Effect of distance learning on the students' performance in science studied for the first time in English (Reproduction topic)

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Abstract: As a preventive measure to decrease the spread of coronavirus (Covid-19), the educational institutions around the globe were closed. Overnight, all teachers and students were forced to shift entirely to online education. Practically, the lessons addressing students were run virtually, and assessments were occurring at a distance. In this context, this research aims to examine the sixth graders' performance in science being taught for them for the first time in a foreign language (English) after being taught for them in previous grades in their mother tongue (Arabic). The lessons prepared were based on the CLIL approach; accordingly, the research highlights the student's performance with regards to the mentioned approach. The study participants consisted of 330 grade six Lebanese students in a private school in Mount Lebanon. Data collection was done through a science test that explored the contribution of the “teaching language" on students' performance in science. The test content covered a specific topic in the grade six curriculum related to “reproduction," a topic encountered by students for the first time in science. Results of the study revealed that students' performance seems to be acceptable in general in science, particularly when the weight of the language is low. Conversely, this performance is lowered when the weight of the language increases.

Keywords: online teaching, performance, COVID, CLIL.

ملخص

أغلقَتْ المؤسساتُ التربويةُ أبوابَها في أرجاءِ المعمورةِ، كإجراءٍ احترازيٍّ للحدِّ منِ انتشارِ فيروس كورونا المستجدِّ (كوفيد-19). وخلالَ ليليةٍ وضحاها، أصبحَ جميعُ المعلّمينَ والتلاميذِ مضطرينَ إلى الانتقالِ الكليّ للتعليمِ منْ بعدٍ. وعمليًّا، أضحى التلاميذُ يتلقّونَ الدّروسَ بشكلٍ افتراضيٍّ، وينفّذونَ الاختباراتِ منْ بعدٍ. في هذا الوضعِ، صُمّمَ هذا البحثُ بهدفِ تقصّي أداءِ تلاميذِ الصفِّ السادسِ الأساسيِّ في مادةِ العلومِ، الّذينَ يدرسونَ هذهِ المادّةَ للمرةِ الأولى باللغةِ الإنكليزيةِ بعدَ أنْ كانوا يدرسونَها في الصّفوفِ السّابقةِ باللّغةِ العربيّةِ. وتمَّ تحضيرُ الدّروسِ لهذا الصفِّ بالاعتمادِ على مقاربةِ (CLIL)، بناءً عليهِ أضاءَتِ الباحثةُ على أداءِ التّلاميذِ منْ منظارِ هذهِ المقاربةِ. وشملَتِ الدراسةُ 330 تلميذًا لبنانيًّا في الصفِّ السادسِ الأساسيِّ منْ مدرسةٍ خاصةٍ في جبلِ لبنانَ، وحُصّلَتِ البياناتُ منْ خلالِ اختبارِ علومٍ يسمحُ بالتقصّي عنْ أثرِ لغةِ التعليمِ على أداءِ التلاميذِ في المادّةِ. غطى محتوى الاختبارِ موضوعًا محددًا منْ منهاجِ الصفِّ السادسِ الأساسيِّ وهوَ "التكاثرُ"، الّذي يتعرضُ لهُ التلاميذُ للمرةِ الأولى في مادةِ العلومِ. أظهرَتْ نتائجُ الدراسةِ أنَّ أداءَ التلاميذِ في العلومِ كانَ مقبولاً بشكلٍ عامٍّ، حيث كانَ ثقلُ اللغةِ غيرَ وازنٍ، بينَما تدنى هذا الأداءُ حيثُ كانَ ثقلُ اللغةِ وازنًا.

The origin of distance education can be traced back to over 100 years ago (Birnbaum, 2001). Distance education has emerged in the mid-18th century to compensate for some gaps in traditional education. Nowadays, it has developed rapidly due to the availability of new technology,

which is considered the reason for the inflation of distance education (Ali, 2011). The new technology is widely utilized after the widespread of the Coronavirus that brought a sudden move towards full online teaching around the world. As for bilingual education, it has existed in one form or another for about 5000 years, since it is a characteristic of human societies (Baker, 2001). Whether in traditional teaching or at a distance, bilingualism is still a dimension in teaching, especially in Lebanon, where science is taught in a second language (Ghaith & Shabaan, 2000). Consequently, this study aims to investigate the grade six students' performance in science being studied for the first time in a second language (English) and at a distance in a private school in Lebanon.

