1) English language proficiency and international exams

Mathematics and science achievements were found to be significantly related to student language proficiency. For example, Abedi and Lord (2001) found that ELLs had significantly lower scores than proficient English speakers in mathematics, science, and reading exams. According to Abedi and Lord (2001) as unfamiliar vocabulary and passive voice constructions may affect the ELLs’ comprehension, they may be at a greater disadvantage when answering mathematics questions written using complex language. The impact of language on ELL assessment was more obvious in content areas that
had higher language demands such as reading, as ELLs may not understand complex questions, may meet unfamiliar vocabulary, and may have a slower reading pace than proficient English speakers (Abedi, 2002). Similarly, Caponera et al. (2016) found that when taking mathematics and science exams, proficient English readers had a better understanding of new text, had a richer vocabulary, were able to ignore irrelevant information, could adjust for a lack of understanding, were able to allocate their time more efficiently, and were able to persist longer with difficult texts (See also Wikberg, 2019).

Some studies on the role of language in teaching and learning mathematics focused on the ability of teachers to engage learners in meaningful mathematical discourse (Boulet, 2007) and mathematical reasoning (Bragg et al., 2016). Schleppegrell (2007) argued that as each content area uses specific language to construct knowledge, students needed to be able to use this language effectively to understand the “ways of knowing.” Particularly, Schleppegrell (2007) noted that while mathematics could be challenging for all students, it was even more challenging for ELLs who did not use English outside school. Understanding mathematics requires a particular “mathematical register” (Halliday, 1978), that is, the ability to use scientific and technical language in new and advanced ways to serve new functions; therefore, to construct meaningful discourses about mathematics and perform well on assessments, students need to be allowed to be involved in interactive activities. However, if the language of instruction is not the students’ native language, the teachers face additional demands because they need to develop the student language skills for the specific mathematics register.

Language is also important for learning science and answering the associated questions. El Masri et al. (2016) argued that language was an inextricable part of the “science literacy construct” and investigated the extent to which language versions (English, French, and Arabic) of the same science test were comparable in terms of item difficulty and demands. They found that comparing the language versions of the same science test was methodologically indefensible as there were obvious translation effects and inevitable bias at some levels (see also Hambleton et al., 2004). El Masri et al. (2016) also commented that while the language in the TIMSS science items appeared considerably simplified to minimize construct-irrelevant variance (i.e., errors in the scores resulting from variables not related to the construct being measured (Haladyna & Downing, 2004)), the PISA science items clearly imposed higher processing demands on participants through elements such as text length and graph use. The higher lexical density (i.e., using many content words and grammatical items) in PISA exams and the use of low-frequency terms are likely to increase the reading demands, thus affecting performance on the science construct.

Haladyna and Downing (2004) found that when ELLs were tested in mathematics and science, their English proficiency impeded the accurate measurement of the targeted constructs and that language proficiency was a common reason for the construct-irrelevant variance in the test scores. Sireci et al. (2008) also concluded the inferences derived from these test scores were suspect and were possibly not comparable with the scores from students fully proficient in English. Therefore, although provisions have been made for accessing tests and promoting valid score interpretations, valid score interpretations may be inhibited if the construct being measured is changed or an unfair advantage is being given to English language proficient students.

(2) Curriculum issues and international exams

Bouhlila (2011) studied the quality of secondary education in the MENA region—the Middle East, North Africa—and found three main reasons for the possible low TIMSS achievements. The first reason is dichotomization or the separation between teaching and learning that occurs when teachers teach and students listen with little or no discussion. The second is decontextualization, which is when the curriculum is not presented in a manner that links to the students’ real-life experiences. The third is memorization, related to the aim of the student to get the right answers rather than to develop understanding. Bouhlila (2011) concludes that although several reasons
were noted for the low MENA achievements in TIMSS, the most serious was that the students’ spoken language was not used at school because standard Arabic was not spoken at home.

