AMERICAN UNIVERSITY OF BEIRUT

THE EFFECT OF A GENRE-BASED APPROACH AND TRANSLANGUAGING ON LEBANESE UPPER ELEMENTARY STUDENTS' SKILLS IN WRITING EXPLANATIONS

by
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ABSTRACT
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Lebanon is a multilingual context in which science is taught in a foreign language. Little attention has been given to how Lebanese students develop subject-specific language skills. The purpose of this study was to examine whether genre-based instruction and translanguaging – the use of the full repertoire of students' linguistic resources - can improve Lebanese sixth-grade students' skills in using the features of the explanation genre in the context of writing. The participants of the study included a total of 70 sixth-grade students, whose native language is Arabic and who fit the profile of being English language learners (ELLs) studying science in English in a Lebanese private school. The study adopted a quasi-experimental design in which a pre-test and post-test were administered to three grade six sections: a control group, and two intervention classrooms. The control group covered three instructional units on "Dangers of Tobacco, Alcoholism, and Drugs" and "Functions of the Nervous System", and "Functions of the Urinary System". The first experimental intervention group received genre-based writing instruction in the context of instruction of the same topics addressed in the control group. The second experimental intervention group also received genre-based instruction, but with the addition of strategic translanguaging. Pre and post-test scores of the students' writing were compared across all groups through an analysis of covariance ANCOVA as well as post-hoc pairwise comparisons in order to evaluate the study's hypotheses. The study's findings demonstrated that genre-based instruction was able to improve students' writing skills, the observed difference approached but did not reach statistical significance in the overall posttest scores, but it did yield significance in one of its prompts. Results also indicated that the integration of translanguaging into genre-based instruction further enhances these writing skills yielding statistical significance in the overall posttest scores and two of the posttest's writing prompts. The study's findings illuminate the potential for future research in understanding the synergistic interplay between genre-based instruction and translanguaging, emphasizing their complementary nature in enhancing writing skills in science. Moreover, the study underscores the importance of integrating genre-based instruction and translanguaging into language instruction, advocating for comprehensive teacher training to effectively implement these strategies.

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1. GBI: Genre Based Instruction
2. TL: Translanguaging

CHAPTER 1

INTRODUCTION

Background and Rational for the Study

An important objective of science education reform efforts around the world is to support the learning of all students (Fensham, 2008). One factor that leads to inequality in student access to quality science learning experiences is language proficiency (Lee & Luykx, 2006). This can be proficiency in the academic language (even if it is in the learner's primary language) or proficiency in a foreign language of instruction itself in multilingual settings (Strevens, 1976). While these language challenges are a global issue, this is a particularly challenging issue in Lebanon and some other parts of the Arab world, where science is taught in a foreign language (Amin, 2009).

Language proficiency is very important for science learning. Sociocultural theories of learning and development make clear that learning, generally, regardless of subject, is closely connected with language use. Vygotsky's (1987) theory makes clear that language and thought are interdependent, that learning occurs through the internalization of communicative patterns, and that support from more knowledgeable others enables learners to participate in activities at a higher level than their current competence allows them to do alone. This difference between what learners can do alone and what they can do with support from others is referred to as the "zone of proximal development." When students are provided with proper guidance, through scaffolding within their zones of proximal development, they can achieve meaningful learning. In this study, a sociocultural perspective on language and learning will be adopted. It is assumed that learning science involves internalizing the specialized

language of that subject and that scaffolding of this language use is needed to support learning.

The specialized language of science is different from the language of everyday life. Linguists have provided detailed characterizations of these differences (Halliday & Martin, 1993). First, the language of science is full of technical terminology specific to each subdiscipline. There are also other aspects of the specialized language of science including non-technical and yet academic vocabulary and grammar such as the frequent use of connectives that link clauses into complex sentences (e.g., If…. then, because, although). These features are used to communicate about processes and causality, temporal sequences, and other issues important in science. Going beyond words and sentences, it has been noted that larger segments of text can have specialized functions with distinctive features. For example, texts that express scientific explanations, classification schemes, and experimental reports have distinctive structures and collections of linguistic features specific to them. These different ways of using language to engage in these scientific activities are referred to as genres.

Research in science education has shown that learners find many of these specialized features of the language of science challenging (Martin & Rose, 2008; Wellington & Osborne, 2001). Students struggle with understanding the meanings of nontechnical words used in science, naming words, process words, concept words, and logical connectives (Wellington & Osborne, 2001). Moreover, the language of science is associated with a level of abstraction that is challenging and quite alienating for the students (Halliday & Martin, 1993).

Some research in science education has examined how to address these challenges. Wellington and Osborne (2001) provide a wide survey for these teaching approaches.

Among these approaches, the authors elaborate on training students on the art of science reading. They shed light on the importance of reading as part of science education for two main reasons. First, reading carefully and critically with healthy skepticism is, by itself, a scientific activity. Second, most students are not likely to become scientists; instead, they will be expected to read about science and should be able to make sense of and reflect meaningfully on what they read. Wellington and Osborne describe strategies for helping learners become active rather than passive readers. Besides training students on reading scientific texts, the authors discuss supporting pupils' writing with what they call "writing frames": structure writing prompts designed to guide learners into producing texts within specific genres. The authors suggest that students must be explicitly taught the conventions of scientific genres. Students must be taught how to transform personal understandings into the discourse of science. Moreover, teachers should explain to the students the differences between scientific forms and genres which could be done by exposing them to different genres in science to encourage them to compare and contrast different scientific texts. This also broadens and diversifies the linguistic repertoires that students build at school. Writing frames are tools used by teachers to scaffold writing skills within a genre using the genre-based instruction approach.

In this thesis, focus will be given to genre-based instruction as a particularly promising strategy for enhancing upper elementary Lebanese students' writing skills. The reason this approach is promising and important to look at is that the genre features can be explicitly taught which gives a comprehensive perspective on multiple linguistic features needed for important scientific practices. Moreover, science teachers can be

trained on the genre-based approach allowing them to link subject matter and literacy instruction in productive ways.

A number of researchers have conducted studies to evaluate the impact of genre-based instruction on students' overall performance in science classrooms in countries around the world. For example, Carter, Ferzli, and Weibe (2004) discuss the importance of explicitly teaching about the genres of science to students. Their study shows that when students are scaffolded through genre-based instruction, they show better understanding of the scientific concepts. De Oliveira and Lan (2014) describe genre-based instruction in its three main phases: deconstruction, joint construction, and independent construction. In other words, learners specialized language skills are developed through modeling, scaffolding, and fading. Students taught through a genre-based instruction approach showed a successful transition from use of everyday colloquial terms to discourse-specific scientific technical terms or field specific vocabulary. Students were also able name experiment materials and use temporal connectors precisely.

Language challenges in science teaching and learning are even more pronounced in multilingual settings where the language of instruction is not the native language of all learners (Berthoud & Gajo, 2020; Salloum, Siry, & Espinet, 2020; Strevens, 1976). If students who learn science in their native language face challenges with the language of science, an even greater challenge would be expected for leaners whose native language is different from the language of instruction. A number of researchers have examined the challenges of learning science in multilingual contexts. For example, Strevens (1976) addressed a number of challenges such as the lack of comprehension in the communication between the learner and the educator. Another challenge is the difficulty

that students face in finding a synonym of a scientific term in their native language and their inability to relate the concepts they learn to their daily life experiences.

In response to these sorts of challenges in multilingual contexts, Ruiz (1984) invited policy makers to examine these situations from three different perspectives: language as a problem, language as a right, and language as a resource. To begin with, language as a problem, is when language poses a problem for the students. For example, in science, the difficulty that students face in understanding the language of texts hinders them from achieving full understanding of science concepts. Driven by the second perspective, students have the full right to use their native language whenever they need to. As for the third perspective, students should be able to freely make use of all their resources, meaning all the languages that they have in their repertoire, to express themselves and make meaning of the concepts being taught in class.

Driven by the perspective of Language as problem and how language poses a serious problem in science education, Ruiz's three-way distinction helps guide us in thinking about how to support learners in multilingual settings. Supporting science learners in the multilingual context of Lebanon, where science is taught in a foreign language, requires that we recognize the foreign language of instruction as a pedagogical problem; but recognize that all the languages learners and teachers have in their repertoire are resources that they can use productively; and respect the use of the native language as a right. Among the pedagogical strategies that seem to acknowledge all three perspectives on language is translanguaging. Translanguaging is an approach that adopts the perspective of language as a resource. It gives students the opportunity to freely draw from their full language repertoire in science classrooms in order to overcome the challenges they face in multilingual settings. Translanguaging can be a

spontaneous act of freely drawing from the full language repertoire of a person and is common in many everyday contexts around the world (Blacklegde & Creese, 2017; Gracia et al, 2011). But translanguaging can also be strategically applied in a classroom context (Probyn, 2015).

A number of researchers have documented the positive impact that strategic translanguaging has on students' understanding and participation in science classrooms (Karlsson et al, 2019; Charamba, 2020; Kwihangana, 2021). Translanguaging has been shown to boost the students' participation and engagement in the classroom (Kwihangana, 2021). It also helps the students relate the scientific concepts to their culture and daily life practices (Charamba, 2020). Translanguaging helps students to bridge between their home language and the foreign language of instruction in science classrooms (Martinez, Mateus, & Henderson, 2014; Karlsson, Larsson, & Jakobsson, 2020). In their study, Setati, Adler, Reed & Bapoo (2002) explained how the transition from home language to discourse-specific English is established in a classroom through translanguaging. Authors highlighted the importance of "exploratory talk", which is usually done in the students' native language when a new topic is introduced. Through exploratory talk, students are able to make meaning of newly introduced scientific phenomena by using their home language in classroom discussions. After the students fully understand the concepts, it is important that they learn how to express their understanding in the foreign language, namely English. For this transition to happen, students must acquire formal discourse-specific talking and writing in English. This way, students would successfully transition from using their home language to using English.

Context of the Problem

In many Arab countries, science is taught in a foreign language creating a multilingual context in which students struggle to understand and express scientific concepts. Amin (2009) reports a number of articles that discuss the linguistic specificities of science learning. He also discusses the multilinguistic nature of the language situation in the Arab region. Accordingly, Amin highlights the need for local research in this area to evaluate whether theories and recommendations from research conducted elsewhere are valid in the Arab context given its specificities. He also argues that scaffolding students at the language level in science classrooms boosts their understanding and helps them better express their ideas.

Lebanon is an example of a multilingual context in which students' native language is the Lebanese dialect. Students are facing serious challenges in science classrooms. Shaaban and Ghaith (1999) present a historical account of multilingualism in Lebanese education and explain how it came about that science is now taught in a foreign language, primarily English or French (Shaaban & Ghaith, 1999). Lebanon was under the French mandate for a period that lasted 23 years (1920-1943). In that period of time, although French and Arabic were agreed to be the two official languages in the country, French was given more power by being mandated as the language of instruction for sciences, mathematics, and social studies. After the Lebanese independence in 1946, the government announced Arabic as the only official language in the country. English was also introduced in 1946 as another foreign language to be taught at schools. In 1968, The government announced that Arabic should be the language of instruction in all school subjects except foreign languages and literature. However, the ministry of education gave the choice for schools to teach sciences and mathematics in the foreign

language. The Center for Educational Research and Development (CERD) produced textbooks for sciences and mathematics in French, English, and Arabic. However, due to the civil war, the Arabic version was never printed. Afterwards, for practical reasons like the importance of being proficient in a foreign language, the bilingual education tradition won over the decision of making Arabic the language of instruction for sciences and mathematics (Shaaban & Ghaith, 1999). The fact that these subjects are instructed in English creates a multilingual context in which students struggle to understand not only the scientific concepts, but also the foreign language of instruction that most of them are not proficient in (Bahous, Bacha, & Nabhani, 2011).

With regard to language challenges in science classrooms in Lebanon, Badreddine (2018) provided evidence that Lebanese middle school students struggle with understanding scientific non-technical terms (e.g. classify, diagnose, converge, estimate, stimulate…). These difficulties are mainly caused by three factors. First, some non-technical terms are close in meaning (e.g. probability and possibility, treat and diagnose, theories and facts…). Second, there are words that look alike (e.g. converge and converse, agent and accent…), and words that sound alike (e.g. source and sauce, efficient and sufficient…). Furthermore, students confuse the meanings of opposite words (e.g. stimulate and deactivate, emit and absorb…). Badreddine (2018) also states that the difficulties students face with non-technical terms, do not differ between students in different grades. Grade 6 and grade 9 students face the same difficulties when it comes to the language of science.

Research has begun to examine how English language learners in Lebanon can be supported in the context of science learning. For example, Yamout (2019) found that there is a positive effect of genre-based pedagogy on improving the quality of Lebanese

elementary students' expository writing and their conceptual knowledge. Results of this study show that students instructed through the genre-based approach were able to write an expository paragraph with accurate use of its features. These features include writing a claim and supporting it with evidence, in addition to using academic vocabulary, writing conventions, and linguistic features correctly.

Moreover, the Language for Science and Mathematics research and development project is underway to support Lebanese students develop subject-specific language skills in science and mathematics. The project is a collaboration between Tamer Amin and Rabih El-Mouhayar at the Science and Mathematics Education at the American University of Beirut and Lebanese Alternative Learning (LAL), an EdTech NGO. LAL provides a free-to-access platform aimed at ensuring quality education for all. Tabshoura features more than 1000 interactive units covering all subjects for Early Childhood Education (ECE), Cycle 1, 2, and 3, aligning with the Lebanese curriculum. The practical goal of the project is to prepare online modules that would be implemented on LAL's Tabshoura platform that would support learners in developing specialized language skills needed for science and mathematics using a genre approach. The modules will help students develop specialized language skills in these subjects - like the language needed for classification or explanation in science or word problems and proofs in mathematics. The modules, which target specialized language skills at a level appropriate for each cycle, will be refined based on pilot and research evidence collected to evaluate their design and effectiveness. The goal of the project is to prepare a full set of modules that cover the full range of genres addressed in the Lebanese curriculum over cycles 1-3 (grades one through nine).

Purpose of the Study and Research Questions

The purpose of the study proposed here is to evaluate the effectiveness of the explanation genre modules created by the researchers (including the present author) who worked on the Language for Science and Mathematics project. During the research project, the researchers undertook the task of mapping the science and mathematics genres with the science and mathematics books of the Lebanese curriculum for all grade levels, ranging from grade 1 to grade 9. This involved a thorough analysis and examination of the various genre features within the science and mathematics texts and exercises. Accordingly, explanation genre was chosen because it is the most commonly spread genre across all cycles in Lebanon, and it has many lexicogrammatical features that students need to learn to use effectively. Moreover, the study targets grade six students because compared to grades one, two and three, upper elementary textbooks include a big number of explanation paragraphs with more lexicogrammatical features that can be addressed in a module. The modules have been designed based on the genre-based instructional approach incorporating modeling, scaffolding, and fading and instructional techniques drawing on sociocultural learning theory. In addition, this study will evaluate the effectiveness of the integrating translanguaging into genre-based instruction in supporting the development students' skills in using the features of an explanation genre. It is hypothesized that the integration of genre-based instruction and translanguaging will further improve the students' skills in using the features of a specific genre over and above the improvements achieved by genre-based instruction alone.

The research questions are:

- Does a genre-based instructional approach incorporating online learning modules improve Lebanese upper elementary students' skills in using the features of the explanation genre?
- Does the integration of translanguaging into genre-based pedagogy further improve Lebanese upper elementary students' skills in using the features of the explanation genre?

Significance of the Research Study

At the theoretical level, as mentioned earlier, language of science has been an important topic of research in science education for decades. There has been a lot of work that has focused on characterizing the language of science (Halliday & Martin, 2003) and identifying the challenges that learners face (Wellington & Osborne, 2001; Martin & Rose, 2008). Research has also demonstrated the positive effects of genre-based instruction in science classrooms (Carter, Ferzli, & Weibe 2004; De Oliveira & Lan 2014; Honig, 2010; Parkinson, 2000). In addition, a number of researchers have evaluated the impact of strategic translanguaging in science classrooms (Martinez, Mateus, & Henderson, 2014; Probyn, 2015; Karlsson, Larsson, & Jakobsson, 2020; Pierson, Clark, and Brady, 2020; Setati et al, 2002). Locally, little research has been conducted in Lebanon to investigate the impact of either genre-based instruction or translanguaging on students' subject-specific language proficiency in science. Moreover, this study makes a novel contribution to the literature internationally by evaluating the effect of integrating genre-based instruction and translanguaging on developing students' genre-specific language skills, an integration that has not yet been explored in the research literature.

At the practical level, if the findings of this study are positive, this has implications for teacher training in Lebanon. The findings would suggest that teachers would need to be trained in how to apply these two approaches in their classrooms to ensure that students develop the skills in using the features of the explanation genre in writing science. Moreover, the modules used in my study could be used by teachers all over Lebanon as teaching aids for boosting the students' skills in writing explanation texts.

CHAPTER 2

LITERATURE REVIEW

The literature review presented in this chapter discusses the relationship between language and science learning. This relationship is looked at from a sociocultural lens to highlight the importance of language in learning any subject. Then, the chapter discusses the characterization of science language through going over the specific features of different genres in science texts. It also presents the difficulties that students face in understanding and using scientific language. Moreover, it presents the genre-based instruction approach and its positive impact on facilitating the students' writing ability to better express scientific ideas. The literature review also tackles science learning in multilingual contexts like Lebanon. It reports studies about the challenges that Lebanese students face in science classrooms given their limited proficiency in the English language. Translanguaging is then presented as another promising approach that seeks to enhance students' understanding of scientific concepts. The chapter also presents a summary of related empirical studies that looked at the positive impact that a translanguaging approach has on science learning.

Language in Science Learning and Teaching

A Sociocultural Perspective on Learning

In his book Vygotsky (1987) looks at learning from a sociocultural perspective. Vygotsky's theory has four main components. He first argues that language mediates thought which is why language and learning are understood as deeply intertwined. Second, he views learning and development as involving the internalization of communication between the learner and the more knowledgeable other. The more knowledgeable other could be a teacher, a peer, or an adult who has a better

understanding or ability than the learner, with respect to a specific concept or skill. Third, Vygotsky believed that learning is the internalization of communicative patterns. This highlights the importance of scaffolding in the learning and teaching processes. Scaffolding is done by the more knowledgeable other through personal assistance or any kind of supportive activities provided by him. Given the importance of scaffolding, the presence of a more knowledgeable other with respect to the learner, and the social interaction between the learner and the educator, we get to the fourth component which is the zone of proximal development. This zone represents the distance between the ability of someone to solve a problem, and his potential capability of solving it. This transition needs the guidance and scaffolding of a more knowledgeable other. Vygotsky believes that when a learner is in the zone of proximal development and is provided with appropriate assistance and support, he will achieve meaningful learning successfully.

A more recent development of the Vygotskian theory is presented by Collins, Brown, and Newman (1989). The highlighted the importance of cognitive apprenticeship for the teaching and learning of cognitive skills in problem solving. They also show the differences between traditional apprenticeship and cognitive apprenticeship in which students get the chance to observe, enact, and practice thinking and problem-solving skills with the help of the teacher and colleagues. The instructional phases of cognitive apprenticeship as described by the authors are modeling, coaching, scaffolding, articulation, reflection, and exploration. In the modeling phase, students observe an example of what they are expected to learn such as a teacher carrying out a mathematical problem. This helps students to build a conceptual model of what is they are expected to do. Teachers watch students carry out a problem and provide feedback

in the coaching phase. Then, in the scaffolding phase, the student solves a problem with the help of a teacher. In articulation phase, students get the chance to articulate their knowledge in a domain. Then, in the reflection phase, they compare their own problem-solving techniques with their classmates. The final phase is the exploration phase in which students are expected to solve a problem on their own. These phases can be condensed into the three main phases modeling, scaffolding, and fading.

When the Vygotskian theory is applied to science learning, it draws attention to the fact that learning science involves learning the language of science. Teachers need to describe the characteristics of the language of science to understand learning and teaching. Students should be explicitly taught how to use these features of the language of science through instruction. Accordingly, modeling, scaffolding, and fading can support students in increasingly becoming more sophisticated users of the language of science. Thus, developing one's scientific thinking is at least in part accomplished through the development of the language skills for science.

Overview of the Characteristics of the Language of Science

To begin with, we have to acknowledge that the scientific language is different from the everyday language. In order to understand the features of the language of science, research has been done on characterizing the language of science. Writing in science has specific purposes that differ from writing in everyday life. This entails making different linguistic choices (at the level of the vocabulary words, logical connectives, grammatical features, and overall text organization and structure) to realize meaning. Genre theory originates, as Halliday & Martin (1993) suggested, from a systemic functional view of language and meaning. Based on analyzing the features of the language of science, authors have identified science genres that share distinctive

structure, lexicogrammatical features, and modes of representation. Examples of such genres are explanations, descriptive reports, taxonomic reports, compositional report, etc.