Problem statement

Prior to the Corona virus, and far from the higher education in universities, the central aspect of teaching driven in schools was the face-to-face education that naturally requires the physical presence of students on the school campus. Within that time, some schools followed a hybrid education making use of the development of technology in this era. In these schools, hybrid education is limited to the secondary grades due to the competency of the students with the technology (Farah & Frayha, 2020). The schools in the world and Lebanon, overnight and due to the outbreak of COVID-19, found themselves obliged to adopt a new approach in teaching that they didn't use previously: distance education. Among the critical issues in distance education, the teachers raised concern over their ability to assess students online (El Rouadi & Anouti, 2020). Another challenge in education that schools face worldwide is bilingualism or multilingualism (Baker, 2001). In addition to the issue of bilingualism, the choice of the language for teaching science is still viewed from different perspectives. Science is taught in the mother language in some countries and the second language in others (as in some African and Arab countries). (Nissabouri, 2018). Although bilingualism is spread in Lebanon and is supported by the curriculum (Badran, 2008), there are no clear policies for teaching science subjects in elementary grades, even in public schools (Ghaith & Shabaan, 2000). In some schools in Lebanon, science is taught in Arabic from grade 1 through grade 5, and they shift entirely to the foreign language starting from grade six. Within our current context, no one can stop the switch to a foreign language at a given grade or refuse to adopt the distance education approach in teaching and assessing students since the situation related to the Coronavirus seems to extend over a long time (WHO, 2020). It is of significant importance to look into these students' performance in science when they switch for the first time to study science in English (foreign language) through online teaching and investigate what might contribute to a positive online teaching experience regarding the language of teaching in science for further investments in education.

Significance of the study

The lockdown as a preventive measure directly impacts the educational systems and Globally, more than 1.2 billion students are at home out of the school's campus (World Economic Forum, in El Rouadi & Anouti, 2020). This unpredictable crisis largely opens the door for e-learning as a solution for the current situation. In Lebanon, the teaching in private and public schools turned to online teaching following the official decree number 15 (Farah & Frayha, 2021). This online teaching varies between a full-online teaching and a hybrid approach of learning via online platforms. However, the educators, teachers, and students do not know their performance via

this type of teaching/learning due to its novelty and unfamiliarity. This study aims to explore the grade six students' performance in science being taught for the first time at a distance and in English after being taught from grade 1 to grade 5 in Arabic. So the main objective is to highlight the effect of one dimension in teaching science with is the language far from any other dimension that might affects the students' performance in this subject matter. The current study adopted the quantitative research design using descriptive analysis, since no previous similar studies were held due to the adoption of the distance education. In other words, the results cannot be compared to the results of previous studies knowing that distance education in its actual form is new and did not figure as a factor in previous studies. The research aimed to gain an understanding of the students' performance in science taught in English for the first time when switched to online teaching by examining their grades and answers in an online science test.

Research question

The study aims to answer the following research question:

- To what extent does English language (foreign language) used for the first time in teaching science affect the students' performance in science studied at a distance (reproduction topic)?

Limitations of the study

Several factors can be identified as limitations in this study. The first factor is related to the student's attitude towards online learning that is, in this case, new. Students have a challenge in adapting to this novice method affecting their attitudes towards online teaching, So the students' motivation might be a possible limitation to the findings of this study. Another limitation can be the occurrence of the online evaluation where students are used in the face-to-face assessment with guidance from the teachers. The fact that the students' sample is taken from one educational institution can also be a limitation that threatens the generalization of the findings. Another factor that can be seen as a limitation is the possibility of cheating during online exams. Likewise, the school profile as a private school with a specific feature can be a limitation in this study. Nevertheless, this study relies on revealing some facts related to the student's performance via online teaching in science being taught for the first time in a foreign language which is English.

Literature review

Distance education is another name for e-learning that necessitates internet connectivity and technological tools and skills. Distance learning can be asynchronous, where students have to deal with the courses content at their own pace, and it can be synchronous where the teacher and students are in real-time together (Arshavskiy, 2013). Blended learning is one of the forms of distance learning that assures a rich learning experience where teachers integrate face-to-face instruction with online activities. Students achieve some learning activities online live with the teachers and other activities alone. Another form of distance education is hybrid learning that adopts both synchronous and asynchronous aspects to assure a flexible learning environment. In hybrid learning, some students participate in person while others do online.