Valverde (2005) claimed that the curriculum in the MENA region was weak in coverage, did not focus on reasoning or problem solving, and cognitively emphasized routine mathematics procedures and simple science information. In the UAE, for example, the curriculum was not designed to provide holistic, cumulative knowledge (Farah & Ridge, 2009) and, because it is in a modular format, is segmented and sometimes inflexible, all of which puts the students in the region at a disadvantage for the TIMSS and PISA exams, which assess holistic and cumulative comprehension and knowledge application. Rutkowski (2015) commented that rather than focusing assessment on measuring the international curriculum, PISA measured the degree to which 15 year-old students in both member and nonmember countries were able to apply their knowledge to real-life situations and assessed whether they were equipped for full participation in society.

Curriculum coverage has also been found to influence international exam performances. For instance, Huang et al. (2016) investigated the cross-language, cross-cultural validity of the PISA 2006 Science assessment using three differential item functioning (DIF) analyses between the USA and Canada, Hong Kong and China, and the USA and China. They explored the language, curriculum, and cultural differences as probable causes for the DIF. An item is said to exhibit DIF when it functions differently for different test taker groups after controlling for their abilities on the construct. The DIF was found to be the most serious between the US and Chinese students; few differences were found between the English-speaking Canadian and US students. Moreover, as the Hong Kong and Chinese students had similar languages and cultures, the language and cultural influences were much smaller, with the differential curriculum coverage appearing to be the most significant cause for the DIF. For the US and Chinese students, language and culture differences explained about 15% of the DIF and curriculum coverage was found to explain around 25% of the detected DIF.

The UAE curriculum is narrow and covers fewer subjects and subject areas than the higher-performing countries in the international exams. Further, as local exams require students to provide limited answers, they do not clearly elucidate student weaknesses, thus providing incomplete feedback on their progress (Farah & Ridge, 2009). Despite many curriculum changes and billions of dollars, Kippels and Ridge (2019) noted that public school students in the UAE were still being subjected to teacher-centered instruction (p. 45).

Zanini and Benton (2015) used TIMSS 2011 data to examine the effect of teaching styles and mathematics curriculum on achievement and found that many MENA countries tended to be test-centric, wherein many teachers used tests and quizzes in almost every lesson. Relative to other countries, the UAE belonged to countries that had delayed mathematics topics, even those considered fundamental to mathematics curricula.

Edriss and Etchells (2016) conducted a qualitative study on TIMSS exam preparation methods and effects with UAE teachers. They found that the TIMSS concepts were not being included in the pacing charts and the students were being trained to memorize the answers rather than to develop conceptual understanding. Therefore, the students gained little benefit from this preparation and found it difficult to adapt to analytical thinking methods. The study participants commented that the students would be able to perform well in the TIMSS if the curriculum matched the assessment topics and if the teaching strategies included critical thinking as a way of learning (p. 143). The participants also commented that teaching both the school curriculum and the TIMSS topics had disrupted the learning experiences of their students. The irony is that because the results of the exams are never shared with the teachers, they remain unaware of their students’ performances and have not been involved in the curriculum improvement process.
4. Methods
This study explored the UAE language and curriculum-related issues which could have a potential impact on students’ performances in international exams. After securing IRB approval and ADEC approval, the data were collected based on qualitative interviews with six ADEC officials, 12 teachers and subject coordinators, and 3 principals and vice principals from six ADEC public schools: two in Abu Dhabi, two in the Western region or Al Gharbiya (recently called Al Dhafra), and two in Al Ain and surrounding areas. Depending on time constraints and staff availability, the school-based interviews were conducted either in a one-on-one or group format while interviews with central officials were conducted in a focus group format. Participants were informed of their rights and signed consent forms. The interviews followed a semi-structured format where specific questions were asked and then probing questions were added to get more clarification. The questions focused on international exams and their relationship to the teaching and learning processes and the factors that might impact student performances in these exams.