Learning and Teaching the Language of Science

In their book entitled *Language and Literacy is Science Education,* Wellington & Osborne (2001) look extensively at the language of science. They examine the English language in science textbooks. They discuss studies identifying difficulties that students face when it comes to the language of science and how these difficulties should be approached by practitioners. A number of studies in the chapter test the students' scientific knowledge through surveys. The results shockingly showed that the majority of the students revealed that they do not know the meanings of a number of nontechnical words used in science, naming words, process words, concept words, and logical connectives. This shows that even for English native students, the language used in science is not the same as the one used in the students' daily lives which is why they struggle to comprehend and write scientific texts.

As discussed earlier, Wellington & Osborne (2001) showed that the characteristics of the language of science pose serious challenges for the students. They won't be able to concretize scientific concepts which makes it difficult for them to relate these concepts to their daily life experiences. In addition, they won't fully understand scientific concepts because they are unfamiliar with the language of science and its characteristics.

In his study, Kamberellis (1999) examined narrative, scientific, and poetic texts created by 54 kindergarten, grade one, and grade two students. The author compared and analyzed these texts by looking at the text cohesion, verb tense, logical connectives,

temporal connectives, and the vocabulary or register used by the students. Results of the study showed that children in the study sample had considerable working knowledge of the narrative genres but less knowledge of the informational and poetic genres. Children build increasingly differentiated and flexible repertoires of genre forms and functions. The author suggests that children's imbalanced exposure to different genres might be the reason behind their differential knowledge of genres. In sum, children's genre development can be characterized as emergent, flexible, and develops steadily across the grades.

In the book entitled *Language, Literacy, and Learning in the STEM Disciplines,* Covitt & Anderson (2018) report on their empirical study that explores students' progression in learning three scientific discourse genres (explanation, argument, and prediction) using learning progression frameworks developed by the authors. In this study, K-12 and university students were provided with prompts about the carbon transformation process and asked to develop explanations, arguments, and predictions. Data was collected from two sources: interviews and written assessments. Results of the study show that students need to transition from less sophisticated, informal discourse to more sophisticated, scientific discourse writing skills to produce scientific explanations, arguments, and predictions. This transition poses a serious challenge for students that authors describe by saying, "mastering scientific genres is much like learning a second language" (Covit & Anderson, 2018, p. 212). This challenge is assumed to be caused by the fact that students come to school with some knowledge about genres which they practice in their daily life rather than scientific genres that are acquired at school.

Genre-Based Instruction

Having agreed that language acts as a barrier for students' ability to produce scientific texts, researchers have discussed a number of strategies that might promote proficiency of the scientific language. The identification of science genres is important because it helps the science teacher know the language skills, she wants students to develop and take them into consideration in the modeling, scaffolding, and fading phases. One approach that has been addressed in research recently is the "Genre Approach". Genre-based instruction is an implementation of the Vygotskian sociocultural theory components specifically applied to genre as a goal.

In his study, Honig (2010) presents the findings of a 2-year descriptive study on second and third graders' science writing. The author's purpose of the analysis is to provide insight into the language of science, the children's role in developing their own writing skills, and how the artifacts or genre-specific texts created by the students develop over time. Based on the analysis of how the artifacts produced by the students functioned in terms of ideas, social purposes, and linguistic/visual features, Honig was able to identify a genre set of four distinct genres in which children participated. These genres are scientific method sheets SMS, What-I-Learned sheets WILS, graphic organizers GOs (done in groups), end of unit reports EOURs, and visual image genres. The study was based on a mixture of ethnographic (field notes, audio and video tapes of classroom talk, students' written and illustrated artifacts, videos of interviews…) and case-study methods with a particular sociolinguistic, multimodal approach to analysis in order to create a contextualized account of the children's participation in science writing and drawing during second and third grade science lessons. Moreover, through analyzing the students' participation and output in the classes, Honig concludes that

they need assistance in understanding the language of science. For example, instead of assuming that students know the meanings of the logical connectors, like *therefore* and *in spite of*, used in explanation genres, Honig suggests that teachers should teach the students explicitly what these words mean. Scaffolding should be done strategically to help the student reach a point where he/she is able to speak and write a paragraph explaining a certain scientific phenomenon. Students, even the ones who preferred working alone at the beginning of the study, grew motivation towards participation in science lessons. Moreover, the pieces of writing that the students were producing clearly improved in terms of meaning accuracy and structure. Thus, through sufficient scaffolding at the level of the scientific language that constitutes each genre, the students were on their way to overcoming the language barriers, better understanding, and expressing scientific concepts.

Moreover, in his longitudinal study, Chapman (2002) collects the writings of one child in mathematics, social studies, science, and music over several years (kindergarten to grade 3). Chapman found that this boy was introduced to genre writing in grade 1 which was something he had never encountered in kindergarten. He suggests that based on the findings, primary children should not be limited to writing in language arts. This is because of the increasing complexity and language demands that children will be exposed to in grade 4. Thus, it is better for them to build an experience in cross-curricular writing during the primary years in order to be prepared for future years. This could be done through engaging the students in writing curriculum genres in primary years in order to build their conceptual knowledge of the functions and forms of various genres.

Carter, Ferzli, & Weibe (2004) presented their study which proves the importance of explicitly teaching genres to students. The authors conduct research on teaching the genre of the laboratory report to first-language university students in biology labs. In this study, a website was designed to scaffold and guide students linguistically through their lab experience. It includes pre-lab questions, in-lab materials, post-lab guide, and a LabCheck revision sheet. 183 biology students were chosen as subjects of the study for two semesters. In the first semester they didn't receive any treatments, whereas in the spring semester they did. The treatment was that students had access to the website LabWrite. Results showed that students who used LabWrite learned the science of the labs more effectively than those who did not. Moreover, the treatments enhanced the students' learning of scientific concepts of the labs independent of what the concepts were. This reflects that genre can be explicitly taught and effectively learned.

De Oliveira & Lan (2014) presented a case study which presents the implementation of a genre-based pedagogy informed by systemic-functional linguistics (SFL) in teaching procedural recounts for 4th grade students whose native language is English. The study took place at a school in Indiana. After meeting with the teacher for several times to support and educate her on genre-based pedagogy, she was asked to incorporate genre-based pedagogy into the science unit on density in her classroom. In class observations and recordings were collected over a period of 3 months. In this study genre-based instruction is used in its three iterative phases as informed by SFL:

1. Deconstruction: This is mainly the modeling phase where the teacher guides the student to analyze and deconstruct a model of the genre addressed. They talk about its language features, structure, and purpose.

2. Joint construction: In this phase, the teachers and students work together to construct a text of the same genre previously modeled and analyzed with the teacher.
3. Independent construction: This is when students are ready to work independently to construct their own texts in the specific genre.

After the implementation of the genre-based pedagogy, one student's output was analyzed to test the effect that the intervention has on his performance. The student chosen was fluent in English language writing but lacked proficiency in writing scientific texts. His writings revealed that he developed a greater ability to use words and phrases to signal essential genre features found in procedural recounts. He was also able to record events with precision and in order, especially his greater control of naming experiment materials and using temporal connectors. Moreover, he shifted from everyday language such as his use of colloquial lexis (e.g., ''the soap thingy'') and repetition of the same process (e.g., ''pour'') to more school-based language such as his use of field-specific vocabulary (e.g., ''dishwasher soap'') and technical processes (e.g., ''float''). In conclusion, the author suggests that SFL can be an effective analytical and pedagogical tool that supports science writing instruction in elementary school.

In addition to the studies discussed earlier, Parkinson (2000) conducted a study to test whether providing the students with a sample of the genre they're dealing with has positive effects on their output. Parkinson designed and taught a content-based language course (theme-based language course) for science and engineering ELLs in South Africa. The major aim of the course was to help students acquire the different literacies of science focusing on genres that are important in science (report and descriptive and explanatory essays). By providing extracts of students' work, acting and models of the

target genre, the author illustrated how a wide range of literacy practices can be acquired. Therefore, providing the students with a model of the genre provides the necessary context for acquisition, and makes the course relevant in the eyes of the student which helps them to become familiar with the required genres. Finally, the author suggested that such language writing programs be written by instructors of the discipline rather than language instructors who have little basis for dealing with the content of other disciplines.

Science Learning in Multilingual Contexts

In many places around the world, children are learning science in a language that is not their native language. The section above discusses the language challenges that all science learners face even if they are learning science in their native language; the challenges become even more significant for those who are not native speakers of the language of instruction. When different languages are used in classroom settings, it creates a variety of different challenges for students and teachers.

Some time ago, Strevens (1976) surveyed the challenges that science educators and learners face when science is taught in a language different from their mother tongue. Strevens mentioned a number of challenges that science learners face such as the lack of comprehension between the educator and the learner, the difficulty that students face to find a synonym of a technical scientific term in their native language, the absence of the students' culture and language in science classrooms, word-order difficulties which differs from one language to another, inability of the students to relate certain concepts to their daily life experiences, and lack of proficiency in the use of the foreign language. All of these challenges arise when the language of instruction in science classroom is not the native language of the learners.

In response to these challenges, Ruiz (1984) invited policy makers to examine these situations from three different perspectives: viewing language as a problem, viewing language as a right, or viewing it as a resource. Language can be seen as a problem when students are viewed as not having the language of instruction in their repertoire which becomes a problem that hinders meaningful learning. On the other hand, policy makers, guided by the language as a right orientation, believe that linguistic inequality leads to social inequality. They argue that language is a right and learners have the right to use their native language as a language of instruction. In the third orientation, multilingualism and cultural diversity are highly valued, and language is viewed as a resource. Policy makers and practitioners in this orientation consider language repertoires as resources that every person can freely draw from. If language is considered a resource, then the more languages you know, the more resources you have to express yourself as a learner and your understanding of what you are being asked to learn. The idea that a learner's full linguistic repertoire should be seen as a resource for teaching and learning has inspired an appreciation for mixing languages in the classroom and even for strategic use of multiple languages; this view of the role of language in teaching and learning has been referred to as translanguaging.

Translanguaging in Everyday Life and Science Classrooms

Garcia (2011) defines translanguaging as bilingual and multilingual people's flexibility of using multiple languages – i.e., using their full language repertoire. It is a spontaneous action that bilingual and multilingual people do unconsciously to better express themselves. Garcia emphasizes that in multilingual settings, all the linguistic repertoire of learners is important, and that the analyst's attention should shift from focusing on the distinction between different languages to examining how interlocutors

use their full language repertoire to engage in meaningful interaction. Canagrajah (2011) also insists that a speaker's languages cannot be separated from each other; they are integrated into the person's memory from which they draw freely when necessary.

Translanguaging is common in daily life circumstances. Blacklegde and Creese (2017) refer to translanguaging in such circumstances as "spontaneous" translanguaging. They describe different scenarios in which people translanguage, without even knowing that they are, such as a conversation between a group of people of different backgrounds at a butcher stall in Brimmingham. They provide this and similar examples to show that translanguaging is effortless and it is done to help people express themselves in lots of different kinds of situations.

Another setting where translanguaging is practiced is in the classroom. In the context of science instruction, other researchers like Probyn (2015) have distinguished between spontaneous and strategic translanguaging. Probyn discusses how translanguaging can be done in a pedagogically strategic way by highly skilled instructors in order to ensure a positive influence on learning in science classrooms.

The Positive Effect of Translanguaging on the Students' Understanding

A number of studies have been done that examine the effects of strategic translanguaging in science classrooms. For example, Palmer, Martinez, Mateus, & Henderson (2014) presented the findings of their 2-year ethnographic study in Texas, in which they test the effects of three different strategies of translanguaging. Two teachers were asked to implement these three strategies in their classrooms (pre-kindergarten, kindergarten, and grade 1). The first strategy includes modeling bilingual language practices and providing the students with space to use their mother tongue by using their own native language in class. The second includes assuming that students are bilingual

even if they're not. This means that in class, students should not be treated as incompetent in a certain language because this might lead to their marginalization. Therefore, they should be positioned as proficient in any language even if they are incompetent in it. This encourages and motivates them to participate and have more confidence in their language skills. The third strategy examined was celebrating and shedding the light on the intersection of languages. This is done through providing positive reinforcement whenever a student points out an area where two languages overlap. The study provided evidence for the positive impact that all three strategies of translanguaging have on the students pedagogically.

Another study that looked at pedagogical translanguaging, or "code-switching" as they referred to it, was conducted by Setati, Adler, Reed & Bapoo (2002). In their article, they looked at the frequency of application and teachers' motives behind using code switching as a pedagogical strategy in Science, Mathematics, and English language classrooms in South Africa across three years, 1996-1998. Science and Mathematics are also taught in English in South Africa. Like Lebanon, students do not have a medium to practice English in outside the classroom which makes English a foreign language. For South African teachers, the challenge is doubled in the sense that they have to teach their content in a language that the students are still trying to acquire. Students in turn suffer to understand the content because of the language barrier. A research team was assigned to observe and analyze the language practices of teachers and learners in the ten schools. The focus was mainly on the reception and production of language through 'code-switching', 'exploratory talk' and 'discourse-specific talk'. The results of the study highlight the positive impact of translanguaging on boosting the students' motivation to participate in the classroom. Setati et al shed the light on the

importance of using the students' native language during *exploratory talk* in the classroom. This helps them understand the content and relate it to their daily lives which contributes to meaningful learning. When the lesson is taught purely in English, students do not get the chance to participate in the exploratory talk in their native language which limits their full understanding of the scientific concepts. Also, the authors discuss that for students to succeed in acquiring the necessary skills in a specific subject, they should be able to successfully transition from informal talking and writing in their native language to formal discourse-specific talking and writing in English. This pathway can be achieved through several routes described in the article and translanguaging plays a major role in this achievement.

Similar to Setati et al's study, Karlsson, Larsson, & Jakobsson (2020) conduct a study in Sweden in which they followed a primary school science classroom for three years. The aim of the study was to explore and clarify how students' use of first and second languages in a translanguaging science classroom may affect learning in science. Authors discuss how translanguaging in a science classroom led to more engagement of the students with the teacher and with each other. Students referred to their native language to negotiate about the significance of a certain word or phenomenon. This facilitated their understanding of the scientific concepts.

In their study, Karlsson, Larsson, & Jakobsson (2019) discuss the effect of translanguaging on learning in a science classroom. Karlsson et al documented language use in science classes in a school in Sweden that has Arab and Swedish students. From kindergarten and until grade 4, instruction was given in both languages, Swedish and Arabic, equally. In grades 4-6, instruction was provided in the Swedish language solely even if new Arabic students join the school in grade 4. In this class, translanguaging

was applied by encouraging students to use their mother tongue as a resource in science classes, either with their peers or with the secondary teacher that helped students who needed scaffolding. Karlsson et al argue that translanguaging is fundamental to understand the language of science. In addition, it also helps them connect science language to their everyday language and prior experiences. This ensures achieving depth in the scientific knowledge which in turn leads to meaningful science learning. According to Karlsson et al, meaningful learning is achieved when the students connect what they learn to previously encountered experiences which creates a desire to build on these experiences and continue learning.

Lastly, in their study, Pierson, Clark, and Brady (2020) state that translanguaging, like scientific modeling, relies on the use of multimodal representations for meaning making and expression. Hence, the authors of this design study conjectured that connecting translanguaging and modeling would privilege other languages and modes, inviting students to use their full representational repertoires to participate in modeling activities. One of the authors, Pierson, and the teacher of a sixth-grade science classroom codesigned and cotaught a unit in the science classroom that included translanguaging and modeling together. Both the teacher and the researcher were monolinguals. The classroom was English-dominant but included five bilingual students. The teacher introduced and encouraged translanguaging by demonstrating interest in students' linguistic resources and offering students opportunities for translanguaging. However, the purpose of this study was not to teach students about translanguaging, but to support students in using a wider range of linguistic and nonlinguistic resources in service of sensemaking during modeling activities. After engaging students in translanguaging, they were involved in modeling activities in

groups of three or four. Analysis of students' discussions and work revealed that they engaged in translanguaging differently. Some of them translanguaged flexibly and fluidly using multiple languages and modes in their models, others used it to translate during modeling, and others (monolinguals) identified and analyzed multimodal resources within and across their models. Using multiple languages enabled students to express ideas with specificity, unpack science terms and concepts, resolve and make sense of complex representations, recognize new relevant variables in their models, express ideas and engage with others' ideas, and identify disciplinary reasons for using multiple representations. Moreover, in addition to supporting multilingual students as a pedagogical strategy, translanguaging and scientific modeling (with an emphasis on multimodality) also supported monolingual students, including students with disabilities that limited their verbal communication. In conclusion, the authors suggested that syncretic translanguaging-modeling practices could be transformative of STEM learning in an English-dominant classroom, both for "bilingual" and "monolingual" students.

Characterizing and Overcoming Language Challenges in Science Teaching in Lebanon

Shaaban and Ghaith (1999) present a historical account of multilingualism in Lebanese education and explain how it came about that science is now taught in a foreign language, English or French, in Lebanon (Shaaban & Ghaith, 1999). Given the fact that Lebanon was under the French mandate for a period that lasted 23 years (1920-1943) and the chaos that Lebanon has been living ever since the independence in 1946, bilingual education became a tradition that won over the decision of making Arabic the language of instruction for sciences and mathematics. Therefore, since the French

mandate, science has been instructed in a foreign language which poses serious challenges for Lebanese students in science classrooms given their incompetency in the language of instruction.

A number of researchers have recently begun to explore the challenges associated with language in Lebanese science classrooms. A study was conducted by Badreddine (2018) that investigated the difficulties associated with middle school students' understanding of non-technical words in science. A sample of 167 students between grades 6-9 whose native language was Arabic were chosen from a Lebanese private school in Beirut. A mixed-method design was adopted where students were asked to answer a questionnaire to test their non-technical vocabulary understanding. Semi-structured interviews were conducted with selected students for validating the questionnaires' findings and further clarifying some students' answers. Results of the study showed that students do not fully understand the majority of non-technical terms in the questionnaire. After reaching this conclusion, the author then selected the 30 most problematic terms and focused on the analyzing the students' understanding of these terms. Findings revealed that the students' responses were almost equally weak for the one-word synonym without a context and the everyday contexts. The author then revealed the sources of difficulty in understanding non-technical words. These difficulties as mentioned by the author are "confusion with words that are close in meaning, confusion with look-alike or sound-alike terms and or confusion with words having opposite meaning."

Similar to Badreddine, Yamout (2019) conducted a study to investigate the challenges that Lebanese students, who are non-native speakers of English, articulate when writing to learn science. However, unlike Badreddine, Yamout's study tackled

elementary students and examined whether the genre-based approach improves the quality of students' expository writing and their conceptual knowledge. The author focused on grade 4 students at a private elementary school in Beirut. The schoolteacher was trained on genre-based pedagogy and its three phases: deconstruction, joint construction, and independent construction (which was considered the post-test mentioned later). After the training, the implementation period lasted 4 weeks during which the teacher, in the experimental group, taught the students based on the genre-based pedagogy. In the control group, there were no interventions. All students took a pre-test, before the intervention, and a post-test, after the intervention. Besides the quantitative analysis which was done through analyzing the findings of the pre and post-tests, qualitative analysis was also conducted through "thinking aloud" sessions which were recorded and analyzed later. The findings showed that genre-based pedagogy has positive impacts on the students' quality of expository writing in most of its aspects. In addition, when it comes to the challenges that students faced and talked about in the "think aloud" sessions, students faced difficulties in translating thoughts to written sentences, generating ideas, hesitating and lacking confidence, and translating from their native language of Arabic to the language of instruction, English.

It has been noted that the issue of language of instruction is an issue in the Arab world generally and Lebanon specifically. In his review, Amin (2009) looks at how research answers critical questions about the language of instruction in science education. After agreeing that the language of science is different from the everyday language, he addresses a number of questions among which two main questions are:

1. What should be the language of instruction in science classes if the students are expected to learn science in an international language?

2. Is there any instructional support that the students learning science in a foreign language should get?

Answering the questions above, Amin argues that using Arabic as a language of instruction in Arab countries reinforces national and regional identity. It also gives the chance for students to engage in science discussions and debates in their national language. Concerning the second question, Amin argues for scaffolding students, whose native language is different than the international language, to help them achieve the scientific objectives efficiently. Moreover, providing the students with support at the language level helps them better express their ideas. Also, explicitly addressing the diverse backgrounds of the students during in-class discussion is also important. And finally, the use of the native language in science classroom has been proven to have positive impacts on the students' understanding of scientific phenomena.