Distance education relies on self-learning in all its forms, where autonomy is one of the most critical factors. This aspect can be seen as an advantage of distance learning, where students develop skills to become responsible for their acquisition (Jacobs, Renandya & Power, 2016). Jacobs, Renandya & Power (2016) have identified some advantages and disadvantages in distance

education. One of these advantages is related to the fact that distance learning can save time and money, where commuting is suppressed. Another advantage is related to the choice of studying time, which is more flexible than traditional education. However, several disadvantages have also been identified). One of these disadvantages is the high chance of distraction where it is difficult to stay in contact with the instructor. In addition, there is an overdependence on complicated technology, which is seen as a source of many problems, including the dysfunction of any software or hardware. Ultimately, one of the most prominent disadvantages of distance education is the lack of social interaction.

Regarding language in science, one of the approaches that have been developed to render a foreign language and mainly English accessible to most of the school populations is the "content and Language Integrated Learning" (CLIL). CLIL refers to an educational approach in which a foreign language is used as a medium of instruction to teach the content of essential subject matters for mainstream students (Nikula, Dalton-Puffer, & Llinares, 2013). CLIL can be defined as a "dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language" (Marsh, Mehisto, Wolff, & Frigols-Martin, 2010). This implies that, in the teaching and learning process, a focus on both content and language is present, even if sometimes the emphasis is greater on one rather than the other. Many CLIL models have been designed so far, but many factors must be well examined before deciding the model to be adopted (Coyle, Hood, and Marsh, 2013). Two of the leading models are considered below. The first model is the “extensive instruction through the vehicular language”. In this model, according to Coyle, Hood, and Marsh (2013), there is almost an exclusive use of the foreign language in the different teaching tasks like summarizing and revising topics. The switching to the first language is restricted to explain specific language aspects of the subjects or vocabulary items. A single content teacher can achieve this task. The second model is the “partial instruction through the vehicular language”. In this model, specific content that might be drawn not only from one subject but maybe from two or more is taught through CLIL. CLIL is implemented within a limited period that might correspond to less than five percent of the whole curriculum.

Several studies have been conducted to look at students' views of online learning regarding language. Zinkovskaya, Katermina, & Plaxin (2020) examined the most successful distance learning educational platforms. From the university students' point of view, they found that Moodle was the best, followed by CLIL for studying the foreign language. Most of the studies related to the language issues have been conducted in universities, and no study related to students' acquisition in science being taught in a foreign language for the first time has been conducted.

Kulal and Nayak (2020) have analyzed in the study they conducted the perceptions of teachers and students in online classes. They have found that teachers prefer physical classes rather than online classes due to technical reasons and the value of traditional classes. Finally, Ainin et al. have analyzed the effects of Facebook usage on academic success, and they found that using Facebook had a positive influence on students' academic performance (2015).

One of the few studies in Lebanon that tackled distance education was that of El Rouadi & Anouti (2020), which explored the online teaching experience in Lebanese intermediate and secondary schools during the Coronavirus crisis. The results of this study were similar to some of the previous ones. The researchers have identified students’ dissatisfaction with online teaching due to a lack of devices and internet access.