The data were collected from May 2015 to May 2016 and the interviews were conducted in English or Arabic or both and were recorded and then transcribed, with the Arabic interviews being translated and then back translated. The data were then thematically organized and analyzed (Bogdan & Biklen, 1992) into two broad sets: issues related to language and the impact on international exam student performances, and issues related to curriculum and teaching. The analysis was done separately by the two researchers and, in joint meetings, agreement was reached on important themes. To ensure anonymity and confidentiality, any identifying information was removed from the transcripts.

5. Findings
Although ADEC had taken steps to improve TIMSS and PISA performances, some issues could not be adequately identified from the results of these global tests. The participant perspectives were sorted into two broad areas: (1) bilingual language abilities and student knowledge in mathematics and science and (2) curriculum-related issues.

(1) **Bilingual language abilities and student knowledge in mathematics and science**

All ADEC schools have applied ADEC’s bilingual education approach to teaching and learning, wherein Arabic is used to teach Arabic, social studies, and religion, and English is used to teach English, mathematics, and science. As mentioned, bilingual literacy was the core component in ADEC’s New School Model, which was expanded to Grade 4 in 2011, Grade 5 in 2012, and Grades 9 and 10 in 2016 (ADEC, n.d.), at the time these interviews were being conducted.

The student abilities to understand and apply mathematics and science skills and knowledge were found to be closely associated with their language abilities. Therefore, a student with poor English language abilities may perform poorly in mathematics and science because of language problems. As one teacher explained, “Can I teach ‘condensation’ to a kid who cannot say ‘Miss, may I go to the bathroom?’” (AD3-5-2015). Most participants therefore believed that language skills have a significant effect on student international assessment performances. One teacher noted the following:

In science and mathematics, the language itself can be a barrier for the students to get involved in the tests. Some students are excellent in English and others are very good in mathematics but they lack English language ability. This will affect their performance in the test (AD6-2-2016).

The teachers all reported that the student English language abilities varied in each class, with a small number of students achieving high levels and the majority having low or extremely low English proficiency. One teacher explained that “Some students are very high [achievers] and other students are low [achievers]. The middle nowadays is it is not there” (AD6-2-2016). These large student disparities further exacerbated the capacity of teachers to teach the mathematics and
science concepts. One mathematics teacher suggested that one of the solutions was to provide teachers with more time to help low-performing students:

I feel in our classrooms we have good students, academically good, and we have really low students. There is nothing in the middle. So, why not group those good students together and let us work with these lower kids on our own. So give us time to work with these kids (AD11-2-2016).

The skill level gaps in the student cohort made it difficult for teachers to ensure that all students understood the complex ideas, which meant they needed to constantly repeat the information to ensure the students grasped the concepts being taught. The mathematics and science teachers also noted that “students lacked basic concepts and skills when they arrived in their class” (AD25-2-2016), meaning that they had to re-teach the concepts and skills that should have been learned in earlier grades. This in turn meant that they were unable to keep up with the required curriculum goals for their own grade.

English is not the native language of UAE students and is rarely spoken at home; therefore, this lack of familiarity means that students find it challenging to understand the subjects and the exam items. One teacher commented as follows:

People who set the exams have never been in a UAE classroom to see the difficulties we face. I mean they set a test based on a native English speaker’s understanding. They do not understand that these students cannot read half the words they are putting in the tests. So what happens is that students answer some questions randomly because they do not understand the language (AD25-2-2016).

Another teacher stated that she used simplified English so that the students could understand the lessons, “I use basic, dumbed down English just so they can understand the concepts, whereas these international tests use higher English” (AD25-2-2016).

The language problems start in the early grades, as only some students develop language similar to their age group, whereas many others do not. As teachers in the primary grades are required to teach three subjects, they focus more on language in English classes than when teaching mathematics and science. One teacher explained as follows:

What I think is happening is that in Cycle 1, teachers are focusing on English because they want the students to start conversing in English. So the mathematics and science have been forgotten about. I am not saying it is true, I am just saying this is what I think is happening ... because they want the students’ English to improve (AD11-2-2016).