A study by Salloum & Boujaoude (2020) looked at and analyzed the language practices in Lebanon and how translanguaging helps the students make meaning in science classrooms. Based on class observations, students use Arabic to ask for clarification, even if the science class is instructed in English. They also use Arabic for long answers whenever they feel the need to elaborate. On the other hand, students use English for short factual answers. According to the authors, this reflects that the students are not proficient enough in English to use it without integrating Arabic words in their sentences. Another finding of this study is that when the teacher used Arabic in the classroom, students felt more engaged in the lesson explanation as they could relate the lesson to their daily life experiences. Therefore, authors of the study suggest that translanguaging could facilitate meaning making in science classrooms as the students

would be able to understand the terms better, connect to their daily life more, and easily express themselves.

In her book chapter entitled “Contradictions Confronting Hybrid Spaces for Translanguaging in the Lebanese Context: A CHAT Perspective”, Salloum (2021) starts by describing the challenges that Lebanese students face in science learning which are all related to the fact that they learn science in a foreign language (English or French). Salloum discusses the importance of using translanguaging in science classrooms as a tool for meaning making. This is done through the AlT (Awakening to Language) approach which helps in bringing the students experiences and life knowledge into the science classrooms. As a form of translanguaging in this approach, the teacher used texts and scripts of different languages, including the students’ home language, which plays a major role in bringing the students’ daily life experience into the classroom. In addition, scaffolding the students at the level of reporting and expressing their understanding enhances their writing skills in science.

The Focus of This Study

Heugh (2015) presented a literature review article that looks at translanguaging and genre together and their effect on enhancing the students’ understanding in the classrooms. Translanguaging in bilingual and multilingual contexts expands the students’ repertoire. It also gives them the freedom of using their full repertoire which eliminates the barrier of language incompetency that inhibits participation and comprehension. This article is extremely important because it was the first to look at the combination of the two pedagogical approaches, genre-based instruction and translanguaging, in the classroom. Heugh draws attention to the positive impact that these two approaches have on the students. However, there is only this review article

looking at the combination of these two approaches, but no empirical studies have been done. Not only there isn't such work like that in Lebanon, but also there isn't work that combines the two approaches internationally.

Translanguaging and Genre approach seem to be two promising strategies that facilitate and improve science learning in the classrooms. My argument is that genre-based instruction improves the students' skills in using the features of science genres in writing. Moreover, the integration of translanguaging in genre-based instruction would further develop the students' writing skills in science. First, translanguaging encourages students to participate in science classes and fully understand the concepts. This ensures the achievement of meaningful learning. However, even if the students fully understand the scientific concepts, they still need scaffolding to express their understanding in writing a scientific text. In other words, their writing skills need to be enhanced. Here comes the role of genre approach. Introducing the different genres of science in their distinct structure, lexicogrammatical features, and modes of representation, through scaffolded activities might facilitate the transition from nonformal exploratory talk in the English to formal discourse-specific talking and writing in English. Language scaffolded activities provide students with the language support needed to be able to formally express their understanding of scientific phenomena. Activities vary based on the students' needs. As the students become more proficient, less scaffolding is needed until he/she reaches a state where little or no scaffolding is needed.

CHAPTER 3

METHODOLOGY

The aim of this study is to evaluate the effectiveness of genre-based instruction and translanguaging on enhancing the students' writing skills in the genre of explanation. The research questions are:

- Does a genre-based instructional approach improve Lebanese upper elementary students' skills in using the features of the written explanation genre?
- Does the integration of translanguaging into genre-based approach further improve Lebanese upper elementary students' skills in using the features of the explanation genre?

Overview of the Research Design

To answer the research questions, the study used a quasi-experimental research design. Study participants were grade six students at a private school in Lebanon. These students were divided into three groups, two of which were considered experimental groups that received interventions to be discussed later in detail. The first group was the control group in which no intervention occurred. The second group was the one that received instruction based on the genre-based approach, while the third group received an intervention based on the integration of translanguaging and genre-based instructional approach. The science teacher was trained on genre-based instruction and translanguaging approaches and how to integrate them in the classroom. Students took a pretest at the beginning of the study, and a posttest at the end of the study. The pre-test consisted of an explanation writing prompt that students were asked to respond to at the beginning of the experiment. The prompt was about plats reproduction which is a topic

they were expected to have covered before the study took place. The post-test consisted of an explanation writing prompt that students were asked to respond to after the intervention. It consisted of three parts: the first part was the same writing prompt that was given to the students in the pretest, the second part was a writing prompt related to one of the three chapters explained in class during the intervention phase, and the third writing prompt was related to a topic that students were familiar with but was not tackled during the intervention. This chapter will elaborate on each of the five aspects of the methodology: participants, procedure, instruments used, data collection and data analysis procedures.

Participants

Sample

Participants in the study were selected from one Lebanese private school in Beirut that offers science in a foreign language, namely English. The school was selected on the basis that it follows the Lebanese curriculum and uses the Center for Educational Research and Development (CRDP) science books assigned by the Lebanese Ministry of Education and Higher Education (MEHE). Another criterion is that the school's use of a foreign language in science classrooms has been identified by it as a challenge. Different indicators were used to check whether a school meets this criterion. For example, the chosen school teaches science in Arabic for the first three elementary classes. This is an indicator because such schools find that the level of English proficiency on admission in grade one is not sufficient enough to teach science in English at this level. In addition to the above-mentioned criteria, the sample included 6th grade elementary school students whose native language is Arabic and who fit the profile of being English language learners (ELLs). The sample consisted of three

different sections of sixth grade, all taught by the same science teacher. The control group comprised 24 students, experimental group 1 comprised 25 students, and experimental group 2 comprised 21 students, making a total of 70 who met the specified criteria. The science teacher chosen for the sample normally uses solely English in her teaching practices.

Sampling procedure

Convenience sampling procedures were followed in this study. This study followed a non-random sampling method that relied on selecting sixth grade students to be part of the researchers' investigation. In addition, the school was chosen based on two requirements. First, it follows the Lebanese curriculum for science education. Second, science is taught in English which is a foreign language for students whose native language is Arabic. Therefore, all students are ELLs. It is important that the school has three sections of grade six so that each section will be randomly assigned to either the control group or one of the two intervention groups. All sections were taught by the same teacher in order to control for the possible effect of the teacher as a confounding variable. The students chosen were considered as a "convenience sample" since the researcher chose a school that has given permission for the study to be conducted. The interventions were implemented on the students who were randomly assigned to the two experimental groups.

Procedure

Overview

There were three distinct stages of the study: the pre-instruction stage, the instructional intervention stage, and the post-instruction stage. In the pre-instructional stage, the teacher was first trained on the two instructional approaches, genre-based

approach and translanguaging. After the training was over, and before the intervention took place, students of all groups were asked to conduct a pre-test. In the instructional intervention phase, students were divided into three groups, the control group and two experimental groups. The teacher was asked to implement genre-based approach in the first experimental group. She was asked to integrate genre-based approach and translanguaging in the second experimental group. As for the control group, the teacher was asked to apply her usual teaching strategies in the classroom with no integration of any of the two approaches. In the post-instruction stage, students of all groups were asked to conduct a post-test, at the end of the study after the intervention took place.

Implementing Pre and Post Tests

A pre-test and post-test were administered to the students of the three classes – the control group the first intervention classroom, and the second intervention classroom – before and after the instructional interventions were implemented (See Appendices A and B). The tests took place during the regular class. The pretest took around 30 minutes and the posttest around 60 minutes. The researcher administered the test in order to reassure the students that these tests were not graded and would only serve the purpose of the research study.

Instructional Interventions

In this study, two instructional interventions were implemented: genre-based instruction focusing on the explanation genre; and another adding strategic translanguaging to genre-based instruction. Writing instruction was integrated with teaching of specific content in the Lebanese science curriculum.

During the intervention, students in Experimental Group 1 were explicitly taught the genre features of explanation genre. This was done as instructed in the lesson plans

provided for the teacher (See Appendix C) through three modules over the period of implementation of the study (links to modules are found in the lesson plans). Each lesson plan was applied over one to two teaching sessions. A module is a series of interactive activities designed on an online platform, Tabshoura, to scaffold students to develop the genre-based skills. The modules were created based on the three phases of the genre-based instructional approach but on different topics. In each of the modules, there is a set of activities that fall under the deconstruction phase, another set of activities that fall under the joint-construction phase, and one essay question that falls under the independent construction phase in which the student is asked to synthesize his/her own explanation text using the genre-features tackled in the module. The researcher provided the teacher with three modules, and the students got the chance to practice the genre-approach learning cycles three times before taking the post-test. These modules were not graded as they serve to help the students practice using genre-features.

For Experimental Group 2, the teacher was asked to apply the lesson plans provided for her (See Appendix D). As mentioned in the lesson plans, the teacher was asked to apply the same modules used for Experimental Group 1. However, in order to integrate translanguaging in the genre-based instructional approach, the teacher is asked to implement four translanguaging strategies, that will be explained in detail later, such that the students were given space to draw from their Arabic and English language repertoires freely.

As for the control group, the teacher was asked to follow lesson plans provided for her by the researcher. These lesson plans had no integration of any of the two approaches (See Appendix E).

Instructional Unit. Two topics from the grade six Lebanese curriculum were selected to be the context for this study: "Dangers of Tobacco, Alcoholism, and Drugs" (Chapter 10, CRDP textbook) and "Chemicals Around Us" (Chapter 15, CRDP textbook). The chapters were chosen because they involve many explanations of scientific phenomena and thus are an appropriate context for teaching about the written explanation genre. Explanation genre is concerned with how processes happen. This entails discussing a sequence of causes and effects. This kind of relationship between the causes and effects is referred to as an Implication sequence. The types of explanation texts vary between sequential, factorial, consequential, and conditional based of the number of causes and effects that a text is discussing. All of the explanation text types share the same features (lexico-grammatical features, logical connectives, mode of representation) (Martin & Rose, 2008). The chapter entitled "Dangers of Tobacco, Alcoholism, and Drugs" was chosen for the study because it discusses the multiple effects that each of tobacco, alcoholism, and drugs have on our body. Thus, it has a number of texts that the teacher may use to model an explanation text and highlight its linguistic features. Similarly, the chapter entitled "Chemicals Around Us" discusses the effects of different chemicals on human beings and the environment. This means that it also has some good examples of explanation texts to be analyzed in the classroom. While other topics could have been chosen, these two chapters were selected in particular because of the scheduled time for instruction of these topics is convenient for the timing of the implementation of this study. The intervention lasted approximately three weeks, where instruction took place during two periods per week. In what follows, a more detailed description of instruction in each of the three class will be explained (See summary in Table 1).

Control Group. The first section is the control group in which no intervention was implemented. In this group, the teacher followed the lesson plan provided by the researcher. A typical lesson had the following features: The teacher used mainly English in the classroom; there was no explicit attention to developing writing skills and genre linguistic features in science. The focus of the teacher was mainly on developing the students' understanding of the scientific topic. To eliminate any confounding factors, the lesson plans for the control group also involved Tabshoura modules, as seen in the lesson plans. The teacher provided each pair of students with tablets in order to interact with the activities in the classroom. She started off her lesson with a motivational activity to hook the students. Then, they interacted with a set of activities related to a scientific concept. Afterwards, she evaluated the students by asking them to solve a question on a separate piece of paper. The teacher did not analyze the language of explanation texts. The sole thing she focused on, was to develop the students' understanding of the scientific content in a deductive approach.

Experimental Group 1. The second section was taught based on a genre-based instructional approach (GBI) through the integration of the modules previously provided for the teacher. In this group, the teacher followed the lesson plans modified by the researcher based on the genre-based instructional approach. As mentioned in the lesson plan, the teacher uses an iPad to follow up with the students the modules found on Tabshoura platform. She distributed 1 tablet to each pair of students in order for the students to interact with the modules in the classroom. Each of the modules involved the three main phases of genre-based instructional approach: Deconstruction, joint construction, and independent construction. The first phase of the module represented the deconstruction phase in which an explanation text was modelled in the module and

dissected through activities that involve the students. The activities include multiple-choice questions, drag-and-drop exercises, matching questions, and others. The dissection process was when the teacher highlights the important linguistic features of an explanation text such as the verb tense, the logical connectives, the mode of representation, and so on. Students learned about these features by solving exercises in the module on the tablets. Then, during the joint construction phase, students were instructed to collaboratively compose an explanatory paragraph with assistance from the teacher, using a separate piece of paper. Although the question was also available in the Tabshoura module, students were directed to provide their responses on paper to avoid wasting time typing. Finally, in the independent construction phase, students were asked to individually respond to a prompt in the module by writing an explanation paragraph on a separate piece of paper, without the help of the teacher.

Experimental Group 2. The third section was taught based on the integration of both genre-based instruction (GBI) and strategic translanguaging (TL) together. In this class, the teacher followed the lesson plan further modified by the researcher based on the strategies of genre-based instruction and translanguaging. In this experimental group, the teacher was also asked the implement genre-based approach, in its three phases using the same module used for experimental group 1. However, unlike the first experimental group, she was asked to integrate strategic translanguaging in the classroom.

Translanguaging was applied by the teacher through four main strategies.

1. Translating key features of the explanation genre to Arabic (non-technical terms like logical connectives…). The teacher was provided with a word bank with all the translations that she might use in the classroom.

2. Providing examples of how to use certain linguistic genre features in Arabic. The teacher was told to be free to dynamically translate ideas and examples to Arabic when she felt that the need to do so.
3. Implementation of translanguaging rings in students' group discussions. For example, the teacher dedicated 10 minutes for a free discussion in which she gave space for the students to use their native language to analyze the features of an explanation paragraph related to the topic being discussed.
4. Contextualizing and wrapping up the class in Arabic. The teacher was asked to introduce the lesson in Arabic. This was done to provide the students with a framework that helps them understand what the lesson is going to be about. She was also asked to wrap up the session in Arabic.

Table 1

Overview of the Procedure

Periods	Control Group	Exp Group 1: GBI	Exp Group 2: GBI + TL
1	Pre-Test	Pre-Test	Pre-Test
2	Ch 10 – Lesson Plan 1 Explanation of the Effects of Smoking	Ch 10: -- Lesson Plan 2, Module 1 Genre- Based Approach to Explaining the Effects of Smoking	Ch 10: Lesson Plan 2, Module 1 + TL Translanguaging and Genre-Based Approach to Explaining the Effects of Smoking
3	Ch 10– Continuation of Lesson Plan 1	Ch 10– Continuation of Lesson Plan 2, Module 1	Ch 10– Continuation of Lesson Plan 2, Module 1 + TL

	Effects of Smoking on Different Body Organs	Explanation of the Effects of Smoking	Explanation of the Effects of Smoking
4	Ch 10	Ch 10: Module 2	Ch 10: Module 2 + TL
	Functions of the Nervous System	Functions of the Nervous System	Functions of the Nervous System
5	Ch 10	Ch 10: Module 2 Cont'd	Ch 10: Module 2 + TL Cont'd
	Functions of the Nervous System	Functions of the Nervous System	Functions of the Nervous System
6	Ch 15	Ch 15: Module 3	Ch 15: Module 3 + TL
	Functions of the Excretory System	Functions of the Excretory System	Functions of the Excretory System
7	Post-Test	Post-Test	Post-Test

Teacher Training

Before the implementation of the study, the teacher was trained, through three or four one-on-one sessions, on genre-based instructional approach and strategic translanguaging. In the first session, the teacher was introduced to Tabshoura platform on which the modules were created and published. She was also trained on how to help the students create accounts on Tabhsoura and access the language for science modules.

In the first session, the teacher learned all about Tabhsoura and how navigate through the platform and access the language for science modules. After the session, the researcher provided the teacher with a guide on how the modules were created and how to use them in the classroom. A couple of days later, the second training session took place in which the teacher was trained on genre-based instructional approach that consists of three phases: deconstruction, joint construction, and independent construction. The researcher explained to the teacher what genres in science are and some of the research studies that prove its effectiveness on improving the learners' writing skills in science. The researcher also walked the teacher through each of the modules she will be using in class. In addition, the teacher was introduced to strategic translanguaging and its importance in facilitating the students' understanding on scientific concepts. In the third training session, the teacher was asked to take lead and apply one lesson plan for experimental group I in front of the researcher before the actual intervention takes place. In these two sessions, the researcher made sure that the teacher had fully understood the two approaches and was capable of applying them in the classroom. Finally, in the last session of the training, the teacher was introduced to translanguaging, and the researcher walked the teacher through the changes that she had to make to the teaching practices applied in the lesson plan for experimental group I. After the training was completed, the teacher was asked to implement both strategies in the classroom as instructed by the researcher.

Instruments

Pre-test, Post-test

The pre and post-tests were created by the researcher. They consisted of writing prompts that students are asked to respond to in a paragraph form.

For the pretest, students of all groups were asked to write down a 5-10 sentence explanation paragraph, about a topic they are familiar with (See Appendix A). The selected topic, already familiar to students from prior exposure in the Lebanese curriculum, corresponds to the scope and sequence as taught by the teacher before the study begins. This question was aimed to test the students' writing skills in explanation genre. The pre assessment was administered by the researcher at the beginning of the study to students of the three sections before any intervention took place.

After the intervention, students of all groups were asked to take the post-test which consists of three writing prompts that students are asked to synthesize three different 5-10 sentence explanation paragraphs (See Appendix B). The first prompt was the same writing prompt that was given to the students in the pretest, which was related to a topic that students were familiar with but was not tackled during the intervention, the second part was related to a topic that students were familiar with but was not tackled during the intervention, and the third writing prompt was a writing prompt related to one of the three chapters explained in class during the intervention phase. Similar to the pretest, the posttest was aimed to test the students' writing skills in explanation genre.

Data Collection Procedures

After receiving IRB approval, the researcher introduced the school principal to the project and asked for permission to conduct the study at the school. The researcher distributed to the students the consent forms to be signed by their parents as well as the assent forms to be signed by the students. The researcher was responsible for collecting the signed consent and assent forms from the students. The teacher's participation was completely voluntary. Students and parents were introduced to the purpose of the study. They were also informed that their scores will remain confidential and would not be

part of the school assessment. They were also assured that they could withdraw from the study at any time.

During the study, the teacher and the researcher were present in class over a period of three weeks. Based on the analysis of session recordings, it is evident that the teacher largely adhered to the prescribed lesson plans. However, occasional usage of Arabic language was noted in the control group sessions. Additionally, minor interventions by the researcher were occurred during the sessions to ensure alignment with the lesson plan objectives. These interventions served to maintain consistency and enhance the fidelity of the lesson implementation process. Detailed descriptions of the three teaching sessions can be found in Appendix F.

The Role of the Teacher

The teacher was responsible for implementing the instructional phase as instructed in the lesson plans provided for her by the researcher.

The Role of the Researcher

The researcher administered the pre and posttests in all groups. The researcher attended all classes and collected observations to check whether the implementation of the lesson plans and modules ran as planned. One class for each of the control and the experimental groups was recorded and the lessons were outlined to make sure that they aligned with the lesson plans provided for the teacher. The researcher was also responsible for scoring the pre and posttests of all students and analyzing the data.

Data Analysis Procedures

Grading Rubric

The previously described language features of an explanation genre are clearly illustrated in Table 2. These features were used to create an SFL-informed coding

framework (Brisk, 2015; Fang & Schleppegrell, 2008; Halliday, 1978) to identify language and organizational features expressed by students in their writings.

In order to analyze the explanation texts written by the students, SFL framework allowed the researcher to look for prominent language and organizational features found in the explanation genre. For example, in each of the students' writings, the researcher looked at the structure of the explanation paragraph written by the student. The researcher also looked for the effective use of introductory statement, timeless present tense, conjunctions and connectives, and coherence. The frequency and the accuracy of the features used by a student determined the score he got. Students' scores followed a scale between 0 and 2, 2 being the best score for each of the genre features (See Table 3).

To answer the research questions, first descriptive statistics for the pre- and post-test score of the three student groups (three conditions) were reported. To address the first research question, results of the control group and the genre-based instruction group were compared. To answer the second research question, results of the first experimental group (genre-based approach) and the second experimental group (combining genre-based approach and translanguaging) were compared. To examine whether differences between the conditions were statistically significant ANCOVA analyses were conducted.