Methodology

Research participants and Instruments

In order to gather relevant information for the current study, the researcher sought permission from the administration of a private school in Mount Lebanon to conduct the study there. The school was selected purposefully to fit the need of the study. It belongs to an educational institution characterized by a high centralized administration system and having a large number of students in each grade. In this school, the participants are the grade six students who have to study science for the first time in English after being taught science in Arabic in the previous years. Therefore, blended learning was adopted where the chosen lessons were asynchronously diffused to the participant students in videos via a Moodle platform. These videos were designed following the first model of CLIL which is "the extensive instruction using the foreign language", knowing that there are 4 weekly science sessions and the curriculum was implemented in English. Moreover, this model was beneficial based on the fact that code-switching (Ahmad, & Jusoff, 2009) between English language and the students' first language is allowed but restricted to explain specific language aspects of the subjects or vocabulary items. These videos were prepared by a team that consists of well-experienced grade six teachers and the researcher. They were constructed to fit the CLIL approach with regards to the level of the language used in them. In addition, in the videos' preparation, code-switching was utilized, characterized by the translation of some non-technical words to the mother language to help students overcome some difficulties related to language (Nikula, Dalton-Puffer, & Llinares, 2013). The synchronous activities consisted of Google meets held by the teachers with students to highlight some points in the lesson and interact live with them. There were two synchronous sessions of 45 minutes each every week, scheduled after making sure that the students have watched the asynchronous activities (videos). The number of videos sent prior to the live sessions must not exceed 2 videos in a week, and a worksheet is attached with each video to help the students benefit from the content of the video. These worksheets had to be submitted as homework via the platform to be corrected by the teachers before holding the live session. Based on CLIL, the live interaction targeted the essential science content and the language at the same time. The topic chosen is" he reproduction in animals and plants" First, this topic was selected since it is a lesson students take for the first time in grade six. Second, it was explained two months post the beginning of the academic year, a period of time necessary for the students to get used to distance education via a Moodle platform, Google-meets, and English as the language of teaching in science. All in all, the participating students were 330 in total.

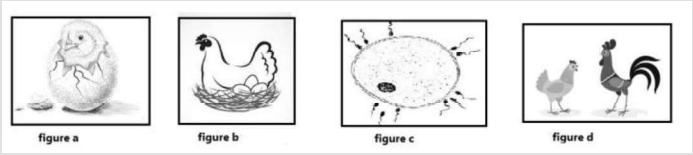
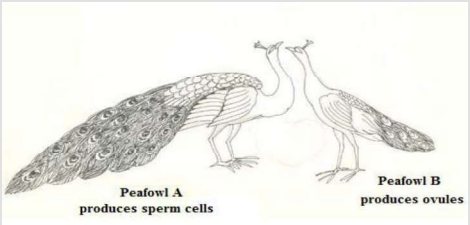
Data Collection

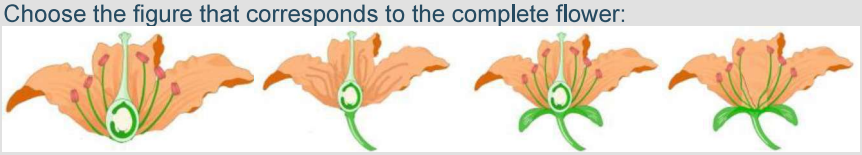
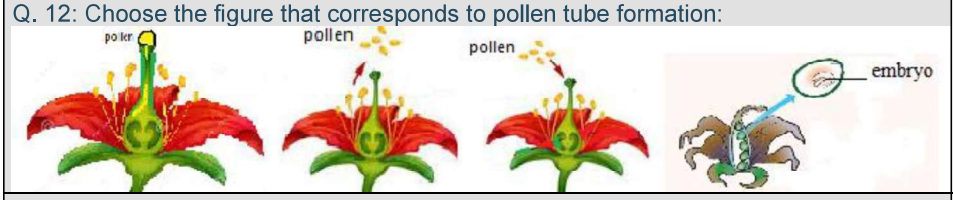
To test the students' performance regarding the reproduction topic, a test of 15 items was conducted online for the students to complete. Each item was scored over one, so the 15 items were statistically of equal weight, and the total grade was over 15. The test was built to assess students in the learning objectives related to the topic" reproduction in animals and plants," so the test items covered the primary purposes related to this topic. In addition to the objectives, it was essential to test the effect of the language. For this purpose, some test items were set in two groups based on the language weight in each. Accordingly, test items 4, 10, and 6 were placed in the first group, and test items 5, 7, and 2 were set in the second group for comparison. Test items of the first group (4, 10, and 6) rely on language, where the students have to read a paragraph that contains entirely new information related to reproduction that was not previously addressed, nor were the students in any way aware of this information. The test was validated by four science teachers, two from the school chosen in the study and two from two schools belonging to the same educational institution. The teachers of the concerned school are well experienced in grade six teaching, and they followed their

students via the same platform and within the same scope and sequence due to the centralized administrative system adopted in the institution. Therefore, the test was piloted over two grade six sections from two schools different from those of the study. The validation and piloting of the test led to some changes for the test to be finalized. It is important to note that the cameras were open during the exam, and the teachers were proctoring with the help of the supervisors.