Similarly, one vice principal indicated that the language deficits were “endemic” and began at an early age. He noted that “if these reading and writing deficits are not corrected during the early years, they remain with the student into higher grade levels.” Therefore, it appeared that the schools were not fully addressing English language deficits in the primary grades. In certain cases, he commented that the “students lack the ability to pronounce and read words correctly and are not able to grasp the meanings of English words” (AD12-3-2016) and noted that the UAE’s vision of becoming a knowledge-based society required strong reading and writing foundations:

The nation’s goals are to move into science and technology at international levels. In no culture can you do that without reading and writing. You have no access to that level of learning and production without those basic tools (AD12-3-2016).
Even though the teachers might focus on language development, when students are focusing on mathematics and science, the language remains a challenge. According to a mathematics coordinator, “language is a barrier to accessing the curriculum ... Science and mathematics are languages in themselves, so language poses a huge challenge for us.” The mathematics coordinator recommended that exam designers understand the language barrier for non-native speakers and “because it is an international mathematics test, it should not measure the English language, especially in problem solving questions” (AD08-02-2016).

(2) Curriculum-related issues

One of ADEC’s policy objectives was to better prepare students for the TIMSS, PIRLS, and PISA by integrating test content into the curriculum and conducting practice test sessions prior to the administration dates. “We train teachers before international tests and provide them with released items so that students will receive better education” (ADEC10-10-2015; focus group).

ADEC has modified the curriculum to integrate the content included in the international student assessments, and sample questions have been added to the curriculum to familiarize students with the types of questions being asked on TIMSS, PIRLS, and PISA. An ADEC official involved in curriculum development explained as follows:

We have done some studies on the components of these different exams ... So we have embedded that into our curriculum to make certain that we are aligned with the exam writers. We have also looked at what types of questions are asked and so we have embedded some of that into the curriculum so that the students are not unaware of how to answer certain types of questions. We want to prepare the students as much as possible for taking the exams (ADEC03-05-2016; focus group).

Another official explained that ADEC has also internationally benchmarked its curriculum with top-performing countries such as Singapore.

We chose several different countries to benchmark our curriculum with. We looked at their TIMSS and PISA scores. We looked at countries that had incorporated English and teach a bilingual curriculum like we do here ... We got copies of their curriculum. We read through their curriculum and pedagogy ... and then we looked at what we were doing to make certain we were aligned with them (ADEC03-05-2016; focus group).

ADEC used a centralized approach to improve student international exam achievement. After they aligned the curricula, they then provided the teachers with learning outcomes and teaching materials.

We provide the teachers with the learning outcomes and the explanatory notes to give the teachers a better idea of what an emergent student looks like, a developing student looks like, and a master student looks like. We do develop some example activities for them so they can see what a good activity would be that will hit all three levels ... We put in skills so we have inquiry skills, we have investigation skills, we have 21st century skills and those are expected to be part of how we implement the curriculum at the school level (ADEC03-05-2016; focus group).

The way ADEC has organized the curriculum and its improvement strategies had not been well received by many teachers. A chemistry teacher explained as follows:

We have a very random selection of topics. We have one topic here, one topic here and one topic there. There are two problems: the topics are not tied together, they are random, and the second thing, the students do not have the basics. You ask me to teach certain skills but the students do not have these skills prior to coming to the class. They do not have any background (AD25-2-2016).

Time was perceived as a barrier to teaching the students and preparing them for the international exams.
We do not have a real timeframe to prepare the students. And how do you prepare students like that in a week or a month? Now, remember we still have all the outcomes to do what ADEC wants us to do. And now you are asking us to do—there is a month, prepare the students. Not possible. The concepts need to be integrated into the curriculum where you are constantly preparing the students and testing them. Now, it is not a process of learning. It is not like a buildup, where we started with this, ok we did this activity, this activity, it leads to that activity. So this is the outcome. This is what we achieved. You want to bring in these tests, you have to introduce it in the learning process (AD25-2-2016).