Table 2

Explanation Genre Features

Explanation

Function (Halliday & Martin, 1993)	-to describe how a natural process happens. -used in reports focusing on processes (classification and composition), but regularly stand-alone in science textbooks.
Structure (Martin & Rose, 2008)	The typical structure of explanations is to start by specifying the phenomenon to be explained, followed by the implication sequence that explains it, the Explanation stage.
Lexicogrammar (Halliday & Martin, 1993)	Two prominent linguistic features of the implication sequence: - relatively high proportion of action verbs - the use of conjunctions (e.g., because, when, however) to construct logical and causal relations across clauses and sentences - the use of passive voice In reports, explanations: - have generic participants (boulders, pebbles, river etc.) - make use of timeless verbs (become, rounds, smooth etc.) - use of nominalization
Keywords (Conjunctions and Connectives)	Terms that convey causes and effects (e.g. comes from, leads to, because, so, thus, therefore, in order to etc.) In questions, these terms could be (why? explain)
Mode of Representation (Martin & Rose, 2008)	Diagrams with lines and arrows with labels

Table 3

Grading Rubric

Overall Score: __/15

Genre Feature	Score: 0	Score: 1	Score: 2
Introductory statement	There is no introductory statement in the paragraph.	An introductory statement is present, but it does not introduce the phenomenon.	There is an introductory statement that clearly introduces the phenomenon.
Explanation Sentences	Processes are not linked to the phenomenon, and there is no reference to them occurring over time and sequence.	There is reference to processes occurring in time and sequence, but they are not linked to the phenomenon.	Processes are linked to the phenomenon, and there is clear reference to them in time and sequence.
Timeless Present Tense	Timeless present tense not used correctly	Some timeless present tense verbs used correctly	All timeless present tense verbs used correctly
Conjunctions and Connectives	Conjunctions and connectives not used correctly	Some connectives are used accurately, others are not	All connectives is used accurately
Coherence	There are no linkages between sentences (e.g. proper use of pronouns).	Some sentences are linked to each other (either by using 'and', 'after that', or any similar linking word or pronouns), while other sentences are not.	All sentences flow smoothly, linked to each other (using linking words and pronouns) when appropriate.

The figures below display samples of weak, intermediate, and strong responses. In Figure 1, the weak response received 2/2 for the verb tense rubric item due to accurate use of timeless present tense verbs. However, they scored 0 on all other items, resulting in a total score of 2/10 for this student.

Regarding the intermediate response in Figure 2, the student achieved a total score of 5/10, gaining 1 point for each of the introductory statement, explanatory sentences, and coherence. The verbs used in the sample were not in the timeless present tense; however, the student adeptly employed several conjunctions accurately.

Moving on to the strong response in Figure 3, the total score was 9/10, with full marks for all items except the introductory statement. While present, it did not effectively introduce the phenomenon.

Figure 1

Weak Response Sample

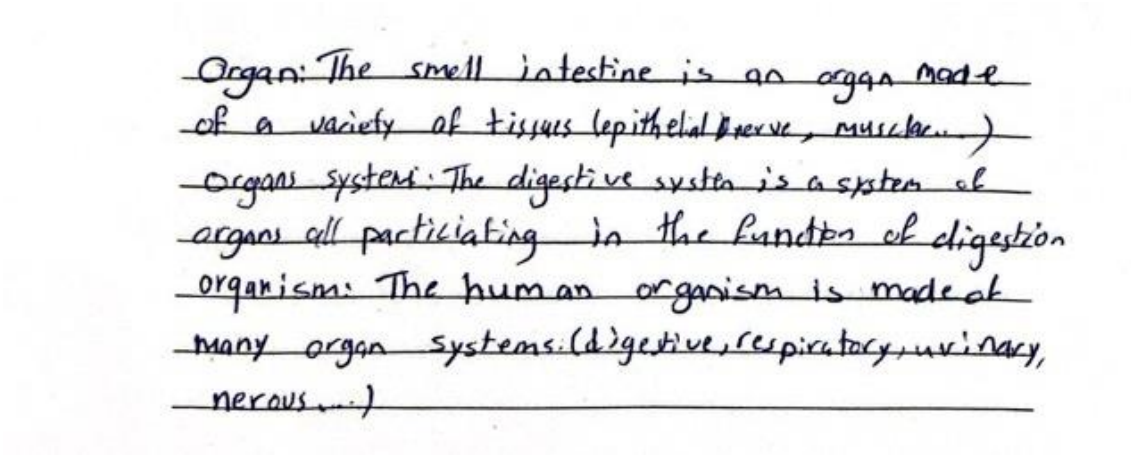


Figure 2

Intermediate Response Sample

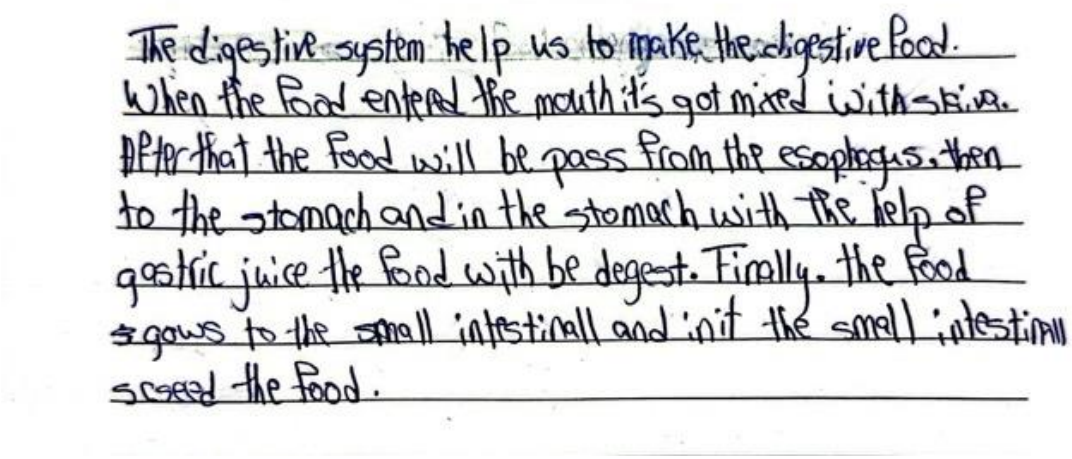
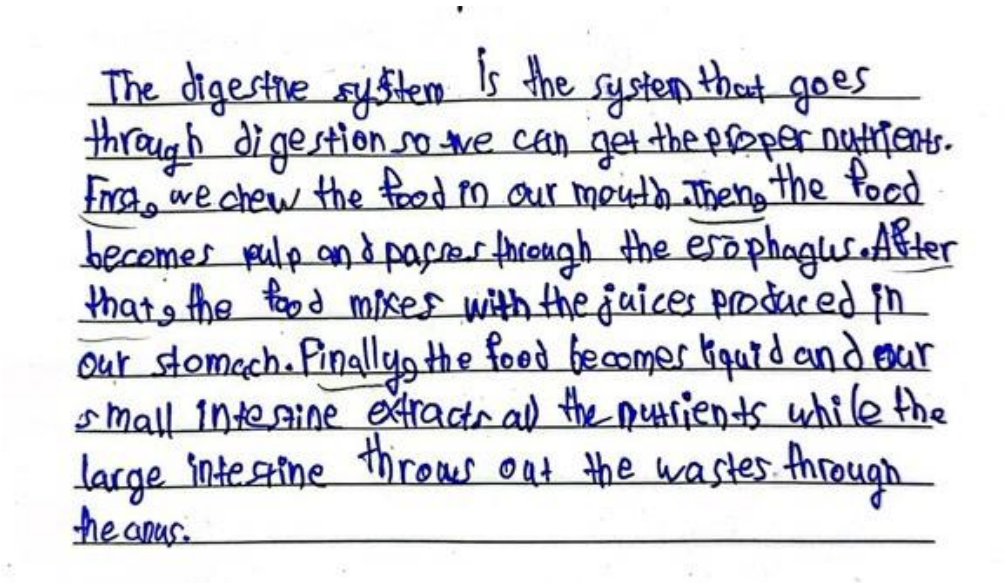

The digestive system help us to make the digestive food. When the food enter the mouth it's got mixed with saliva. After that the food will be pass from the esophagus. then to the stomach and in the stomach with the help of gastric juice the food with be degest. Finally. the food goes to the small intestinall and init the small intestinall sceed the food.

Figure 3

Strong Resposne Sample


The digestive system is the system that goes through digestion so we can get the proper nutrients. First, we chew the food in our mouth. Then, the food becomes pulp and passes through the esophagus. After that, the food mixes with the juices produced in our stomach. Finally, the food becomes liquid and our small intestine extracts all the nutrients while the large intestine throws out the wastes through the anus.

Validity and Reliability

Reliability

To ensure the study's reliability, a second rater, a researcher involved in the Language for Math and Science in Lebanon project and well-versed in the genre features of explanations, was assigned to analyze 20% of the pretests and posttests from each of the three groups, adjusting for differences in group size. The ratings of the second coder for each element in the rubric were compared to that of the researcher's ratings to test for inter-rater reliability. The agreement between the researcher and the second rater's scores in all five components of the rubric was >90%. Table 4 shows the % agreement between the scores for every item in the rubric.

Table 4

Inter-Rater Reliability

	Introductory statement	Explanation Sentences	Timeless Present Tense	Conjunctions and Connectives	Coherence
% Agreement	98.4	93.5	90.3	96.8	91.9

Validity

The main instrument used for the data analysis is the scoring rubric. The rubric was based on the characterization of genres as presented in the work of linguists Halliday & Martin, 1993. The genre language features listed in Table 2 were used to create an SFL-informed coding framework (Brisk, 2015; Fang & Schleppegrell, 2008; Halliday, 1978) to identify language and organizational features expressed by students in their writings. Moreover, in order to get an expert validation, science education researchers specialized

in language and science education examined the scoring rubric as well as the pretest and posttest prompts and evaluated them to make sure they assess the targeted construct.

CHAPTER 4

RESULTS

This chapter reports the results of this study which investigates whether a genre-based instructional approach, with and without translanguaging, improves Lebanese upper elementary students' skills in using the features of the written explanation genre. The first part of the chapter will be reporting on the study's descriptive statistics. The second part presents an overall ANCOVA analysis across instructional conditions to determine if there is a significant difference between conditions in the proficiency of student writing of explanations. The subsequent section reports post hoc pair-wise analyses to isolate the effect of genre-based instruction alone and the effect of adding translanguaging to genre-based instruction, addressing the first research question and the second research questions of this study, respectively.

Report on the Study's Descriptive Statistics

Three in-tact classes in the same school participated in this study: one class, serving as the control group, received instruction typical of that school; the second (Experimental 1) received the genre-based instructional approach (GBI); and the third (Experimental 2) received genre-based instruction with the addition of translanguaging (GBI + TL). All three groups received instruction covering the same curricular content but differed only in instructional approach. The three groups were given a pretest before the intervention. After the intervention was completed, they underwent a posttest. The pre- and post-tests prompted students to write explanations on various topics. Before the intervention, students in all three groups completed a pretest consisting of one writing prompt. Following the intervention, students took a posttest comprising three prompts: the first prompt was the same as the pretest prompt that

covers a topic familiar to the students before the intervention, the second covered a different topic that is also familiar to students before the intervention, and the third addressed a topic introduced during the intervention. Students' pre and posttests were scored using a specific rubric (as described in Chapter 3). An average score was calculated for the three prompts in the posttest. Before comparing the posttest scores across groups, Table 5 shows the number of students in each of the groups. Table 6 shows descriptive statistics about the study. The table includes the means of the posttest scores per group, for the average scores of the posttest as well as for each individual prompt in the posttest. As shown in the table, for the average posttest scores, both experimental groups achieved higher scores compared to the control group (Mean (Control) = 1.88, Mean (GBI) = 3.25, Mean (GBI + TL) = 4.01). When comparing the scores of each of the prompts in the posttest, the second experimental group (GBI) obtained a mean score higher than that of the control group, while the second experimental group (GBI + TL) demonstrated even higher mean posttest scores for each of the writing prompts.

Table 5

Number of Students in Each Instructional Condition

	Control	Exp1: GBI	Exp2: GBI + TL	Total
Males	14	14	9	37
Females	10	11	12	33
Total	24	25	21	70

Table 6

Means for Post-test Scores

Group	Pretest	Post Av	Post 1	Post 2	Post 3
Control	1.83	1.88	2.21	2.50	0.96
Exp 1: GBI	2.04	3.25	2.36	4.08	3.36
Exp 2: GBI + TL	1.95	4.01	2.86	5.05	4.14

Overall ANCOVAs Across Instructional Conditions

To determine if differences in post-test scores across instructional conditions are significant, they were analyzed using a univariate analysis of covariance (ANCOVA) on SPSS. The instructional condition was considered as the independent variable, while students' post-test scores served as the dependent variable. ANCOVA was conducted to assess whether the independent variable had an impact on the dependent variable, with the pre-test results utilized as a covariate to take into account initial variation among students in their proficiency in writing explanations. Prior to conducting ANCOVA, preliminary checks were conducted to ensure the dataset met statistical assumptions (Field, 2018). The first assumption is the independence of covariate and treatment effect. In other words, there should be no significant difference between the pretest scores of the three groups. The second assumption is the homogeneity of regression slopes. Detailed results of the assumption tests can be found in separate tables in Appendix G.

To check the first assumption, ANOVA test was conducted with the pretest as the dependent variable and the group as the fixed factor. The results indicated no statistically significant difference between the pretest scores across groups ($F = 0.096$, $df = 2$, $p = 0.908$), confirming that the first assumption was met. To assess the second

assumption, we conducted tests for the homogeneity of regression slopes. This analysis was performed for the average scores of the posttest and each of its individual prompts. The results indicated no statistically significant differences for the posttest average ($F = 1.25$, $df = 2$, $p = 0.29$), Post1Total ($F = 1.11$, $df = 2$, $p = 0.33$), Post2Total ($F = 0.75$, $df = 2$, $p = 0.47$), and Post3Total ($F = 1.06$, $df = 2$, $p = 0.35$). Consequently, we confirmed that the second assumption was met.

After ensuring that the assumptions were met, we will examine whether there was significant variation in the average posttest scores across the three groups. Additionally, we will assess whether there was significant variation in the scores for each individual posttest question across the three groups. The results of a series of ANCOVA tests will be presented to test for the significance of any variation. The next section will report post-hoc pairwise comparisons to examine more closely whether there were differences between specific conditions.

Table 7 displays the results of the ANCOVA conducted on the post-test average scores, with the pre-test scores serving as the covariate. It is observed that there was a statistically significant difference between the groups ($F = 7.105$, $df = 2$, $p = 0.002$).

Table 7

Results of ANCOVA on Posttest Average Scores Using Pretest as a Covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	122.012[a]	3	40.671	11.949	< .001	.352
Intercept	98.928	1	98.928	29.066	< .001	.306
PreTotal	69.191	1	69.191	20.329	< .001	.235
Group	48.365	2	24.183	7.105	.002	.177
Error	224.637	66	3.404			
Total	982.603	70				

Corrected Total	346.649	69

a. R Squared = .352 (Adjusted R Squared = .323)

When examining the variation in the posttest scores of the first prompt (which was identical to the post-test and covered a topic that students are familiar with before the intervention) across the three groups using ANCOVA, we can see that there is no statistically significant difference ($F = 7.105$, $df = 2$, $p = 0.241$) between the groups as seen in Table 8.

On the other hand, the ANCOVA using the post-test score for the second prompt (which covered a topic familiar to students before the intervention) revealed significant variation across the three groups using ANCOVA ($F = 5.483$, $df = 2$, $p = 0.006$) between the groups as seen in Table 9 below. Similarly, regarding the posttest scores of the third prompt (which addressed a topic introduced during the intervention), ANCOVA test revealed that the difference between the groups is statistically significant ($F = 8.068$, $df = 2$, $p < 0.001$) as seen in Table 10.

Table 8

Results of ANCOVA on Posttest Prompt 1 Using Pretest as a Covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	52.617[a]	3	17.539	10.843	< .001	.330
Intercept	63.202	1	63.202	39.074	< .001	.372
PreTotal	47.535	1	47.535	29.388	< .001	.308
Group	4.710	2	2.355	1.456	.241	.042
Error	106.755	66	1.617			
Total	582.000	70				
Corrected Total	159.371	69				

a. R Squared = .330 (Adjusted R Squared = .300)

Table 9

Results of ANCOVA on Posttest Prompt 2 Using Pretest as a Covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	170.189[a]	3	56.730	9.006	< .001	.290
Intercept	175.635	1	175.635	27.882	< .001	.297
PreTotal	95.039	1	95.039	15.087	< .001	.186
Group	69.077	2	34.538	5.483	.006	.142
Error	415.754	66	6.299			
Total	1612.000	70				
CorrectedTotal	585.943	69				

a. R Squared = .290 (Adjusted R Squared = .258)

Table 10

Results of ANCOVA on Posttest Prompt 3 Using Pretest as a Covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	197.498[a]	3	65.833	8.925	< .001	.289
Intercept	74.767	1	74.767	10.136	.002	.133
PreTotal	70.444	1	70.444	9.550	.003	.126
Group	119.027	2	59.514	8.068	< .001	.196
Error	486.845	66	7.376			
Total	1222.000	70				
CorrectedTotal	684.343	69				

a. R Squared = .289 (Adjusted R Squared = .256)

Specific Comparisons Between Conditions

This study aims to answer two research questions. The first one focuses on whether genre-based instruction improves students' skills in using the features of the explanation genre over and above regular instruction. The second focused on whether integrating translanguaging into genre-based instruction further improves these skills. To address these questions, a series of post-hoc pairwise comparisons with Bonferroni correction for the overall posttest average scores, as well as for each individual question in the posttest, was conducted. The following post-hoc pairwise analyses will allow me to answer both of these questions. I will return at the end of the section to answer these research questions in light of the findings.

As seen in Table 9 below, when comparing the posttest average scores across groups, a significant difference ($df = 2$, $F = 7.105$, $p = 0.001$) is observed between experimental group 2, which incorporates translanguaging into genre-based instruction, and the control group. However, there was no significant difference between experimental group 2 compared to experimental group 1 ($df = 2$, $F = 7.105$, $p = 0.420$), and no significant difference ($df = 2$, $F = 7.105$, $p = 0.067$) between experimental group 1, which has genre-based instruction alone, compared to the control group, although the latter comparison approached significance.

Table 11

Pairwise Comparisons of Posttest Average Across Groups

(I) Group	(J) Group	Mean Difference (I - J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound	df	f
Exp 1	Exp 2	-.816	.546	.420	-2.158	0.526	2	7.105
	Control	1.236	.528	.067	-.061	2.533	2	7.105
Exp 2	Exp1	.816	.546	.420	-.526	2.158	2	7.105
	Control	2.053*	.552	.001	.698	3.407	2	7.105
Control	Exp 1	-1.236	.528	.067	-2.533	.061	2	7.105
	Exp 2	-2.053*	.552	.001	-3.407	-.698	2	7.105

Based on estimated marginal means

*. The mean difference is significant at the .05 level

b. Adjustment for multiple comparisons: Bonferroni

Moving on to examine the individual prompts in the posttest, the results are presented in Tables 12, 13, and 14. Considering the first prompt in the posttest, as seen in Table 4.6a, there was no significant variations between experimental group 1 and the control group (F = 1.456, df = 2, p = 1.00). Similarly, the difference was not statistically significant when comparing experimental group 2 and the control group (F = 1.456, df = 2, p = 0.380), nor was there any significance between the two experimental groups (F = 1.456, df = 2, p = 0.465).

If we consider the second prompt in the posttest, Table 10b shows that difference is statistically significant when comparing experimental group 2 and the control group (F = 5.483, df = 2, p = 0.005). However, there was no significant difference between

experimental group 1 and the control group (F = 5.483, df = 2, p = 0.151). Similarly, there was no significant difference between the two experimental groups (F = 5.483, df = 2, p = 0.510).

Table 10c presents the results of the comparisons of the third prompt in the posttest across groups. The results show that the difference between experimental group 2 and the control group is significant (F = 8.068, df = 2, p < 0.001). Similarly, the difference is significant when comparing experimental group 1 and the control group (F = 8.068, df = 2, p = 0.014). However, there is no significant difference between the two experimental groups (F = 8.068, df = 2, p = 0.905).