Data analysis and findings (simple past tense to be used)

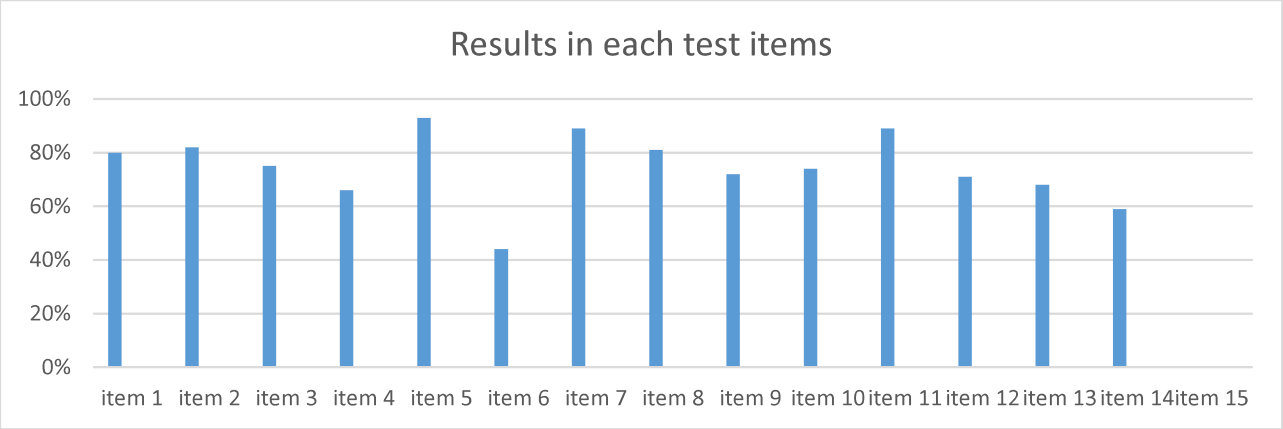
The design of this study was quantitative, where a descriptive analysis was utilized to obtain the results. The findings of the data analyzed quantitatively are revealed as detailed below.

Descriptive Statistics			
	N	Percentage	Std. Deviation
Q. 1: Which stage is specific (found only) for reproduction in birds? a- Incubation b- Fertilization c- Mating d- Hatching	330	80	.401
Q. 2: The stage in which the bird's egg breaks is called: a- Hatching b- Laying c- Incubation d- Mating	330	82	.386
Q. 3: Referring to the following figures, the correct order of stages of reproduction in birds is:  a- figures: a-b-c-d b- figures: d-c-b-a c- figures: b- c- a-d d- figures: b-a-c-d	330	75	.433
Q. 4: Peafowl is the common name of species of birds in the family of pheasants (الطاووس). Male peafowl is called peacock, and the female peafowl is called peahen. Their mating season starts from March to August. When fertilization occurs, the peahen lays 3 to 5 eggs and sits on them for 28-30 days.  Referring to the text and the figure, choose the best answer (in items 4 and 5): Peafowl A in the peahen: a. False, because it produces male sex cells b. True, because it produces sperm c. True, because it produces female sex cells d. True, because it produces the male sex cells	330	66	.473
Q. 5: The incubation period in peafowl is from March to August: a- True b- False	330	93	.260

Q. 6: Referring to the acquired knowledge, answer the questions (items 6 to 15): 6- The period of their life span where the peafowl can reproduce is: a- Puberty b- Childhood c- From March to August d- From birth	330	44	.497
Q. 7: Reproduction in peafowl helps it to be extinct: a- True b- False	330	89	.316
Q. 8: The nutritive substance inside the bird's egg is the: a- Eggshell b- Fetus c- Zygote d- Egg yolk	330	81	.394
Q. 9: In the fertilized egg of a bird, as time increases, the amount of nutritive substance decreases: a- True b- False	330	72	.452
Q. 10: All the following expressions are incorrect concerning the sexual reproduction except: a- Body cells are involved b- Fertilization is one of the stages c- The offspring are identical to their parents d- One parent must be present	330	74	.440
Q. 11: Complete flower is the flower that has all its parts: petal, sepal, male and female reproductive parts. Choose the figure that corresponds to the complete flower:  figure a figure b figure c figure d	330	89	.308
Q. 12: Choose the figure that corresponds to pollen tube formation: 	330	71	.455
Q. 13: After fertilization, the ovary of a flower develops into: a- New plants b- Embryo c- Fruit d- Seeds	330	68	.465
Q. 14: During reproduction in flowering plants, sperm is transmitted by the wind in: a- Anther b- Stamen c- Pollen grain d- Pistil	330	59	.492
Q. 15: The female reproductive organ in flower is the: a- Ovule b- Ovary c- Pollen grain d- Anther	330	58	.494
Total/15	330	11.01	3.072
Valid N (listwise)	329		