International exams measure cumulative knowledge, which has proven to be a challenge to many students in the ADEC system. “The exams measure many skills that are accumulated over time and these might not be retained by the students who are used to exams at the end of a semester” (AD02-05-2015). One teacher explained that the students were not equipped to take these international student assessments because of the way their learning was organized:

Students have to remember previous skills so they can answer a question and this is difficult, because in our curriculum, students study each unit separately and have an exam on it and then turn to the next unit, while in the TIMSS they have to study all the units and have an exam on all of them (AD2-5-2015).

In other words, the ADEC curriculum has been designed in modules to ensure a specific understanding of specific concepts; however, the TIMSS is testing the holistic knowledge a student should have accumulated over a certain number of school years. Therefore, the poor TIMSS performances are possibly a reflection of the knowledge accumulation challenges the students are facing as they move from primary to middle to secondary school, some of which can be attributed to poor language abilities and a poor or only a basic grasp of mathematics and science concepts.

The teachers indicated that the daily school curriculum was a barrier to developing a thriving learning culture. Specifically, they noted that the length of the school day caused fatigue for both students and teachers and that the number of classes per day was a heavy load for both. The average teaching load for English Medium Teachers, who teach English, mathematics, and science in Cycle 1, is six periods a day (a total of 30 periods a week), which leaves no room for planning or working with students who have learning difficulties.

Both positive and negative effects were found for the impact of TIMSS and PISA on teaching and learning practices. From a positive perspective, the teachers claimed that as the TIMSS and PISA questions were not reliant on student memorization, the “students developed higher thinking skills and improved their thinking skills” (AD02-05-2015). Another teacher stated the following:

The good thing about them is that they make the students gather all the information ... everything they learned before and ties them with the external world ... So the exams train them to think quicker and give them more confidence (AD04-02-2016).

Teachers also commented that the assessment questions could improve the teaching and learning as the TIMSS and PISA practice questions helped them teach the curriculum differently and develop new ideas. For example, one science teacher noted that “there are new ideas. There are ideas in the questions” (AD11-02-2016), which helped her expand the curriculum and integrate new teaching methods.

However, the culture of testing being instilled because of the participation in these global tests was affecting ADEC’s student-centered learning policy. The data suggested that because of the desire for the UAE to rank better on these international exams, there was a tendency to shift toward “teaching to the test” and training the students to take the test. Some participants said
that they spent time “teaching to the test instead of giving children required hands-on activities” as well as “practicing” to take the test (AD03-05-2015). Several participants told us that they spent significant time teaching the students selected to participate in the TIMSS and PISA on how to take these tests. In one school, a specific class was established for this type of training, “one day for mathematics and the other for science and so on” (AD02-05-2015).

Some teachers were critical of this need for international exam practice as they felt that it took time away from the required curriculum and created an exam preparation driven culture.

The disadvantage of having those tests is that teachers become caught up in teaching to the test and not teaching the curriculum. Then, you get schools that are results-driven and they focus primarily on PISA or TIMSS, and as a result, they neglect the curriculum, so I do not think it is a fair reflection on the students, on the school, or on the society. They should be preparing a more holistic individual, and looking at their learning as a whole. Because this sort of test is just a measurement and it is easy to achieve fantastic results if you practice enough papers, in reality the knowledge and skills of the person as a whole would be lacking in that regard (AD08-02-2016).

6. Discussion
In general, the findings from this study indicated that in the ADEC schools, student language proficiency, the required curriculum, and the related teaching and learning practices presented challenges to improving student TIMSS and PISA performances. The data suggested that ADEC’s approach to improving the UAE’s international exam ranking was characterized by a centralized approach, a heavy reliance on external education quality measures, and an emphasis on assessment of learning rather than assessment for learning. In our view, an assessment of learning approach is constraining and does not allow for experimentation and innovation to address the range of student abilities or the challenges in the education system. The evidence suggested that if ADEC shifted its focus away from external measures and focused more on improving student language proficiency and curriculum issues, it might be better equipped to deal with the complex but interrelated factors such as the weak language abilities, the gaps in mathematics and science knowledge and skills, and the poor teaching and learning practices.