Table 12

Pairwise Comparisons of Posttest Prompt 1 Across Groups

					95% Confidence Interval for Difference[a]			
(I) Group	(J) Group	Mean Difference (I - J)	Std. Error	Sig.[a]	Lower Bound	Upper Bound	df	f
Exp 1	Exp 2	-.542	.377	.465	-1.467	.383	2	1.456
	Control	.046	.364	1.000	-.848	.941	2	1.456
Exp 2	Exp1	.542	.377	.564	-.383	1.467	2	1.456
	Control	.588	.380	.380	-.346	1.522	2	1.456
Control	Exp 1	-.046	.364	1.000	-.941	.949	2	1.456
	Exp 2	-.588	.380	.380	-1.522	.346	2	1.456

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni

Table 13

Pairwise Comparisons of Posttest Prompt 2 Across Groups

(I) Group	(J) Group	Mean Difference (I - J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound	df	f
Exp 1	Exp 2	-1.031	.743	.510	-2.856	.795	2	5.483
	Control	1.431	.718	.151	-.333	3.196	2	5.483
Exp 2	Exp1	1.031	.743	.510	-.795	2.856	2	5.483
	Control	2.462*	.750	.005	.619	4.305	2	5.483
Control	Exp 1	-1.431	.718	.151	-3.196	.333	2	5.483
	Exp 2	-2.462*	.750	.005	-4.305	-.619	2	5.483

Based on estimated marginal means

*. The mean difference is significant at the .05 level

b. Adjustment for multiple comparisons: Bonferroni

Table 14

Pairwise Comparisons of Posttest Prompt 3 Across Groups

(I) Group	(J) Group	Mean Difference (I - J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound	df	f
Exp 1	Exp 2	-.837	.804	.905	-2.813	1.138	2	8.068
	Control	2.274*	.777	.014	.364	4.183	2	8.068
Exp 2	Exp1	.837	.804	.905	-1.138	2.813	2	8.068
	Control	3.111*	.812	<.001	1.116	5.105	2	8.068
Control	Exp 1	-2.274*	.777	.014	-4.183	-.364	2	8.068
	Exp 2	-3.111*	.812	<.001	-5.105	-1.116	2	8.068

Based on estimated marginal means

*. The mean difference is significant at the .05 level

b. Adjustment for multiple comparisons: Bonferroni

In conclusion, our study addresses two research questions regarding the impact of genre-based instruction and the integration of translanguaging into genre-based instruction on improving students' skills in writing explanation texts. With regard to the first question, our findings suggest that genre-based instruction alone did not yield statistically significant results across groups. However, significance was reached when comparing posttest prompt 3, covering a topic addressed during the intervention, to the control. Moreover, considering the overall average of the posttests, with a p-value of 0.067, which approaches the significance threshold of 0.05, indicates promising outcomes for the intervention. Moving to the second research question, integrating translanguaging into genre-based instruction demonstrated significant improvement in students' skills, as evidenced by the notable differences observed when comparing posttest scores of experimental group 2 with the control group. When examining the individual prompts, statistically significant differences were observed in prompt 2, related to a topic not addressed during the intervention, as well as prompt 3, related to a topic covered during the intervention. Nevertheless, when comparing posttest scores between the two experimental groups, no significant difference emerged, rejecting the hypothesis that one experimental group outperformed the other. These findings underscore the potential benefits of integrating translanguaging into genre-based instruction and emphasize the need for further investigation to fully elucidate the impact of genre-based instruction alone on students' writing skills.

CHAPTER 5

DISCUSSION

This study addresses two research questions regarding the impact of genre-based instruction and the integration of translanguaging into genre-based instruction on students' skills in writing explanations. This chapter will be divided into four sections. The first section presents a summary and a discussion of the research findings organized by research question. The second section presents the limitations of the study. The third section discusses implications for both research and practice. Finally, the chapter ends with an overall conclusion.

Discussion of Results

Overall, the results of the study were in line with the expected outcomes. Students in the group that received genre-based instruction produced better explanations than those in the control group, and those in the group that received genre-based instruction along with translanguaging produced even better explanations. While the difference between the second experimental group (genre-based instruction GBI + translanguaging TL) and the control group's posttest average scores was statistically significant, the difference approached but did not reach significance when comparing the average posttest scores of experimental group 1 (GBI) to the control group.

Furthermore, upon examining each of the three prompts in the posttest individually, it became evident that for the GBI + TL group, the second and third prompts exhibited statistically significant differences when compared to the control group. Moreover, prompt 3 showed a statistically significant difference when the posttest scores of the third prompt of the GBI group were compared to the control

group. This suggests that the interventions had a discernible impact on enhancing students' proficiency in writing explanations.

It is worth mentioning that no significant difference was observed for the first prompt in either experimental group 1 (GBI) or experimental group 2 (GBI + TL). This lack of significance may be attributed to the difficulty of the topic chosen for the students. Plant reproduction appears to be challenging for the students, as evidenced by their responses in both the pretests and posttests, which primarily focused on the types of plant reproduction rather than the process itself. Additionally, when comparing the students' answers to this prompt with those of other prompts, it became evident that they were notably shorter and lacked explanatory components. For instance, in response to the second prompt, students were able to produce longer explanation paragraphs, although not always with extensive or accurate use of genre-specific features. These paragraphs demonstrated a certain level of content knowledge, unlike the first prompt where their answers were minimal in both the pre and post-tests.

First Research Question: Genre-Based Instruction

While experimental group 1, which received genre-based instruction only, demonstrated improved explanation texts in the overall posttest average compared to the control group after the intervention, the observed difference approached but did not reach statistical significance. However, in analyzing the posttest results of individual prompt, a statistically significant difference emerged between experimental group 1 (GBI) and the control group specifically for prompt 3. This finding underscores the sensitivity of prompt 3 in detecting the impact of the intervention compared to the other prompts. Notably, prompt 3 required students to respond to a question directly related to the material covered during the intervention period, focusing on the nervous system.

This specificity likely heightened students' engagement and comprehension, making prompt 3 more sensitive to capturing the effects of the instructional intervention. However, it's essential to note that while there appears to have been an effect, it may not be particularly strong. Several factors could have contributed to the outcomes of this study, warranting further investigation and consideration.

The first factor that might have contributed to these results is the sample size and the duration of the study. It suggests that with a larger sample size and longer intervention duration, the difference would possibly have been significant. Had the duration been longer and the students received more extensive training on writing explanation paragraphs through genre-based instruction, the difference might have been statistically significant. In several other studies demonstrating positive effects of genre-based instruction, both the duration of the intervention and the sample size were larger compared to those in this study (Carter, Ferzli, and Weibe, 2004; De Oliveira & Lan, 2014; Traga Philippakos & MacArthur, 2021). This point will be discussed more fully in detail in the limitations section.

The fidelity of implementation of genre-based instruction might have also played a role in shaping the outcomes of our study. While efforts were made to adhere to the instructional plan, several challenges arose during the implementation process. For instance, technical difficulties with tablets necessitated the skipping of one exercise. In another session, time constraints led to the consolidation of a module (the excretory system) into a single session. Furthermore, deviations from the prescribed lesson plan, such as conducting activities meant for pairs as whole-class exercises, may have inadvertently limited individual student engagement and interaction. These deviations could potentially have had repercussions on students' performance in the subsequent

posttest, underscoring the importance of closely aligning instructional implementation with intended strategies for optimal posttest outcomes.

Lastly, another significant factor to consider is the overall weak English language proficiency among the students, particularly evident in their writing skills. A considerable portion of the student cohort exhibited deficiencies in writing, with six out of twenty-five students scoring below 1 out of 10 on both the pre and posttests. It's worth noting that these students often provided minimal responses, sometimes limited to just one sentence, or in some cases, did not write anything at all in response to the prompts. This widespread weakness in English proficiency likely exerted a notable influence on the outcomes of our study.

In light of these findings, the genre-based instruction (GBI) approach emerges as a noteworthy methodology warranting further exploration in future research. Its effectiveness, particularly highlighted by the statistically significant difference observed between GBI and the control group for prompt 3 in the posttest, suggests promising potential for enhancing students' writing skills in explanation texts. This conclusion aligns with existing literature on genre-based instruction, which emphasizes its efficacy in improving students' writing proficiency across various genres. Honig (2010) conducted a descriptive study revealing how genre-based instruction enhances students' grasp of scientific language and structures, facilitating improved writing accuracy and motivation. Similarly, Chapman's (2002) longitudinal investigation emphasized the importance of introducing genre writing in primary education, highlighting its role in preparing students for the language demands of higher grades. Carter, Ferzli, and Weibe (2004) provided evidence supporting the explicit teaching of genres, particularly in scientific contexts, through their study demonstrating enhanced learning outcomes

among students. Furthermore, De Oliveira and Lan's (2014) case study showcased the efficacy of genre-based pedagogy, informed by systemic-functional linguistics, in enhancing students' scientific writing skills. Additionally, Parkinson (2000) demonstrated the benefits of providing students with genre models, reinforcing the acquisition of literacy practices in science and engineering. Collectively, these studies advocate for the integration of genre-based pedagogy across disciplines, suggesting its potential to enhance students' writing proficiency and content understanding. While the conclusion drawn from our findings is tentative and warrants further investigation with larger sample sizes and diverse student populations, it is largely consistent with the findings of previous studies reinforcing the potential of GBI as an effective instructional approach.

Second Research Question: Integrating Translanguaging into Genre-Based Instruction

The second experimental group, receiving a genre-based instructional approach with the integration of translanguaging, exhibited statistically significant differences in posttest scores compared to the control group. This suggests that the addition of translanguaging may have amplified the effectiveness of genre-based instruction (GBT), as certain differences between GBT and the control, previously non-significant, became significant when comparing GBT+TL with the control (Posttest Average and Prompt 2). Moreover, when we look at the individual prompts, significant differences were observed for both the GBI and GBI + TL groups in prompt 3, which covered a topic instructed during the intervention. However, when examining prompt 2, which pertains to a topic not covered during the intervention, no significant difference was found for the GBI group, but there was a significant difference for the GBI + TL group. This

suggests that translanguaging may be necessary to facilitate the transfer of skills from one domain to another.

Our findings are in line with several studies that examined the effects of translanguaging in science classrooms. For instance, Palmer, Martinez, Mateus, & Henderson (2014) conducted a 2-year ethnographic study testing the effects of three translanguaging strategies on pre-kindergarten, kindergarten, and grade 1 classrooms, highlighting their positive impact on students' pedagogical experiences. Similarly, Karlsson, Larsson, and Jakobsson (2020, 2019) explored the use of translanguaging in primary school science classrooms in Sweden, revealing its benefits in enhancing student engagement, understanding of scientific concepts, and connection to prior experiences.

The effectiveness of translanguaging in this study can be attributed to the several translanguaging strategies adopted in the intervention phase. Firstly, key features of the explanation genre were translated into Arabic, including non-technical terms like logical connectives. Secondly, examples of how to use certain linguistic genre features were provided in Arabic. The teacher was given the freedom to dynamically translate ideas and examples into Arabic as needed. Thirdly, translanguaging rings were implemented during group discussions. For instance, the teacher dedicated 10 minutes to a free discussion where students could use their native language to analyze the features of an explanation paragraph. Lastly, the lesson was introduced and concluded in Arabic to provide a framework for understanding. Classroom observations revealed that students in this group were more engaged and participative compared to those in the control and first experimental groups. They were able to answer questions posed by the teacher correctly, reflecting their understanding of the topic. Moreover, during translanguaging

rings, students engaged in conversations in Arabic, fostering a lively discussion where many students participated in both English and Arabic based on preference. Students weak in English felt more comfortable participating in the discussion. Furthermore, during the deconstruction phase, where students synthesized explanation paragraphs, a larger number of students in this group were able to accurately use genre-specific features.

In conclusion, our study underscores the potential of integrating translanguaging into genre-based instruction to enhance student outcomes in science writing and to facilitate the transfer of genre skills from one domain in science to another. Our findings align with prior research highlighting the positive impact of translanguaging strategies in science classrooms. This study contributes uniquely by exploring the specific combination of translanguaging and genre-based instruction, an area with limited existing research. The adoption of various translanguaging strategies in our intervention facilitated deeper engagement and understanding among students. This study thus provides evidence for the benefits of integrating translanguaging into genre-based instruction and calls for further research to explore this promising approach in diverse educational contexts.

Limitations of the Study

The study's limitations warrant further discussion to provide a fair appreciation of its scope and implications. Firstly, as mentioned in the discussion of the first research question, the relatively small sample size of 70 students distributed among three groups raises concerns about the generalizability of the findings. With an average of 23 students per group, the statistical power may have been limited, potentially obscuring significant differences between groups. Although the lack of statistical significance may

partly be attributed to the sample size, the trend towards significance suggests that a larger sample might have yielded different outcomes, underscoring the need for caution in interpreting the results.

Another significant limitation concerns the choice of topic for the pretest, which may have influenced students' responses and subsequent performance. In the pretest, students were asked to respond to an explanation writing prompt in which they had to write a 5-10 sentence paragraph answering the question “How do plants reproduce?”. The nature of this particular phenomenon might have presented challenges in generating explanations of the quality expected. For example, the rubric incorporates features that might have been particularly difficult to generate in the context of this specific topic. One of the items in the rubric focuses on explanation sentences, and since the students responded to the prompt by focusing on the different types of reproduction in plants, t the explanation sentences they produced were limited. Another item is the accurate use of logical connectives and conjunctions. Given that the majority of the students did not treat the prompt as an explanation prompt, as just mentioned, they did not explain how a process come about, and thus did not use conjunctions expected in explanation texts. This issue made it difficult for the researcher to identify whether students could use conjunctions accurately. In addition to the scoring rubric, it is worth mentioning that this prompt was the same as the one of three used in the posttest. This might have made it difficult to demonstrate the effect of GBI. Based on the posttest analysis, students mostly treated this prompt in the posttest the same way they treated it in the pretest, which might have been the reason the difference across groups was not significant. The lack of meaningful engagement with the prompt likely contributed to the absence of statistically significant differences in posttest scores across all groups in the first prompt of the

posttest. Despite the study's quantitative nature, conducting qualitative analysis of the students' responses could provide valuable insights into the underlying reasons for their performance on prompt 1, enriching the interpretation of the quantitative findings.

Furthermore, as previously noted, the relatively short duration of the intervention – comprising only 5 teaching sessions over a span of 3 weeks – may have limited the extent to which students could develop genre-specific writing skills. Writing proficiency is a complex skill that requires time and practice to develop. The brevity of the intervention period likely impeded students' ability to fully acquire and internalize these skills within the given timeframe. These factors underscore the necessity of carefully considering the timing and duration of interventions in future research endeavors. However, implementing longer interventions in traditional instructional settings with high-stakes examinations presents practical challenges, such as curriculum constraints and time limitations. Nonetheless, it's crucial to consider that, based on the study's findings, genre-based instruction (GBI) and translanguaging (TL) emerge as two promising strategies to be implemented in science classrooms throughout the academic year. This extended duration would afford students sufficient time to engage in iterative practice and receive targeted feedback, thereby fostering more substantial enhancements in their writing proficiency. But it is important to repeat that the GBI group posttest average scores were better than that of the control group, and this difference approached significance. Moreover, when the responses to prompt 3 of the post-test were singled out for analysis, the GBI group's mean score were also significantly better than that of the control group. This suggests that even an intervention with relatively short duration, had an impact on students' proficiency in writing explanations.

In addition to the limitations mentioned above, it is important to mention that this study relies solely on quantitative analysis without incorporating any qualitative analyses. While quantitative methods offer valuable insights into the effectiveness of interventions, they may not fully capture the nuanced experiences, perspectives and abilities of participants. Mixed methods research, combining quantitative and qualitative approaches, allows for a more comprehensive understanding of the phenomenon under investigation. As mentioned earlier, for example, conducting qualitative analysis of the students' responses could provide valuable insights into the underlying reasons for their performance on prompt 1, enriching the interpretation of the quantitative findings. Qualitative data can provide context, depth, and rich descriptions that complement quantitative findings, offering a more holistic view of the impact of genre-based instruction and translanguaging on students' language skills. Incorporating qualitative analyses would enable researchers to explore students' attitudes, perceptions, and experiences, shedding light on the challenges of language learning in a multilingual context like Lebanon. Therefore, future studies may benefit from adopting a mixed methods approach to gain a deeper understanding of the complex interactions between language instruction, student learning, and contextual factors.

Finally, as mentioned in the discussion of the first research question, the overall fidelity of implementation across the entire study is a limitation. Despite efforts to adhere to the research design, various challenges were encountered throughout the study. Technical issues, such as those experienced with tablets and internet connectivity, posed obstacles to smooth implementation, leading to adjustments in session plans. Additionally, time constraints occasionally necessitated modifications, such as condensing modules, which could have impacted the depth of student engagement.

Moreover, deviations from the intended protocol, such as inadvertent use of Arabic in both the control and GBI groups by the teacher and conducting group activities as whole-class exercises, might have inadvertently altered student participation dynamics, potentially influencing the study's outcomes.

Implications of the Study

Research in science education has long emphasized the significance of developing proficiency in the language of science (Halliday & Martin, 2003), as well as identifying the challenges learners encounter (Martin & Rose, 2008; Wellington & Osborne, 2001). When it comes to language of instruction in Arab countries, Amin (2009) underscores the challenges posed by foreign language instruction in science education and highlights the necessity for localized research to assess the applicability of existing theories and recommendation in this unique context. Within the local context of Lebanon, Bahous, Bacha, & Nabhani (2011) shed the light on the instruction of these subjects in English contributing to a multilingual environment where students encounter challenges not only in comprehending scientific concepts but also in understanding the foreign language itself. Moreover, in their study Salloum & BouJaoude (2020) notice that in various school settings, both teachers and students utilized the home language primarily for communication purposes, with students generally preferring it for expressing understandings and questions, while English was predominantly used for brief factual responses despite recognition of its importance for accessing higher education and employment opportunities. Salloum & BouJaoude (2020) advocate for a comprehensive approach to science education that bridges language barriers and fosters deeper conceptual understanding, emphasizing the need for pedagogical practices that

integrate students' linguistic resources and support their diverse language needs, particularly in multilingual settings.

The two promising approaches addressed in this study are genre-based instruction and translanguaging. An extensive literature highlights the positive impact of genre-based instruction in science classrooms (Carter, Ferzli, & Weibe, 2004; De Oliveira & Lan, 2014; Honig, 2010; Parkinson, 2000). Similarly, strategic translanguaging in science classrooms has been a hot topic for researchers, with studies demonstrating its efficacy (Martinez, Mateus, & Henderson, 2014; Probyn, 2015; Karlsson, Larsson, & Jakobsson, 2020; Pierson, Clark, & Brady, 2020; Setati et al., 2002). Particularly in Lebanon, recent research has explored strategies to support English language learners in science education, revealing positive outcomes, such as improved expository writing quality and conceptual knowledge through genre-based pedagogy (Yamout, 2019).

The findings of this study contribute to existing research and practice in several significant ways. In the next two sections, we will discuss the implications of this study for research as well as practice.

Implications for Research

Firstly, the results did not yield statistically significant differences between the genre-based instructional group and the control group (except for one of the post-test prompts, as discussed above), they indicate the potential for significant findings with a larger sample size and longer intervention duration in future research. This underscores the necessity for further studies to investigate the impact of genre-based pedagogy on students' language proficiency with larger samples and with longer intervention durations.

Secondly, the study sheds light on the potential benefits of integrating translanguaging into genre-based instruction. The statistically significant differences observed in the posttest scores of the group receiving genre-based instruction with translanguaging emphasize the significance of incorporating translanguaging strategies in language instruction. As our study is one of the few to explore this combination, it underscores the necessity for future research to delve deeper into this area, conducting more comprehensive investigations into the integration of these two pedagogical approaches. Moreover, the incorporation of the four translanguaging strategies within genre-based instruction yielded statistically significant improvements in students' ability to write explanation texts in the context of science. This underscores the effectiveness of translanguaging in facilitating language development and academic achievement. However, it's important to note that this study only explored a subset of translanguaging strategies. There exists a wide array of potential strategies that could further enhance students' language skills in science writing. Therefore, future research should explore additional translanguaging techniques within the genre-based instruction framework to comprehensively assess their efficacy in addressing language barriers and promoting scientific literacy among students.

Another implication for research stemming from these results is the need to explore more systematically the transfer of genre skills from one domain to another. While the study demonstrated the effectiveness of genre-based instruction and translanguaging in enhancing students' proficiency in writing explanations in one scientific topic, further investigation is warranted to assess whether these skills transfer from one topic to another, even if it was not instructed by genre-based instruction and translanguaging. It's worth noting that based on the findings of my study, significant

differences were observed for both experimental groups in prompt 3, which covered a topic instructed during the intervention. However, when examining prompt 2, which pertains to a topic not covered during the intervention, no significant difference was found for the GBI group, but there was a significant difference for the GBI + TL group. This suggests that translanguaging may be necessary to facilitate the transfer of skills from one domain to another. Nevertheless, further research in this area is essential to gain a more nuanced understanding of the relationship between genre-based instruction, translanguaging, and skill transfer. For example, a follow-up study to this one could be conducted to specifically investigate the skill transfer from one scientific domain to another, exploring factors such as the similarity of genres, the role of translanguaging, the integration of other translanguaging strategies, the role of genre-based approach alone, and the cognitive processes involved in transferring genre knowledge across domains. Such a study could provide valuable insights into the mechanisms underlying skill transfer and inform instructional practices aimed at fostering transferable writing skills across diverse disciplinary contexts.