The mean for students' scores $\bar{x} = 11.01$, and the $\sigma < 1$, which shows that the scores were distributed close to the mean, which indicates that the scores reflected the students' competence. Since the mean is $\bar{x} = 11.01$, which is greater than the average (7.5), one can say that students had acceptable overall performance.

The results of each test item are represented in the graph below.



The percentage of each of the test items was above 50 %, except for item 6. This revealed that the students' performance was acceptable in the online evaluation. Regarding test item 6, although this item is short and appears to be easy, it contains three language expressions on which the true answer depends. The three expressions are life span, puberty, and childhood. In addition, the answer to this question needs an understanding of the instruction for the true answer to be "puberty". Most of the students' answers were "From March to August," which is a wrong answer that was taken as-is from the text where it was used to describe another fact about peafowl reproduction.

Further analysis was done to check the effect of the language on the results. Accordingly, the results of test items 4, 10, and 6 that were set in one group (since they rely on language) were compared with the results of test items 5, 7, and 2 that were placed in a second group (since they were direct and with less use of language). A paired-samples t-test was conducted to compare scores items relying on language and scores in items that do not rely on language. The results obtained in each of the two groups are shown in the below table.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Don't rely on language	.88	989	.328	.010
	Rely on language	.61	989	.487	.015

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Don't rely on language & Rely on language	989	.159	.000

Paired Samples Test

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Don't rely on language - Rely on language	.265	.542	.017	.231	.299	15.362	988	.000

The result of the analysis showed that there was a significant difference in the scores for questions that don't rely on language (M= 0.88 SD= 0.32) and scores of questions that rely on language (M=0.61, SD= 0.48) conditions; t (988) = 15.36 p= 0.00.
So whether online or not, the language is still viewed to have an effect on these students' performance.

Conclusion and study implications

Throughout the past year, there was a great emphasis on the online study as a solution for the spread of the Corona virus. The results of this study indicate that the Lebanese grade six students' performance in science is acceptable via an online assessment, knowing that their learning took place at a distance. Also, the results show that the foreign language is still an additional burden to the students in science. Many implications are associated with the outcomes of this study, some related to distance education and others to the language of teaching. The study presented an analysis of Lebanese students' performance on online assessment during the Covid-19 period. Its value lies in examining students' performance in science knowledge and in the English language used to study science for the first time. Since the situation in the educational field related to the Covid-19 crisis is new, there are no previous similar studies. Therefore, the results of this study cannot be compared to other results. Still, its importance lies in the fact that they can be considered, among other studies, as a cornerstone for the study of the effect of distance education on students' performance. Also, the results of this study can be a start for further studies in the future that would improve online teaching and assessment in the formal education system. It is a start for the schools and educational system to reconsider their cultures and practices to identify the lack of efficient online teaching in parallel with the traditional system; therefore, it will be possible to rely on online teaching smoothly whenever needed. In a parallel way, the language of teaching science has to be considered as a main factor that affects the students' performance in science. Consequently, science teachers and coordinators have to consider this dimension as essential in the students' results. In this study CLIL approach was considered to help students overcome some difficulties in science coming from the language. So, science teachers and coordinators have to identify efficient and suitable approaches to be adopted in their schools in order to minimize the effect of the language and to enhance its understanding and its usage by the students.

Recommendations

This research study analyzed grade six students' performance in science being studied for the first time in English (foreign language). The outcome of this study indicates that the grade six students' performance of a private school in Lebanon where the study is conducted was acceptable. However, the students still find difficulties dealing with the language used in science. There is a need for future research to be conducted in different schools with a wider population in order to get comparable results. For online assessment to be more valid, it is essential to use the different software designs to increase the validity of the exam results (decreasing the possibility of cheating). Providing science teachers with the necessary training to increase their awareness toward the difficulties coming from the language in science must also be a concern for the educators. This research has presented a perspective of the effect of the language in science on students' performance.

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