6.1. Language abilities and knowledge in mathematics and science
As the data suggested, there were significant gaps in the student language abilities and mathematics and science knowledge. It was found that students with language deficits including poor pronunciation, insufficient vocabulary, and lack of grammar understanding would find it difficult to understand meanings and thus might not be able to develop their “mathematics register” (Halliday, 1978; Schleppegrell, 2007) or improve their science literacy (El Masri et al., 2016). This might explain students’ low performance in TIMSS and PISA exams. According to Abedi and Lord (2001), Abedi (2002), and Caponera et al. (2016), the proficiency of ELLs affected their reading, mathematics, and science international exam performances. Unfortunately, it appeared that primary school teachers were not addressing these challenges or were not getting the necessary support to address them, which meant that UAE students were moving up to the middle and secondary grades with these language gaps; however, this situation was not unique to the UAE. For example, Choi and Jerrim (2016) found that in Spain, poor performances on international reading assessments were evident in primary and pre-primary grades and did not appear to improve during secondary school. Therefore, improving the poor language skills of primary school children is critical to significantly improving UAE education and its ranking on international exams.

Further research is necessary to identify why these learning gaps exist in the early grades and what methods are needed for teachers to effectively address them. If a decentralized approach were adopted to address these factors, solutions could include internal consultations and in-depth discussions to determine the needs of both the teachers and the students. A solution recommended by a participant was to have Arabic–English “dual” or co-teaching in most subjects, which echoed the thoughts of several others who had commented that it would be helpful to have Arabic-speaking assistants or helpers when
teaching and reaching out to the parents. Strengthening and reinforcing both Arabic and English as part of the K-12 curriculum could not only improve global test performances but also more significantly improve student learning and their ability and capacity to grasp complex concepts.

Challenges for improving students’ achievements are compounded when students are allowed to move from one grade to another without the basic knowledge and skills required for each grade level. It appears that rather than assessing whether the students had grasped the necessary language proficiency and mathematics and science knowledge and skills for the grade, the students were being assessed so that they could “pass” to the next grade level. Given these challenges, schools need to develop strategies to ensure that students have sufficient bilingual language proficiency and adequate mathematics and science knowledge and skills for each grade level, ensure access to remedial learning sessions if students are not able to keep up during class, and make teachers available to provide one-on-one tutoring. Further, schools need to assess students as they enter middle school to ensure that the necessary remedial learning and support is provided to succeed. At the same time, teachers need to be given the necessary training and specialization to teach complex subjects such as mathematics and science and provided with the necessary resources to effectively teach complex mathematics and science concepts.

Ashour and Fatima (2016) highlighted the several challenges students encounter when transitioning from secondary school to higher education and, in reference to Bassem Barqawi, indicated that students were generally not well prepared for English medium instruction. Similarly, Wilkins (2010) found in a UAE survey that many university professors believed their students had “average or below average abilities in mathematics and writing in English” (p. 397). Further, as UAE students in the public school system are exposed to “traditional learning methods” (Ashour & Fatima, 2016, p. 386) in their K-12 education, they are not equipped with the problem solving and critical thinking skills necessary for academic success. Wilkins (2010) commented also that students found it difficult to transition from a “didactic, teacher-centred secondary education” to the “student-centred and independent learning” environment (p. 395) required at college. Therefore, secondary schools need to equip students with the necessary knowledge and skills to pursue post-secondary education, put greater effort into enhancing student English language abilities and mathematics and science knowledge and reasoning, lighten curriculum loads for both students and teachers, and develop innovative strategies that address language barriers and more effectively involve parents.