Furthermore, it is important to extend the investigation of genre skills transfer to other genres beyond explanation texts. Given that our study focused on enhancing students' proficiency in writing explanations, exploring the development of skills within various writing genres can provide a more comprehensive understanding of the efficacy of genre-based instruction and translanguaging. By examining how students develop genre-specific writing skills in different subject-specific genres, such as taxonomic reports, compositional, procedural recounts and others, researchers can provide a more comprehensive picture of the development of genre-specific writing skills and the conditions that support that development.

It is also crucial to investigate different ways that the modules, as a computer-based tool, that were developed and used in this study can be integrated into instruction. This includes exploring various blended learning formats that incorporate the use of modules alongside traditional classroom instruction. By examining the effectiveness of different integration approaches, such as flipped classrooms, hybrid learning models, or fully online learning experiences, researchers can identify optimal strategies for maximizing the benefits of genre-based instruction. Understanding how to seamlessly integrate modules into instructional practices can enhance student engagement, learning outcomes, and overall effectiveness of genre-based instruction and translanguaging interventions. Therefore, future research endeavors should explore diverse integration methods to provide educators with practical insights into leveraging technology-enhanced tools to support language instruction and literacy development effectively.

Lastly, exploring teachers' pedagogical content knowledge in this domain is an important implication of this study. Understanding how teachers perceive and implement genre-based instruction and translanguaging strategies can provide valuable insights into the factors that influence instructional practices and student outcomes. Research in this area could explore teachers' beliefs, attitudes, and experiences related to teaching genre-specific language skills and integrating translanguaging into their instructional approaches. By examining teachers' pedagogical content knowledge, researchers can identify areas of strength and areas for improvement in teacher preparation and professional development programs. This deeper understanding can inform the design of more effective teacher training initiatives aimed at enhancing educators' competencies in implementing genre-based instruction and translanguaging strategies. Ultimately, investigating teachers' pedagogical content knowledge can

contribute to improving the quality of language instruction and literacy development in diverse educational contexts.

Implications for Practice

From a practical perspective, the findings of this study offer valuable insights for educators and practitioners involved in language instruction, especially as this applies to the subject of science in particular. Firstly, it highlights the importance of providing explicit instruction in genre-based writing skills to enhance students' proficiency in writing explanation texts. By systematically teaching students the conventions and structures of scientific explanations, educators can better equip them with the necessary tools to communicate their understanding effectively. This approach not only fosters language development but also enhances students' ability to convey complex scientific concepts and explanations in a clear and organized manner.

Secondly, the significant differences observed in the posttest scores of the group receiving genre-based instruction with translanguaging underscore the potential advantages of incorporating students' native languages into language instruction. Strategic translanguaging strategies can create inclusive learning environments that cater to linguistic diversity and promote language development among all students. By allowing students to leverage their linguistic resources, educators can facilitate deeper comprehension and engagement with academic content, ultimately fostering more robust language skills across multiple domains.

Additionally, positive findings from this study hold significant implications for teacher training in Lebanon. There is a clear need for educators to be equipped with the skills to effectively implement genre-based instruction and strategic translanguaging in their classrooms. Providing professional development opportunities that focus on these

pedagogical approaches can empower teachers to create dynamic and culturally responsive learning environments that support the diverse needs of their students.

Furthermore, the Tabshoura modules used in the implementation phase of the study offer a promising resource for educators across Lebanon. This free platform could play a crucial role in developing students' genre skills by providing access to tailored modules designed to enhance their writing proficiency. By incorporating these modules into classroom instruction, teachers can offer targeted support to students, ultimately facilitating their ability to craft effective explanation texts. However, training teachers on how to make use of the module and the platform in the classroom is also important. Providing professional development opportunities that focus on integrating Tabshoura modules into instruction can empower educators to effectively leverage this digital resource to support students' language development.

Overall, the findings of this study underscore the importance of incorporating genre-based instruction and translanguaging strategies into language education practices, while also highlighting the potential of digital platforms like Tabshoura to support educators in this endeavor.

Conclusion

The findings of this study bear significant implications for language instruction, particularly in the realm of science education in Lebanon. The study specifically investigated the impact of integrating genre-based instruction and translanguaging strategies. While acknowledging some limitations, it's important to note that the two main hypotheses of the study were supported: firstly, that genre-based instruction improves students' writing skills, and secondly, that the integration of translanguaging enhances these skills further. Additionally, the study revealed that translanguaging

facilitates the transfer of genre skills from one scientific domain to another. These findings pave the way for promising directions in future research endeavors. The significance of this study lies in its unique exploration of the symbiotic relationship between genre-based instruction and translanguaging, shedding light on how these approaches can effectively complement each other. From a practical standpoint, the study underscores the critical importance of explicitly teaching genre-based writing skills and integrating students' native language into language instruction to cultivate conducive learning environments. Furthermore, the findings underscore the urgent need for comprehensive teacher training programs to equip educators with the requisite skills for implementing genre-based instruction and strategic translanguaging effectively.

APPENDIX A

PRETEST

In 5-10 sentences, answer the following question.

"How do plants reproduce?"

APPENDIX B

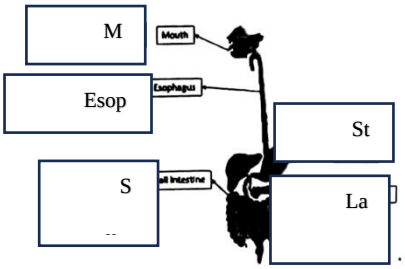
POSTTEST

Prompt I: In 5-10 sentences, answer the following question.

"How do plants reproduce?"

Prompt II: In 5-10 sentences, answer the following question.

"The Digestive System: How does our body extract nutrients from the food we eat to provide energy and support growth?"



Prompt III: In 5-10 sentences, answer the following question.

“How does our body allow us to move when we decide to?”

APPENDIX C

LESSON PLANS (EXPERIMENTAL GROUP1)

Lesson Plan 1

Explanation of the Effects of Smoking

Link to module: Smoking

- **Subject:** Science
- **Driving Question:**
  - How to construct a scientific explanation text.
  - What are the effects of smoking on the human body?
  - What are the effects of drugs on the human body?
  - What are the effects of unhealthy eating on the human body?
- **Grade Level:** 6
- **Duration:** 100 minutes

- **Before You Start**
  - Materials: projector/ tablets/ whiteboard

- **Objectives**
  - Identify the effects of smoking, drugs, and unhealthy eating on the human body
  - Identify the scientific explanation genre
  - Identify the structure of an explanation text
  - Identify the linguistic features of an explanation
  - Construct scientific explanation texts

Keywords: Genre, Scientific explanation, Smoking, Drugs, Unhealthy Eating

- **Before-Class Activities**
  - Students research the topic “The Effect of Smoking on Health”

- **In-Class Activities**

Session 1

- **Warming Up (5 mins)**
  - The teacher asks students about the results of their research in the before-class activities and encourages students to share any questions they have with their classmates.
  - The teacher introduces the students to Tabshoura platform and asks them to log into their accounts (created for them ahead of time)
  - The teacher gives a brief introduction about the session telling the students what the session will be about. (An explanation is an important type of text that is commonly used in science. Scientists write explanation texts to explain how and why something in the world happens. Explanations are mainly about processes and how they occur. In this session, smoking is used as context to help you construct an explanation text.)

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Completing the Module

Deconstruction*: (In this phase, students are introduced to an example of a text that is written in the explanation genre. The teacher is asked to use only English in the classroom. If asked for emanings of words, she explains it English.)*

- Activity 1: (In the first couple of slides, there is an explanation text about smoking followed by questions about it. Each pair of students will be provided with one tablet.)

- The teacher projects the module on the white board and divides the students into pairs and asks them to solve the questions together on their tablets.
    - Activity 2: (In this activity, there are a couple of activities for the students to answer. Each activity draws the students' attention to a particular feature of the explanation genre.)
- In the same groups, the teacher asks the students to solve the questions together on the tablets.
- After each exercise, the teacher provides feedback and highlights to the whole class the genre feature addressed.

Joint Construction: *(In the second section of the module, the students put together their acquired knowledge about explanation genre to synthesize a full explanation paragraph with the help of the teacher.)*

- In the 2nd section of the module, each pair is asked to answer the question on this section in a full paragraph as the teacher roams around to provide help when needed.

- **Wrapping up:**

The teacher wraps up the session in English.

Today we learned about the negative effects that smoking has on our bodies. We learned what explanation texts in science are. (Teacher elicits the answers from the students). We also highlighted some important language

features used in explanations (Teacher elicits the answers from the students). Hold on to these features, you will be using them tomorrow to write your own explanations.

Session 2

- **Warm up:** The teacher starts the session by reminding the students of what they did the day before. (Can you remind me and your friends about what we did yesterday? We tackled the negative effects of smoking on the human body. We also defined explanations in science. We highlighted some of the language features that we can find in explanations. Can you remind me what these features are? Today, we will start by analyzing a text about the effects of drugs on the human body. Then, you will be using the language features we discussed in the previous session to write your own explanation paragraphs.)

- ***Discussion Rings***
    - In this section, the teacher divides the students into groups of four. She projects on the white board Activity 1 (Writing Your Own Explanation) which has a paragraph about the effects of drugs on the human body. She also projects a number of questions that trigger the students' thoughts in the discussion. (1. Why do people use drugs? 2. What makes drugs dangerous? 3. Is this paragraph an explanation? Why? 4. Can you highlight some examples of the language features of explanations in the paragraph?)

The teacher tells the students that they have 10 minutes to answer these questions and that they should use only English in their discussions together.

- After the discussion rings, the teacher collects the answers of the students in groups and highlights the language features present in the paragraph (timeless present tense, the linking word and phrases used, and the purpose of the paragraph. She will also highlight the importance of starting an explanation with an introductory statement to introduce the topic.)

- ***Independent Construction: (****This section is where scaffolding fades away so that the student can synthesize an explanation paragraph without the help of the teacher.)*
    - In activity 2 (Writing Your Own Explanation), each student is asked to answer the questions in a full paragraph individually, without the help of the teacher or any of his classmates.
    - The teacher writes a sample paragraph with the students as she highlights the genre-features of explanations as she writes in on the whiteboard (sample answer is already found on Tabshoura and can be projected on the whiteboard). The teacher asks the students to go back to the paragraphs they wrote and identify areas that could be improved in their own paragraphs and share their thoughts with their classmates.)
- ***Wrap Up***

The teacher concludes the session by a recap of what the main objectives of the sessions, what they did throughout the past two sessions, and whether they have benefited from the activities or not.

(In this section, the teacher is asked to use only English to conclude and summarize the lesson.)

(In this session we analyzed a paragraph about the effects of drugs on the human body. You also wrote your own explanation paragraphs. Is there anything you would like to share with your classmates?)

Lesson Plan 2

THE NERVOUS SYSTEM

Link to module: Functions of the Nervous System

- **Subject:** Science
- **Grade Level:** 6
- **Driving Questions:**
  - How do we know what we are smelling, hearing, tasting, seeing, and touching?
  - What happens inside our body that enables us to move when we want to?
  - What is reflex and what happens inside our body that makes us react without thinking?
- **Duration:** 100 minutes

- **Before You Start**
  - Materials: projector/ tablet/ whiteboard

- **Objectives**
  - Explain some aspects of the nervous system functioning
  - Use new linking words and phrases used in explanations effectively
  - Write an explanation paragraph about how our body reacts when we touch a flame
  - Translate an explanation diagram to a paragraph

Keywords: Nervous System, function, body movement, reflex

- **Before-Class Activities**

- Think about the driving question 1 of the session: How do we know what we are smelling, hearing, tasting, seeing, and touching?

- **In-Class Activities**

<u>Session 1</u>

- **Warm Up (5 mins) (***In this section, the teacher introduces the objectives of the lesson.)*
    - The teacher poses the first two driving question of the lesson in class and listens to the students' answers.
    - The teacher asks students to log into their accounts on Tabshoura.
    - The teacher gives a brief introduction about the session telling the students what the session will be about. (*Today, we're going to explore some amazing questions about our senses and movements. We'll discover how our brain helps us know what we're smelling, hearing, tasting, seeing, and touching. We'll also dive into the question of what happens inside our bodies when we decide to move. Ever wondered about reflexes? We'll learn what they are and how our bodies react without us even thinking about it. While we do that, we will be introduced to some linking words and language features used in explanation paragraphs. Do you remember any of the features that we discussed in the session about smoking? We are working on a different explanation topic today. Get ready for an exciting journey into understanding how our bodies work!)*

Completing the Module

(In this phase, students are introduced to an example of a text that is written in the explanation genre.)

- **Activity 1 (5 mins):** (In the first activity, students engage in a drag and drop activity in which they categorize the five senses)

  The teacher projects the module on the white board and divides the students into pairs (each pair with a tablet) and asks them to solve questions about the drag and drop activity together on their tablets.

- **Activity 2 (10 mins):** (In this activity, students look at a diagram in which they read about the five senses and what how are we able to know what we are smelling, hearing, tasting, touching, or seeing. Above the diagram, an explanation text is modeled for the students which represents the deconstruction phase.)

  In the same pairs, students are asked to solve questions about the diagram together on their tablets.

  Activity 3: (10 mins) (This is the scaffolding phase where implicit genre-specific instructions are integrated to help students become better writers of explanations.)

  In the same pairs, the teacher asks the students to solve the "Looking at the Details" section on their tablets. This section focuses mainly on the language of an explanation in science, specifically in the paragraphs related to the five senses presented in the diagram.

  After each activity, the teacher provides feedback on the whiteboard and highlights genre feature addressed.

- **Activity 4: Question 1 (10 mins)**

  (This section focuses on the second driving question of the session.)

  In the same groups, the teacher asks the students to solve the "From Stimulus to Response" section on their tablets. This section helps student understand what happens inside our body when we want to move. The activities also help students read an explanation diagram better.

  Students are asked to only solve the question one which focuses on Rita. The Teacher then corrects the exercise on the whiteboard.

- **Wrap Up (5 mins)**

  The teacher wraps up the session.

  Today we learned about hearing, smelling, eating, touching, and seeing. Can you tell me what exactly did we learn? (teacher elicits answers from the students) So we learned how we are able to know what we are hearing, smelling, eating, touching, and seeing. We also learned about some new linking words that we can use in explanations.

<u>Session 2</u>

- **Warm Up: (***In this section, the teacher introduces the objectives of the lesson.)*

  Can you remind where we left off in the previous session? (teacher elicits answers from the students) So we went learned about the five senses. What was the last exercise about? (How are we able to move when we want to?) So today, we will continue working on this exercise. Then, we will go over more language features related to explanations by analyzing a paragraph together. Finally, you will write your own paragraph about reflexes.

- **Activity 4: (10 minutes)**

  Students, in the same pairs as the previous session, continue working on questions 2 and 3 of activity 4. The last question in the activity is *joint construction* in which the students put together their acquired knowledge about explanation genre to synthesize a full explanation paragraph with the help of the teacher. Each pair is asked to answer the question in a full paragraph as the teacher roams around to provide help when needed.

- After the activity, the teacher writes down a sample of an explanation paragraph on the board and asks students to improve their own paragraphs afterwards. The teacher highlights the genre-features discussed in the module and how she is effectively using them in writing an explanation.

- The sample paragraph is: A reflex is a rapid and automatic response that our body carries out without us consciously thinking about it. When we accidentally touch something hot, such as a flame, tiny sensors on our skin send a speedy message to our spinal cord, which acts like a quick messenger. The spinal cord then tells our muscles to move away from the heat in a swift and protective manner. This entire process happens so fast that it helps us avoid harm without needing our brain to give the command. It's like a built-in safety mechanism that kicks in automatically!

- **Discussion Rings (10 mns)**

In this section, the teacher divides the students into groups of four. She projects on the white board Activity 5 (Discussion Rings) which has a paragraph about the involuntary action of breathing. She also projects a number of questions that trigger the students' thoughts in the discussion. (1. What happens when we breathe? 2. Why is breathing an involuntary action? 3. Is this paragraph an explanation? Why? 4. Can you highlight some examples of the language features of explanations in the paragraph?)

The teacher tells the students that they have 10 minutes to answer these questions.

After the discussion rings, the teacher answers of the students in groups and highlights the language features present in the paragraph (timeless present tense, the linking word and phrases used, and the purpose of the paragraph. She will also highlight the importance of starting an explanation with an introductory statement to introduce the topic.)

- **Activity 4: (15 minutes)** (The teacher is asked to help students answer the first 7 questions. When they get to question 8, the teacher is asked to leave students write their paragraphs individually without any guidance.)

  Students go back to working in pairs. They are asked to answer the first 7 questions that help them understand what a reflex is and how we automatically react without thinking to stay safe.

  In the last question (question 8) of activity 5, (fading is illustrated in this section where students are asked to write their own explanation)

students are asked to individually translate the diagram into an explanation paragraph.

Again, after this activity, the teacher writes down a sample of an explanation paragraph and asks students to improve their own paragraphs afterwards. The teacher highlights the genre-features discussed in the module and how she is effectively using them in writing an explanation.

Wrap Up

The teacher concludes the session by a recap of what the main objectives of the sessions, what they did throughout the past two sessions, and whether they have benefited from the activities or not.

- **After-Class Activities**
  - The teacher asks the student to continue solving activity 6 (Wrapping Up) at home.

Lesson Plan 3

THE URINARY SYSTEM

Link to module: Functions of the Unirary System

- **Subject:** Science
- **Driving Questions:** Why do we pee? How does our body get rid of the waste?

  How does the dialyzer or the artificial kidney works?

- **Grade Level:** 6
- **Duration:** 100 minutes

- **Before You Start**
  - Materials: projector/ tablets/ whiteboard

- **Objectives**
  - Explain the function of the urinary system and identify the dangers of its failure to work properly
  - Explain how the dialyzer or artificial kidney works to replace the kidneys
  - Identify the role of each sentence in an explanation paragraph
  - Use new linking words effectively
  - Translate an explanation diagram into a paragraph

Keywords: Urinary System, function, kidney, dialyzer

- **Before-Class Activities**
  - Think about the first driving question of the session.

In-Class Activities

Session 1

- **Warm Up (5 mins) (***In this section, the teacher is asked introduces the objectives of the lesson.)*
- The teacher poses the first driving question of the lesson in class and listens to the students' answers.
- The teacher asks students to log into their accounts on Tabshoura.
- The teacher gives a brief introduction about the session telling the students what the session will be about. (Today, we're going to learn about the urinary system, which is like our body's cleanup crew for waste. We'll discover how it works and what can happen if our kidneys, the special filters in our bodies, aren't doing their job properly. It's like a little adventure into understanding how we keep our bodies clean from the inside! Plus, we'll learn about the structure of explanation paragraphs in science. Let's explore it together!)

Completing the Module

(In this phase, students are introduced to an example of a text that is written in the explanation genre.)

- **Activity 1 (15 mins):** (In the first activity, students look at a table in which they compare the compositions of blood leaving the kidneys and urine in a healthy person. Above the table, an explanation text is modeled for the students which represents the deconstruction phase)

  The teacher projects the module on the white board and divides the students into pairs and asks them to solve the questions about the table together on their tablets.

- **Activity 2 (15 mins):** (This is the scaffolding phase where implicit genre-specific instructions are integrated to help students become better writers of explanations.)

  In the same pairs, the teacher asks the students to solve the "Looking at the Details" section on their computers. This section focuses mainly on the structure of an explanation in science.

  After each activity, the teacher provides feedback and explains to the whole class the genre feature addressed.

- **Wrap up (5 mins):**

  The teacher wraps up the session.

  Today, we learned about the wonderful job our kidney does. Who can tell me about it? How does our body get rid of the waste and harmful substances? What happens if our kidneys fail to work properly?

Session 2

- **Warm up (5 mins):** *In this section, the teacher introduces the objectives of the lesson.)*

  Can you remind us about what we did yesterday? Today, we are going to talk about the dialyzer and the artificial kidney that help people with kidney diseases. We will learn how the dialyzer and artificial kidney work. You will also write your own explanation paragraph.

- **Discussion Rings (10 mins)**

  Activity 3: the teacher divides the students into groups of four. She projects on the white board (Discussion Rings) which has a paragraph about the causes of kidney diseases. She also projects a number of questions that

trigger the students' thoughts in the discussion. (1. What are the causes of kidney diseases? 2. How can people with kidney diseases take care of themselves? 3. Is this paragraph an explanation? Why? 4. Can you highlight some examples of the language features of explanations in the paragraph?)

- The teacher tells the students that they have 10 minutes to answer these questions together.
- After the discussion rings, the teacher collects the answers of the students in groups and highlights the language features present in the paragraph (timeless present tense, the role of each sentence in the paragraph, the linking word and phrases used, and the purpose of the paragraph.)
- **Activity 4: (10 minutes)** (This section focuses on the second driving question of the session.)

  Back in pairs, the teacher asks the students to solve the question set under the dialyzer diagram section on their tablets. This section helps student understand how the dialyzer or an artificial kidney works.

  After each activity, the teacher provides feedback to the students.

- **Activity 5: (10 mins)** (Fading: In this section, students are asked to write their own explanation.

  Individually, students are asked to translate a diagram into an explanation paragraph.

  After this activity, the teacher writes down a sample of an explanation paragraph on the board and asks students to improve their own paragraphs afterwards. The teacher highlights the genre-features

discussed in the module and how she is effectively using them in writing an explanation.

- ***Wrap Up (5 mins)***

The teacher concludes the session by a recap of what the main objectives of the sessions, what they did throughout the past two sessions, and whether they have benefited from the activities or not.

APPENDIX D

LESSON PLANS (EXPERIMENTAL GROUP 2)

Lesson Plan 1

Explanation of the Effects of Smoking

Link to module: Smoking

- **Subject:** Science
- **Driving Question:**
  - How to construct a scientific explanation text.
  - What are the effects of smoking on the human body?
  - What are the effects of drugs on the human body?
  - What are the effects of unhealthy eating on the human body?
- **Grade Level:** 6
- **Duration:** 100 minutes

- **Before You Start**
  - Materials: projector/ tablets/ whiteboard

- **Objectives**
  - Identify the effects of smoking, drugs, and unhealthy eating on the human body
  - Identify the scientific explanation genre
  - Identify the structure of an explanation text
  - Identify the linguistic features of an explanation

- Construct scientific explanation texts

Keywords: Genre, Scientific explanation, Smoking, Drugs, Unhealthy Eating

- **Before-Class Activities**
  - Students research the topic “The Effect of Smoking on Health”
- **In-Class Activities**

Session 1

- **Warming Up**
  - The teacher asks students about the results of their research in the before-class activities and encourages students to share any questions they have with their classmates.
  - The teacher introduces the students to Tabshoura platform and asks them to log into their accounts (created for them ahead of time)
  - The teacher gives a brief introduction about the session telling the students what the session will be about. (An explanation is an important type of text that is commonly used in science. Scientists write explanation texts to explain how and why something in the world happens. Explanations are mainly about processes and how they occur. In this session, smoking is used as context to help you construct an explanation text.)

In this section, the teacher is asked to use Arabic (Lebanese Dialect) to introduce the objectives of the lesson.

تفسير هو نوع مهم من النص الذي يشيع استخدامه في العلوم. يكتب العلماء نصوصًا توضيحية لشرح كيف ولماذا يحدث شيء ما في العالم. التفسيرات تتعلق بشكل أساسي بالأفعال وليس بالأشياء. في هذه الوحدة، يتم استخدام التدخين كسياق لمساعدتك في بناء نص توضيحي

- **Completing the Module**

***Deconstruction**: (In this phase, students are introduced to an example of a text that is written in the explanation genre. The teacher is asked to translate key features of the explanation genre, like nontechnical terms, to Arabic and to allow the students to provide examples in Arabic if they do so. The teacher also allows herself to dynamically translate ideas and examples to Arabic if needed. Words like sequence, cause, effect, linking phrases and conjunctions, habits, general truths, opinions, regular arrangements, and explanation are translated by the teacher in class. A word bank is found at the end of the lesson plan to assist the teacher in translation of certain words in the module as well as to be provided for the students as a reference.)*

  - Activity 1: (In the first couple of slides, there is an explanation text about smoking followed by questions about it. Each pair of students will be provided with one tablet.)
- The teacher projects the module on the white board and divides the students into pairs and asks them to solve the questions together on their tablets.
  - Activity 2: (In this activity, there are a couple of activities for the students to answer. Each activity draws the students' attention to a particular feature of the explanation genre.)

- In the same groups, the teacher asks the students to solve the questions together on the tablets.
- After each exercise, the teacher provides feedback and highlights to the whole class the genre feature addressed.

Joint Construction: *(In the second section of the module, the students put together their acquired knowledge about explanation genre to synthesize a full explanation paragraph with the help of the teacher. The teacher tells the students that they are allowed to use Arabic in their discussion together. The teacher is asked to translate the words found in the word-bank to Arabic.)*

- In the 2nd section of the module, each pair is asked to answer the question on this section in a full paragraph as the teacher roams around to provide help when needed.

- **Wrapping up:**

The teacher wraps up the session is Arabic (Lebanese dialect).

Today we learned about the negative effects that smoking has on our bodies. We learned what explanation texts in science are. (Teacher elicits the answers from the students). We also highlighted some important language features used in explanations (Teacher elicits the answers from the students). Hold on to these features, you will be using them tomorrow to write your own explanations.

Session 2

- **Warm up:** The teacher uses the Lebanese dialect to start the session by reminding the students of what they did the day before (Can you remind me and your friends about what we did yesterday? We tackled the negative

effects of smoking on the human body. We also defined explanations in science. We highlighted some of the language features that we can find in explanations. Can you remind me what these features are? Today, we will start by analyzing a text about the effects of drugs on the human body. Then, you will be using the language features we discussed in the previous session to write your own explanation paragraphs.)

- ***Translanguaging Rings***
    - In this section, the teacher divides the students into groups of four. She projects on the white board Activity 1 (Writing Your Own Explanation) which has a paragraph about the effects of drugs on the human body. She also projects a number of questions that trigger the students' thoughts in the discussion. (1. Why do people use drugs? 2. What makes drugs dangerous? 3. Is this paragraph an explanation? Why? 4. Can you highlight some examples of the language features of explanations in the paragraph?)

      The teacher tells the students that they have 10 minutes to answer these questions and that it is okay to use Arabic in their discussions together.
    - After the discussion rings, the teacher uses Arabic to collect the answers of the students in groups and highlights the language features present in the paragraph (timeless present tense, the linking word and phrases used with their translations to Arabic, and the purpose of the

paragraph. She will also highlight the importance of starting an explanation with an introductory statement to introduce the topic.)

- ***Independent Construction: (****This section is where scaffolding fades away so that the student can synthesize an explanation paragraph without the help of the teacher.)*
    - In activity 2 (Writing Your Own Explanation), each student is asked to answer the questions in a full paragraph individually, without the help of the teacher or any of his classmates.
    - The teacher writes a sample paragraph with the students as she highlights the genre-features of explanations as she writes in on the whiteboard (sample answer is already found on Tabshoura and can be projected on the whiteboard). The teacher asks the students to go back to the paragraphs they wrote and identify areas that could be improved in their own paragraphs and share their thoughts with their classmates.)
- ***Wrap Up***

The teacher concludes the session by a recap of what the main objectives of the sessions, what they did throughout the past two sessions, and whether they have benefited from the activities or not.

(In this section, the teacher is asked to use Arabic to conclude and summarize the lesson.)

شو عملنا اليوم؟ (In this session we analyzed a paragraph about the effects of drugs on the human body. You also wrote your own explanation paragraphs. Is there anything you would like to share with your classmates?)

Word-Bank

Explanation		When	
Harmful		After	
Inhaling		Link	
Narrow		Events of a Process	
Irritation		Causes, Results in, Leads to	
Damage		However	
Create a coat		Opinions	
General Truth		Regular agreement	
Consistently		General Truth	
Addiction		Therefore	
Dental Distress		Stroke	
Bloating and Puffiness		High Blood Pressure	

Lesson Plan 2

THE NERVOUS SYSTEM

Link to module: Functions of the Nervous System

- **Subject:** Science
- **Driving Questions:**
  - How do we know what we are smelling, hearing, tasting, seeing, and touching?
  - What happens inside our body that enables us to move when we want to?
  - What is reflex and what happens inside our body that makes us react without thinking?
- **Grade Level:** 6
- **Duration:** 100 minutes

- **Before You Start**
  - Materials: projector/ tablet/ whiteboard

- **Objectives**
  - Explain some aspects of the nervous system functioning
  - Use new linking words and phrases used in explanations effectively
  - Write an explanation paragraph about how our body reacts when we touch a flame
  - Translate an explanation diagram to a paragraph

Keywords: Nervous System, function, body movement, reflex

- **Before-Class Activities**
  - Think about the driving question 1 of the session: How do we know what we are smelling, hearing, tasting, seeing, and touching?

- **In-Class Activities**

Session 1

- **Warm Up (5 mins) (***In this section, the teacher is asked to use Lebanese Dialect to introduce the objectives of the lesson.)*
    - The teacher poses the first two driving question of the lesson in class and listens to the students' answers.
    - The teacher asks students to log into their accounts on Tabshoura.
    - The teacher gives a brief introduction about the session telling the students what the session will be about. (*Today, we're going to explore some amazing questions about our senses and movements. We'll discover how our brain helps us know what we're smelling, hearing, tasting, seeing, and touching. We'll also dive into the question of what happens inside our bodies when we decide to move. Ever wondered about reflexes? We'll learn what they are and how our bodies react without us even thinking about it. While we do that, we will be introduced to some linking words and language features used in explanation paragraphs. Do you remember any of the features that we discussed in the session about smoking? We are working on a different explanation topic today. Get ready for an exciting journey into understanding how our bodies work!)*

اليوم، سنستكشف بعض الأسئلة المذهلة حول حواسنا وحركاتنا. سنكتشف كيف يساعدنا دماغنا في معرفة ما نشمه، ونسمعه، ونذوقه، ونرى، ونلمسه. سوف نتعمق أيضًا في مسألة ما يحدث داخل أجسادنا عندما نقرر التحرك. هل تساءلت يومًا عن ردود الفعل؟ سنتعرف على ماهيتها وكيف تتفاعل أجسامنا دون أن نفكر فيها. وأثناء قيامنا بذلك، سنتعرف على بعض الكلمات المرتبطة وميزات اللغة المستخدمة

في فقرات الشرح. هل تتذكر أيًا من الميزات التي ناقشناها في الجلسة حول التدخين؟ نحن نعمل على موضوع شرح مختلف اليوم. استعد لرحلة مثيرة لفهم كيفية عمل أجسامنا!

Completing the Module

(In this phase, students are introduced to an example of a text that is written in the explanation genre. There are certain words in the text that the teacher is asked to translate to Arabic (these words are found in the word-bank at the bottom of the lesson plan). She is also asked to allow herself to dynamically translate ideas and examples to Arabic. The word-bank should be provided for the students as a reference.)

- **Activity 1 (5 mins):** (In the first activity, students engage in a drag and drop activity in which they categorize the five senses)

  The teacher projects the module on the white board and divides the students into pairs (each pair with a tablet) and asks them to solve questions about the drag and drop activity together on their tablets.

- **Activity 2 (10 mins):** (In this activity, students look at a diagram in which they read about the five senses and what how are we able to know what we are smelling, hearing, tasting, touching, or seeing. Above the diagram, an explanation text is modeled for the students which represents the deconstruction phase. The teacher translates all the words found in the word-bank and the texts to Arabic.)

  In the same pairs, students are asked to solve questions about the diagram together on their tablets (teacher informs the students that they can use Arabic in their discussion together.

  Activity 3: (10 mins) (This is the scaffolding phase where implicit genre-specific instructions are integrated to help students become better

writers of explanations.) (The teacher is asked to translate the linking words to Arabic again.)

In the same pairs, the teacher asks the students to solve the "Looking at the Details" section on their tablets. This section focuses mainly on the language of an explanation in science, specifically in the paragraphs related to the five senses presented in the diagram.

After each activity, the teacher provides feedback on the whiteboard and highlights genre feature addressed.

- **Activity 4: Question 1 (10 mins)**

  (This section focuses on the second driving question of the session. Teacher is asked to translate the keywords before the students start solving.)

  In the same groups, the teacher asks the students to solve the "From Stimulus to Response" section on their tablets. This section helps student understand what happens inside our body when we want to move. The activities also help students read an explanation diagram better.

  Students are asked to only solve the question one which focuses on Rita. The Teacher then corrects the exercise on the whiteboard.

- **Wrap Up (5 mins)**

  The teacher wraps up the session in Arabic. **شو عملنا اليوم؟**

  Today we learned about hearing, smelling, eating, touching, and seeing. Can you tell me what exactly did we learn? (teacher elicits answers from the students) So we learned how we are able to know what we are hearing,

smelling, eating, touching, and seeing. We also learned about some new linking words that we can use in explanations.

Session 2

- **Warm Up: (***In this section, the teacher is asked to use Lebanese Dialect to introduce the objectives of the lesson.)*

  Can you remind where we left off in the previous session? (teacher elicits answers from the students) So we went learned about the five senses. What was the last exercise about? (How are we able to move when we want to?) So today, we will continue working on this exercise. Then, we will go over more language features related to explanations by analyzing a paragraph together. Finally, you will write your own paragraph about reflexes.

- **Activity 4: (10 minutes)** (Teacher reminds the students about the exercise and translations that they went over the previous session. She also reminds the students that they can use Arabic freely in their discussions.)

  Students, in the same pairs as the previous session, continue working on questions 2 and 3 of activity 4. The last question in the activity is *joint construction* in which the students put together their acquired knowledge about explanation genre to synthesize a full explanation paragraph with the help of the teacher. are also allowed to use Arabic in their discussion together. Each pair is asked to answer the question in a full paragraph as the teacher roams around to provide help when needed.

  - After the activity, the teacher writes down a sample of an explanation paragraph on the board and asks students to improve their own

paragraphs afterwards. The teacher highlights the genre-features discussed in the module and how she is effectively using them in writing an explanation. She uses Arabic during her explanation to translate the words in the word-bank.

- The sample paragraph is: A reflex is a rapid and automatic response that our body carries out without us consciously thinking about it. When we accidentally touch something hot, such as a flame, tiny sensors on our skin send a speedy message to our spinal cord, which acts like a quick messenger. The spinal cord then tells our muscles to move away from the heat in a swift and protective manner. This entire process happens so fast that it helps us avoid harm without needing our brain to give the command. It's like a built-in safety mechanism that kicks in automatically!

- **Translanguaging Rings (10 mns)**

In this section, the teacher divides the students into groups of four. She projects on the white board Activity 5 (Discussion Rings) which has a paragraph about the involuntary action of breathing. She also projects a number of questions that trigger the students' thoughts in the discussion. (1. What happens when we breathe? 2. Why is breathing an involuntary action? 3. Is this paragraph an explanation? Why? 4. Can you highlight some examples of the language features of explanations in the paragraph?)

The teacher tells the students that they have 10 minutes to answer these questions and that it is okay to use Arabic in their discussions together.

- After the discussion rings, the teacher uses Arabic to collect the answers of the students in groups and highlights the language features present in the paragraph (timeless present tense, the linking word and phrases used with their translations to Arabic, and the purpose of the paragraph. She will also highlight the importance of starting an explanation with an introductory statement to introduce the topic.)

- **Activity 4: (15 minutes)** (The teacher is asked to translate the words found in this activity and in the word-bank to Arabic. She is asked to help students answer the first 7 questions and use Arabic to answer their questions if necessary. When they get to question 8, the teacher is asked to leave students write their paragraphs individually without any guidance. She is only asked to translate the question to Arabic (**بهيدا السؤال مطلوب تجربو إترجمو الرسم البياني لفقرة تفسير)**

Students go back to working in pairs. They are asked to answer the first 7 questions that help them understand what a reflex is and how we automatically react without thinking to stay safe.

In the last question (question 8) of activity 5, (fading is illustrated in this section where students are asked to write their own explanation) students are asked to individually translate the diagram into an explanation paragraph.

Again, after this activity, the teacher writes down a sample of an explanation paragraph and asks students to improve their own paragraphs afterwards. The teacher highlights the genre-features discussed in the module and how she is effectively using them in writing an explanation.

Wrap Up

The teacher concludes the session by a recap of what the main objectives of the sessions, what they did throughout the past two sessions, and whether they have benefited from the activities or not.

(In this section, the teacher is asked to use Arabic to conclude and summarize the lesson.)

شو عملنا اليوم؟

- **After-Class Activities**
  - The teacher asks the student to continue solving activity 6 (Wrapping Up) at home.

Word-Bank

Communication center		Consequently	
Signals		Since	
Reaction		As a result	
Receptor		Events of a Process	
Processing		Causes, Results in, Leads to	
Transformed		However	

Transmits		Connecting words	
Involuntary		Afterwards	
Voluntary			

Lesson Plan 3

THE URINARY SYSTEM

Link to module: Functions of the Urinary System

- **Subject:** Science
- **Driving Questions:** Why do we pee? How does our body get rid of the waste?

  How does the dialyzer or the artificial kidney works?
- **Grade Level:** 6
- **Duration:** 100 minutes

- **Before You Start**
  - Materials: projector/ tablets/ whiteboard

- **Objectives**
  - Explain the function of the urinary system and identify the dangers of its failure to work properly
  - Explain how the dialyzer or artificial kidney works to replace the kidneys
  - Identify the role of each sentence in an explanation paragraph
  - Use new linking words effectively
  - Translate an explanation diagram into a paragraph

Keywords: Urinary System, function, kidney, dialyzer

- **Before-Class Activities**
  - Think about the first driving question of the session.

In-Class Activities

Session 1

- **Warm Up (5 mins) (***In this section, the teacher is asked to use Lebanese Dialect to introduce the objectives of the lesson.)*

- The teacher poses the first driving question of the lesson in class and listens to the students' answers.
- The teacher asks students to log into their accounts on Tabshoura.
- The teacher gives a brief introduction about the session telling the students what the session will be about. (Today, we're going to learn about the urinary system, which is like our body's cleanup crew for waste. We'll discover how it works and what can happen if our kidneys, the special filters in our bodies, aren't doing their job properly. It's like a little adventure into understanding how we keep our bodies clean from the inside! Plus, we'll learn about the structure of explanation paragraphs in science. Let's explore it together!)

اليوم، سوف نتعرف على الجهاز البولي، الذي يشبه طاقم تنظيف الجسم من الفضلات. سوف نكتشف كيف يعمل وماذا يمكن أن يحدث إذا كانت كليتنا، المرشحات الخاصة في أجسامنا، لا تقوم بعملها) وظيفتهم بشكل صحيح. إنها بمثابة مغامرة صغيرة لفهم كيفية الحفاظ على نظافة أجسامنا من الداخل! بالإضافة إلى ذلك، سنتعرف على بنية فقرات الشرح في العلوم. دعونا نستكشفها معًا!)

- **Completing the Module**

(In this phase, students are introduced to an example of a text that is written in the explanation genre. The teacher is asked to translate key features of the explanation genre, like nontechnical terms, to Arabic and to allow the students to provide examples in Arabic if they do so. The teacher also allows herself to dynamically translate ideas and examples to Arabic if needed. Words and phrases to be translated by the teacher are found in the word-bank at the bottom of the lesson plan. The teacher is expected to provide the students with a copy of the word-bank as a reference.)

- **Activity 1 (15 mins):** (In the first activity, students look at a table in which they compare the compositions of blood leaving the kidneys and urine in a healthy

person. Above the table, an explanation text is modeled for the students which represents the deconstruction phase)

The teacher projects the module on the white board and divides the students into pairs and asks them to solve the questions about the table together on their tablets.

- **Activity 2 (15 mins):** (This is the scaffolding phase where implicit genre-specific instructions are integrated to help students become better writers of explanations. The teacher translates all the words found in the word-bank and the texts to Arabic.)

  In the same pairs, the teacher asks the students to solve the "Looking at the Details" section on their computers. This section focuses mainly on the structure of an explanation in science.

  After each activity, the teacher provides feedback and explains to the whole class the genre feature addressed.

- **Wrap up (5 mins):**

  The teacher wraps up the session in Arabic. **شو عملنا اليوم؟**

  Today, we learned about the wonderful job our kidney does. Who can tell me about it? How does our body get rid of the waste and harmful substances? What happens if our kidneys fail to work properly?

Session 2

- **Warm up (5 mins):** *In this section, the teacher is asked to use Lebanese Dialect to introduce the objectives of the lesson.)*

  Can you remind us about what we did yesterday? Today, we are going to talk about the dialyzer and the artificial kidney that help people with kidney

diseases. We will learn how the dialyzer and artificial kidney work. You will also write your own explanation paragraph.

- **Translanguaging Rings (10 mins)**

  Activity 3: the teacher divides the students into groups of four. She projects on the white board (Discussion Rings) which has a paragraph about the causes of kidney diseases. She also projects a number of questions that trigger the students' thoughts in the discussion. (1. What are the causes of kidney diseases? 2. How can people with kidney diseases take care of themselves? 3. Is this paragraph an explanation? Why? 4. Can you highlight some examples of the language features of explanations in the paragraph?)

- The teacher tells the students that they have 10 minutes to answer these questions and that it is okay to use Arabic in their discussions together.
- After the discussion rings, the teacher uses Arabic to collect the answers of the students in groups and highlights the language features present in the paragraph (timeless present tense, the role of each sentence in the paragraph, the linking word and phrases used with their translations to Arabic, and the purpose of the paragraph.)
- **Activity 4: (10 minutes)** (This section focuses on the second driving question of the session. She is asked to translate the words required in the word-bank to Arabic before students start working together.)