6.2. Curriculum-related issues
Despite ADEC’s efforts to improve the curriculum, both the curriculum organization and the way it is presented were not aligned with international test design. As described, the teaching in the UAE is modular, which means that specific pieces of knowledge are given in small amounts each week on a sequential module-by-module basis. As the teachers test the students after each module, the students have difficulty scaffolding the knowledge, which means there are large gaps in the student knowledge and abilities. This type of curriculum and teaching encourages a “memorization” approach (Bouhlila, 2011) and does not prepare the students for international exams such as TIMSS and PISA, which assess accumulated knowledge from Grade 1 to Grade 9 and focus on knowledge application (Rutkowski, 2015). Therefore, low student TIMSS and PISA performances are an indication of the larger problems within the education system.

Our evidence suggested that several challenges to teaching and learning in the ADEC system require resolution. For example, teacher frustration (Ibrahim & Al-Taneji, 2019) is a serious issue affecting the quality of teaching and learning. In most cases, in Cycle 1 schools, English, mathematics, and science teachers teach 30 periods and are usually teaching six periods a day. These barriers to educational quality are compounded when the teachers have little time to help students that require remedial learning because of their heavy teaching load. Moreover, it may be difficult to implement student-led classroom learning given the students’ lack of basic knowledge and skills.
What would be the impact on teaching and learning if teachers were provided with more time and autonomy? In such a scenario, teacher professional development and the nurturing of professional exchange would be prioritized. Based on the teachers’ input, teachers’ workloads are adapted to meet the students’ needs, time is allocated for the teachers to teach students with low English proficiency, and students with learning difficulties are identified early because of the open communication instituted with the teachers.

The evidence indicated that in certain cases, the use of international assessments could change the teaching and learning culture as teachers reported providing intensive training to students to familiarize them with the TIMSS and PISA test questions, and some schools had established specific practice classes for the students participating in the TIMSS and PISA (Morgan & Ibrahim, 2019). Although this approach is not ideal, it was also found that the types of questions used in TIMSS and PISA had made some teachers rethink the types of questions they asked their students and had altered their teaching methods. These types of pedagogical changes could impact both the students and teachers, with the teachers moving away from memorization and emphasizing higher-order critical thinking skills such as analysis, evaluation, and problem solving. However, the magnitude of these changes is questionable as only a select number of students are exposed to this pedagogy and few teachers are actually involved in instructing students for the TIMSS and PISA practice questions. In other words, the teachers’ experiences with TIMSS and PISA should be shared so that all teachers can benefit from these pedagogical insights.

Sui Chu (2016) suggested that international assessments should be considered low stake, be used to inform different stakeholders, and be a springboard for professional teacher development and educational reform. Rather than seeing TIMSS and PISA participation as an opportunity for professional development, schools should treat these global tests as a one-time task to be performed by a select group of teachers and students, with no tangible benefits for the whole school. However, this view represents a missed pedagogical opportunity for both the teachers and the students as the preparation for these tests could be an important opportunity for improvement.

Our evidence also suggested that the culture of professional responsibility and trust, wherein teachers are provided autonomy to develop the curriculum, was weak (Ibrahim, 2020) as there appeared to be few opportunities for self-evaluation, reflection, or collaboration. Thus, the UAE has been relying on a test-based accountability mechanism for education reform. Further, the significant workforce diversity in UAE schools may not be conducive to creating a culture of mutual responsibility and trust as many teachers may have little understanding of Emirati culture and therefore may not be able to build community–school relations. However, as the UAE works toward increasing the number of Emirati teachers in the school system, it may need to rethink its approach and focus more on developing teachers’ capacities and autonomy.

7. Limitations
There were several limitations to this research study. As this study was based on a small sample of ADEC officials and school-based participants in public schools in the Emirate of Abu Dhabi only and on qualitative data, the conclusions made may not be representative of the other Emirates such as Dubai and the Northern Emirates. Therefore, this study only identified those issues that are impacting TIMSS and PISA exam performances in ADEC/ADEK schools.