  Back in pairs, the teacher asks the students to solve the question set under the dialyzer diagram section on their tablets. This section helps student understand how the dialyzer or an artificial kidney works.

  After each activity, the teacher provides feedback to the students.

- **Activity 5: (10 mins)** (Fading: In this section, students are asked to write their own explanation. The teacher is asked to translate the words found in this activity and in the word-bank to Arabic. She is also asked to translate the instructions to Arabic: **بهيدا السؤال مطلوب تجربو إترجمو الرسم البياني لفقرة تفسير)**

  Individually, students are asked to translate a diagram into an explanation paragraph.

  After this activity, the teacher writes down a sample of an explanation paragraph on the board and asks students to improve their own paragraphs afterwards. The teacher highlights the genre-features discussed in the module and how she is effectively using them in writing an explanation.

- ***Wrap Up (5 mins)***

The teacher concludes the session by a recap of what the main objectives of the sessions, what they did throughout the past two sessions, and whether they have benefited from the activities or not.

(In this section, the teacher is asked to use Arabic to conclude and summarize the lesson.)

شو عملنا اليوم؟

Word-Bank

Purification		Build up	
Kidneys		Suffering from	
Urine		Order of steps	
Excess		Linking words	
Introductory statement		Consists of	

Contribute to		Artificial	
Inherit		Dialysis	

APPENDIX E

LESSON PLANS (CONTROL GROUP)

Lesson Plan 1

Explanation of the Effects of Smoking

Link to module: Smoking

- **Subject:** Science
- **Driving Question:**
  - How to construct a scientific explanation text.
  - What are the effects of smoking on the human body?
  - What are the effects of drugs on the human body?
  - What are the effects of unhealthy eating on the human body?
- **Grade Level:** 6
- **Duration:** 100 minutes

- **Before You Start**
  - Materials: projector/ tablets/ whiteboard

- **Objectives**
  - Identify the effects of smoking, drugs, and unhealthy eating on the human body

Keywords: Genre, Scientific explanation, Smoking, Drugs, Unhealthy Eating

- **Before-Class Activities**
  - Students research the topic "The Effect of Smoking on Health"

- **In-Class Activities**

Session 1

- **Warming Up (10 mins)**
    - The teacher asks students about the results of their research in the before-class activities and encourages students to share any questions they have with their classmates.
    - The teacher introduces the students to Tabshoura platform and asks them to log into their accounts (created for them ahead of time)
    - The teacher gives a brief introduction about the session telling the students what the session will be about. (An explanation is an important type of text that is commonly used in science. Scientists write explanation texts to explain how and why something in the world happens. Explanations are mainly about processes and how they occur. In this session, smoking is used as context to help you construct an explanation text.)

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Completing the Module (30 mins)

- Activity 1: (In this activity, students learn about the effects of smoking as they interact with a number of activities. The teacher asks them to work in pairs. Each pair of students will be provided with one tablet.)
- The teacher projects the module on the white board and divides the students into pairs and asks them to solve the questions together on their tablets.

- Activity 2: (In this activity, students will learn about the negative effects that alcohol has on our bodies.)
    - In the same groups, the teacher asks the students to solve the questions together on the tablets.
    - After each exercise, the teacher provides feedback.
- **Wrapping up (5 mins):**

  The teacher wraps up the session in English.

  Today we learned about the negative effects that smoking and alcohol have on our bodies. Can you remind me about them?

Session 2

- **Warm up: (5 mins)** The teacher starts the session by reminding the students of what they did the day before. (Can you remind me and your friends about what we did yesterday? We tackled the negative effects of smoking on the human body. We also talked about alcohol and its effect on our bodies. Today, we will start by analyzing a text about the effects of drugs on the human body. Then, we will work on a project to encourage people quit smoking.)

- ***Discussion Rings (10 mins)***
    - In this section, the teacher divides the students into groups of four. She projects on the white board **Activity 3** which has a paragraph about the effects of drugs on the human body. She also projects a number of

questions that trigger the students' thoughts in the discussion. (*1. Why do people use drugs? 2. What makes drugs dangerous?)*

The teacher tells the students that they have 10 minutes to answer these questions.

After the discussion rings, the teacher collects the answers of the students in groups.

- ***Activity 4 (20 mins)***
  - In this activity, students are asked to work in groups of 3. They should come up with a creative illustration to encourage people to quit smoking. Students present their projects afterwards.
- ***Wrap Up (5 mins)***

The teacher concludes the session by a recap of what the main objectives of the sessions, what they did throughout the past two sessions.

(In this section, the teacher is asked to use only English to conclude and summarize the lesson.)

(In this session we analyzed a paragraph about the effects of drugs on the human body. You also worked on a project to encourage people quit smoking!)

Lesson Plan 2

THE NERVOUS SYSTEM

Link to module: Functions of the Nervous System

- **Subject:** Science
- **Driving Questions:**
  - How do we know what we are smelling, hearing, tasting, seeing, and touching?
  - What happens inside our body that enables us to move when we want to?
  - What is reflex and what happens inside our body that makes us react without thinking?
- **Grade Level:** 6
- **Duration:** 100 minutes

- **Before You Start**
  - Materials: projector/ tablet/ whiteboard

- **Objectives**
  - Explain some aspects of the nervous system functioning

Keywords: Nervous System, function, body movement, reflex

- **Before-Class Activities**
  - Think about the driving question 1 of the session: How do we know what we are smelling, hearing, tasting, seeing, and touching?

- **In-Class Activities**

Session 1

- **Warm Up (5 mins) (***In this section, the teacher introduces the objectives of the lesson.)*
    - The teacher poses the first two driving question of the lesson in class and listens to the students' answers.
    - The teacher asks students to log into their accounts on Tabshoura.
    - The teacher gives a brief introduction about the session telling the students what the session will be about. (*Today, we're going to explore some amazing questions about our senses and movements. We'll discover how our brain helps us know what we're smelling, hearing, tasting, seeing, and touching. We'll also dive into the question of what happens inside our bodies when we decide to move. Ever wondered about reflexes? We'll answer the question "What happens when we accidentally touch a flame?". Get ready for an exciting journey into understanding how our bodies work!)*

Completing the Module

(In this phase, students are introduced to an example of a text that is written in the explanation genre.)

- **Activity 1 (5 mins):** (In the first activity, students engage in a drag and drop activity in which they categorize the five senses)

    The teacher projects the module on the white board and divides the students into pairs (each pair with a tablet) and asks them to solve questions about the drag and drop activity together on their tablets.

- **Activity 2 (10 mins):** (In this activity, students look at a diagram in which they read about the five senses and what happens when we smell, hear, taste, touch, or see.)

  In the same pairs, students are asked to solve 2 separate sets of questions about the diagram together on their tablets.

- **Activity 3: Question 1 (20 mins)**

  (This section focuses on the second driving question of the session.)

  In the same groups, the teacher asks the students to solve the "From Stimulus to Response" section on their tablets. This section helps student understand what happens inside our body when we want to move.

  Students are asked to only solve the question one which focuses on Rita the Omar. The Teacher then corrects the exercise on the whiteboard.

- **Wrap Up (5 mins)**

  The teacher wraps up the session.

  Today we learned about hearing, smelling, eating, touching, and seeing. Can you tell me what exactly did we learn? (teacher elicits answers from the students) So we learned how we are able to know what we are hearing, smelling, eating, touching, and seeing.

<u>Session 2</u>

- **Warm Up: (5 mins) (***In this section, the teacher introduces the objectives of the lesson.)*

Can you remind where we left off in the previous session? (teacher elicits answers from the students) So we went learned about the five senses. What was the last exercise about? (How are we able to move when we want to?) Today, we will talk about what a reflex is!

- **Activity 4: (15 minutes)** (The teacher is asked to help students answer the 8 questions. When they get to question 8, the teacher is asked to leave students write their paragraphs individually.)

  Students go back to working in pairs. They are asked to answer the 8 questions that help them understand what a reflex is and how we automatically react without thinking to stay safe.

  - After the activity, the teacher shows the students a sample answer.
  - The sample paragraph is: A reflex is a rapid and automatic response that our body carries out without us consciously thinking about it. When we accidentally touch something hot, such as a flame, tiny sensors on our skin send a speedy message to our spinal cord, which acts like a quick messenger. The spinal cord then tells our muscles to move away from the heat in a swift and protective manner. This entire process happens so fast that it helps us avoid harm without needing our brain to give the command. It's like a built-in safety mechanism that kicks in automatically!

- **Discussion Rings (10 mins) – Activity 5**

  In this section, the teacher divides the students into groups of four. She projects on the white board **Activity 5** (Discussion Rings) which has a paragraph about the involuntary action of breathing. She also

projects a number of questions that trigger the students' thoughts in the discussion. (1. What happens when we breathe? 2. Why is breathing an involuntary action?)

The teacher tells the students that they have 10 minutes to answer these questions.

After the discussion rings, the teacher answers of the students in groups.)

Wrap Up (5 mins)

The teacher concludes the session by a recap of what the main objectives of the sessions, what they did throughout the past two sessions, and whether they have benefited from the activities or not.

- **After-Class Activities**
  - The teacher asks the student to continue solving activity 6 (Wrapping Up) at home.

Lesson Plan 3

THE URINARY SYSTEM

Link to module: Functions of the Urinary System

https://tabshoura.com/mod/h5pactivity/view.php?id=20049

• **Subject:** Science	• **Grade Level:** 6

- **Driving Questions:** Why do we pee? How does our body get rid of the waste?

  How does the dialyzer or the artificial kidney works?

- **Duration:** 100 minutes

- **Before You Start**
  - Materials: projector/ tablets/ whiteboard

- **Objectives**
  - Explain the function of the urinary system and identify the dangers of its failure to work properly
  - Explain how the dialyzer or artificial kidney works to replace the kidneys

Keywords: Urinary System, function, kidney, dialyzer

- **Before-Class Activities**
  - Think about the first driving question of the session.

In-Class Activities

<u>Session 1</u>

- **Warm Up (5 mins) (***In this section, the teacher is asked introduces the objectives of the lesson.)*
- The teacher poses the first driving question of the lesson in class and listens to the students' answers.
- The teacher asks students to log into their accounts on Tabshoura.
- The teacher gives a brief introduction about the session telling the students what the session will be about. (Today, we're going to learn about the urinary system, which is like our body's cleanup crew for waste. We'll discover how it works and what can happen if our kidneys, the special filters in our bodies, aren't doing

their job properly. It's like a little adventure into understanding how we keep our bodies clean from the inside! Let's explore it together!)

Completing the Module

- **Activity 1 (15 mins):** (In the first activity, students look at a table in which they compare the compositions of blood leaving the kidneys and urine in a healthy person.)

  The teacher projects the module on the white board and divides the students into pairs and asks them to solve the questions about the table together on their tablets.

- **Activity 2 (15 mins): Discussion Rings**

  The teacher divides the students into groups of four. She projects on the white board (Discussion Rings) which has a paragraph about the causes of kidney diseases. She also projects a number of questions that trigger the students' thoughts in the discussion. (1. What are the causes of kidney diseases? 2. How can people with kidney diseases take care of themselves?)

- The teacher tells the students that they have 10 minutes to answer these questions together.
- After the discussion rings, the teacher collects the answers of the students in groups.)
- (**Wrap up (5 mins):**

  The teacher wraps up the session.

  Today, we learned about the wonderful job our kidney does. Who can tell me about it? How does our body get rid of the waste and harmful substances? What happens if our kidneys fail to work properly?

Session 2

- **Warm up (5 mins):** *In this section, the teacher introduces the objectives of the lesson.)*

  Can you remind us about what we did yesterday? Today, we are going to talk about the dialyzer and the artificial kidney that help people with kidney diseases. We will learn how the dialyzer and artificial kidney work.

- **Activity 3: (10 minutes)** (This section focuses on the second driving question of the session.)

  Back in pairs, the teacher asks the students to solve the question set under the dialyzer diagram section on their tablets. This section helps student understand how the dialyzer or an artificial kidney works.

  After each activity, the teacher provides feedback to the students.

- **Activity 4: (10 mins)**

  In this activity students are asked to write a paragraph about how the dialyzer works individually. After this activity, the teacher writes down a sample of a paragraph on the board and asks students to improve their own paragraphs afterwards.

- ***Wrap Up (5 mins)***

The teacher concludes the session by a recap of what the main objectives of the sessions, what they did throughout the past two sessions, and whether they have benefited from the activities or not.

APPENDIX F

DESCRIPTION OF SESSIONS

Control Group
The researcher initiates by instructing the students to switch users to access the module for the control group. The teacher introduces the topic with the question, "Why do we pee?" and translates it into Arabic. Arabic is utilized by the teacher in the session introduction (this was not instructed in the lesson plan). Activity 1: A student is tasked with reading the paragraph while the students collectively engage in the activity as a whole. To ensure comprehension, the teacher describes the steps of the purification process in English, providing explanations for terms such as "pure," "impure," "leave," and "enter". Activity 2 is skipped as it was omitted in groups C and B, and the class proceeds directly to Activity 3. Activity 3: The teacher initiates the activity by inquiring about treatments for individuals with kidney dysfunction. The students collectively engage in Activity 2 instead of working in pairs. Instead of allowing time for students to answer questions, the teacher first explains the diagram and then prompts students to respond to the questions.

Students proceed to Activity 4. They compose a paragraph on a piece of paper explaining how the dialyzer functions. Subsequently, they return to Activity 2, where they are divided into groups to analyze a paragraph. The teacher collects their responses and provides feedback.

The session concludes with the teacher reiterating the session objectives to the students.

Exp 1: Genre-based Instruction

The teacher initiates the session by posing several questions. She begins with asking, "Why do we pee?" and then swiftly delves into the digestion process, leading to a discussion on the kidneys and their function. The teacher distributes a tablet to each pair of students and guides them through the steps of logging into their accounts and accessing Module 3.

Next, the teacher invites one of the students to read a paragraph aloud, following which the students engage in answering questions related to the paragraph's content. The teacher clarifies the meanings of certain terms in English. This activity is conducted as a whole class rather than in pairs, as outlined in the lesson plan. Some students provide feedback on the activities and pose questions in Arabic but the teacher answers in English.

Transitioning to Activity 2, the students examine the paragraph's details collectively and respond to a set of activities as a group. The teacher prompts the

students to discuss the significance of the first sentence and why the paragraph qualifies as an explanation paragraph. Given that this is the final module and the students have previously encountered explanation genre features, they respond to the questions swiftly and confidently.

Due to the omission of Activity 3 in Group C, the teacher proceeds directly to Activity 4 to avoid any confounding factors. A late-arriving student is briefed by a classmate on the preceding discussions. The students speculate about the implications of kidney diseases, prompting the teacher to introduce the dialyzer as a solution. One student is assigned to read a question, and the students collectively address it. The researcher intervenes with some prompts to assist the teacher in adhering to the lesson plan.

(Owing to the extended session duration and the completion of activities within the allotted time, the teacher decides to finalize the module in one session instead of two.)

Advancing to Activity 5, students are instructed to respond to a question on a separate piece of paper. Before commencing writing, they are reminded of the components of an explanation paragraph and encouraged to use linking words to organize their ideas.

At the teacher's request, the researcher takes charge of introducing the writing activity. The teacher then takes the lead of the activity with the students. Students identify areas for improvement, and the teacher solicits various examples of introductory statements from them.

With the students' assistance, the teacher proceeds to compose an example of an explanation paragraph on the whiteboard. The session concludes with the teacher inquiring about the day's activities and providing a summary in English.

Exp 2: Genre-based Instruction + Translanguaging

The teacher initiates the session by raising questions about the upcoming session in Arabic. Beginning with the question, "Why do we pee?" She swiftly navigates through the digestion process to the kidneys and their function. Each pair of students receives a tablet, with the teacher guiding them through the steps of logging into their accounts and accessing Module 3.

Subsequently, the teacher selects a student to read the paragraph detailing the functions of the urinary system. She identifies the introductory statement as the first sentence and prompts the students to identify the paragraph type, which they correctly identify as an "explanation paragraph." The students then engage in answering questions about the paragraph's content, with the teacher translating and elaborating on the questions in Arabic. This activity is conducted as a whole class instead of in pairs as outlined in the lesson plan. Some students provide feedback and pose questions in Arabic.

Transitioning to Activity 2, the students examine the paragraph's details collectively and respond to a set of activities as a group. The teacher prompts the students to discuss the significance of the first sentence and why the paragraph qualifies as an explanation paragraph. Given that this is the final module and the students have previously encountered explanation genre features, they respond to the questions

swiftly and confidently. The teacher employs Arabic to explain questions and translates certain terms found in the word bank to Arabic, such as "purification" and "kidneys."

Due to technical issues, Activity 3 is skipped, and the class proceeds to Activity 4. The teacher explains the purpose of the activity in Arabic, focusing on people with kidney diseases. Students speculate about the implications of kidney diseases, prompting the teacher to introduce the dialyzer as a solution. She also translates certain terms to Arabic, such as "artificial," "filtering," "pure," and "impure." The students collectively address the questions, with the researcher intervening to assist the teacher in adhering to the lesson plan. However, the teacher does not translate the linking words into Arabic as expected in the lesson plan.

(Owing to the extended session duration and the completion of activities within the allotted time, the teacher decides to finalize the module in one session instead of two.)

Proceeding to Activity 5, students are instructed to respond to a question on a separate piece of paper. Before commencing writing, they are reminded of the components of an explanation paragraph and encouraged to use linking words to organize their ideas.

At the teacher's request, the researcher takes charge of introducing the writing activity. The teacher then takes the lead of the activity with the students. Students identify areas for improvement, and the researcher elicits different examples of introductory statements from them. With the assistance of the students, the teacher continues to write an example of an explanation paragraph on the whiteboard.

Subsequently, students revisit Activity 3, where they are divided into groups to discuss the paragraph, and the teacher elicits answers from them. Students use Arabic freely in this activity as well.

The session concludes with the teacher inquiring about the day's activities and providing a summary in Arabic.

APPENDIX G

ANCOVA ASSUMPTIONS

Table 1

ANCOVA First Assumption: Independence of Covariate and Treatment Effect

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	0.526[a]	2	0.263	0.096	0.908
Intercept	262.511	1	262.511	95.982	< .001
Group	0.526	2	0.263	0.096	**0.908**
Error	183.246	67	2.735		
Total	448.000	70			
CorrectedTotal	183.771	69			

a. R Squared = .003 (Adjusted R Squared = -0.027)

Table 2

Homogeneity of Regression Slopes:

Dependent Variable: PostAvTotal

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	130.518[a]	5	26.104	7.730	< .001
Intercept	104.278	1	104.278	30.879	< .001
Group	25.938	2	12.969	3.840	.027
PreTotal	56.750	1	56.750	16.805	< .001

Group * PreTotal	8.506	2	4.253	1.259	**.291**
Error	216.131	64	3.377		
Total	982.603	70			
CorrectedTotal	346.649	69			

a. R Squared = .377 (Adjusted R Squared = .328)

Table 3

Homogeneity of Regression Slopes: Dependent Variable:

Post1 Total

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	56.207[a]	5	11.241	6.974	< .001
Intercept	65.398	1	65.398	40.571	< .001
Group	6.132	2	3.066	1.902	.158
PreTotal	40.507	1	40.507	25.129	< .001
Group * PreTotal	3.590	2	1.902	1.114	**.335**
Error	103.165	64	25.129		
Total	582.000	70	1.114		
CorrectedTotal	159.371	69			

a. R Squared = .353 (Adjusted R Squared = .302)

Table 4

Homogeneity of Regression Slopes: Dependent Variable:

Post2 Total

Source	Type III Sum of Squares	df	Mean Square	F	Sig.

Corrected Model	179.706[a]	5	35.941	5.662	< .001
Intercept	180.796	1	180.796	28.483	< .001
Group	31.446	2	15.723	2.477	.092
PreTotal	80.052	1	80.052	12.612	< .001
Group * PreTotal	9.517	2	4.758	.750	**.477**
Error	406.237	64	6.347		
Total	1612.000	70			
CorrectedTotal	585.943	69			

a. R Squared = .307 (Adjusted R Squared = .253)

Table 5

Homogeneity of Regression Slopes: Dependent Variable:

Post3 Total

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	213.177[a]	5	42.635	5.791	< .001
Intercept	83.202	1	83.202	11.302	.001
Group	62.132	2	31.066	4.220	.019
PreTotal	54.081	1	54.081	7.346	< .009
Group * PreTotal	15.679	2	7.840	1.065	**.351**
Error	471.166	64	7.362		
Total	1222.000	70			
CorrectedTotal	684.343	69			

a. R Squared = .312 (Adjusted R Squared = .258)

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