8. Conclusion
This paper analyzed the language and curriculum-related issues in the UAE, impacting student performances in international exams such as TIMSS and PISA. The findings indicated that the student TIMSS and PISA assessments had a mixed effect on the schools. Despite attempts at improving the student learning outcomes on these types of international tests, the findings indicated that decision makers needed to pay greater attention to bilingual language abilities, student mathematics and science knowledge, the curriculum, and the methods used to prepare students for these exams.
The main finding was that the ADEC officials appeared to have adopted a test preparation approach to improving the UAE’s international exam ranking by benchmarking the curricula from top-performing countries and integrating test questions into the reading, science, and math curricula. Furthermore, schools appeared to have a test preparation culture prior to the TIMSS and PISA test dates, with ADEC officials, school principals, teachers, and students all being involved. However, teaching to the test was found to have some positive effects such as helping teachers shift from lower-order cognitive skills to higher-order cognitive thinking.

The main concern is that the apparent preoccupation with international exam rankings and results on tests such as the TIMSS and PISA could conflict with the country’s long-term policy objective of a knowledge-based economy based on knowledge generation and diffusion. As Sahlberg (2010) noted, knowledge society learning requires skills that international student assessments do not adequately measure, such as teamwork, critical thinking, and creativity. Therefore, it is suggested that decision makers raise student performances by developing long-term, in-depth, deliberative, and contextualized approaches that integrate complex language, curriculum, and teaching and learning factors.

Although this study found that language deficiencies, mandated curriculum, and teaching delivery methods impacted UAE student achievements in international exams, future research need to consider additional factors, such as student motivation (Eklof, 2007), workforce diversity in UAE schools (Ridge, 2014), and these international assessments’ pressure on schools, teachers, and students (Elliott et al., 2019; Sui Chu, 2016).

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Notes
1. TIMSS measures the level of students’ competencies in science and mathematics in Grades 4 and 8. PIRLS assesses reading comprehension of students in the fifth or sixth grade (at 9.5 years of age) and is administered every four years. PISA is administered triennially to test 15 year-old students’ knowledge and skills in mathematics, science, and reading.
2. Results are found on TIMSS-PIRLS website—TIMSS 2011: http://timssandpirls.bc.edudata-release-2011/pdf/Overview-TIMSS-and-PIRLS-2011-Achievement.pdf; TIMSS 2015 mathematics results: http://timssandpirls.bc.edu/timss2015/international-results/timss-2015/mathematics/student-achievement; TIMSS 2015 science results: http://timssandpirls.bc.edu/timss2015/international-results/timss-2015/science/student-achievement; PISA results in OECD PISA publications (OECD, 2016).
3. Public education is freely available to Emiratis; public education access to the expatriate population is based on merit and is fee-based. ADEC restricts the number of expatriate students to 20% for each school/year. (https://www.adec.ac.ae/en/Students/PS/Pages/Expats-Students.aspx). 4. The Ministry of Education has full jurisdiction over the northern emirates of Sharjah, Ras Al Khaimah, Ajman, Fujairah, and Umm Al Quwain while also managing the public schools in the Emirate of Dubai and Abu Dhabi. 5. Abu Dhabi Education Council (ADEC), which is currently called the Abu Dhabi Department of Education and Knowledge (ADEK), governs private schools in the Emirates of Abu Dhabi. 6. The Knowledge and Human Development Authority (KHDA) governs private schools in the Emirate of Dubai. 7. New School Model https://www.adec.ac.ae/en/education/p12education/pages/new-school-model.aspx.
8. AECK, for example, has increased the number of Emirati teachers to 52% in 2016 (http://gulfnews.com/news/uae/education/52-of-teachers-in-abu-dhabi-public-schools-are-emirati-1.188877).

Disclosure statement
There are no conflicts of interest to declare.

Photo of the author
The photo attached is for Dr. Ali Ibrahim

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