

Developing Persuasive Writing Skills Through Scientific Argumentation Using a Time-Series Design

Desarrollo de habilidades de escritura persuasiva a través de la argumentación científica utilizando un diseño de series temporales

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Abstract

This study investigates the development of persuasive writing skills in a sample of 44 grade VIII English learners from a private school in Rawalpindi-Pakistan. It employs a quasi-experimental time-series design, carrying out three pre-tests at different intervals which are followed by five lessons integrating scientific argumentation. To explore the effectiveness of the intervention, three post-tests at different intervals have also been conducted. The use of this design with six levels of measurement is aimed at improving the reliability in measuring variables. Furthermore, a semi-structured interview protocol has been developed to explore the students' experience with scientific argumentation, its strengths, and challenges. Quantitative data has been analysed using mean, SD, t-test, and ANOVA, while qualitative data has been thematically analysed. Results from inferential statistics reveal a significant improvement in the students' persuasive writing. Their involvement in scientific argumentation has enabled them to think critically, make an informed decision, and support it with valid arguments. The interview data highlights certain challenges as well as ways of improving scientific argumentation and its integration into English language teaching.

Keywords: argumentation; English learners; persuasive writing; quasi-experimental time-series design

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Resumen

Este estudio investiga el desarrollo de habilidades de escritura persuasiva en una muestra de 44 estudiantes de inglés de grado VIII procedentes de una escuela privada en Rawalpindi-Pakistán. Usando un diseño cuasi-experimental de series de tiempo, se han realizado tres pruebas preliminares en diferentes intervalos, seguidas de cinco sesiones que integran la argumentación científica. Para explorar la efectividad de la intervención, también se han realizado tres pruebas posteriores en diferentes intervalos. Se decide hacer uso de este diseño con seis niveles de medición para mejorar la fiabilidad de los resultados en lo relativo a la medida de las variables. Además, se pone en práctica un protocolo de entrevista semiestructurada para explorar la experiencia de los estudiantes con la argumentación científica, sus fortalezas y desafíos. Los datos cuantitativos se analizan mediante fórmulas estadísticas de media, DE, prueba t y ANOVA, mientras que los datos cualitativos se examinan temáticamente. Los resultados de las estadísticas inferenciales revelan una mejora significativa en la escritura persuasiva del estudiantado. Su participación en actividades de argumentación científica ha fomentado el desarrollo del pensamiento crítico, permitiéndoles tomar decisiones informadas y respaldadas con argumentos válidos. Los datos de la entrevista destacan ciertos desafíos y posibles mejoras entorno a la argumentación científica y su integración en la enseñanza del inglés.

Palabras clave: argumentación; estudiantes de inglés; escritura persuasiva; diseño cuasi-experimental de series de tiempo

Introduction

Among the different language skills, writing has received relatively less attention from researchers (Hassan et al., 2017). It is a cognitive and social process (Bakry & Alsamadani, 2015), which turns our speech and thoughts into graphic form (Indah & Hermi 2023). It is an essential skill for students of English as a Foreign Language (EFL). However, students struggle to improve their writing skills in schools, workplaces, and even in their personal lives (Graham & Perin, 2007). A possible reason for this might be its dependence on the other three language skills of speaking, reading, and listening (Klimova, 2014). According to Hadfield and Hadfield (2008), students' writing skills improve through proper guidance, clear instructions, and practice with different writing forms. This study focuses on persuasive writing, one of the most challenging writing skills for language students (Handayani, 2020).

Persuasive writing aims at convincing the reader to believe in a specific point of view (Nurtjahyo et al., 2019). It is also called argumentative writing, comprising of claims with supporting evidence. A well-written persuasive writing text can convince the reader of the writer's viewpoint (Handayani 2020). Moreover, it will enable students "to produce, evaluate, and understand ethical, professional, and political discourse" (Gill et al., 2022, p. 50), thereby making their voices more articulate and effective (Mahmood et al., 2021). However, students face difficulty in writing a convincing description for various reasons.

Handayani (2020) found that one problem in persuasive writing is the learners' inability to develop a good argument. The students struggle with finding logical evidence to support their argument which makes them feel bored and anxious during persuasive

writing. Baghbadorani and Roohani (2014) concluded that students have difficulty arranging their thoughts and supporting their views in persuasive writing. Their intervention of Self-Regulated Strategy Development effectively improved persuasive writing in Iranian English learners. However, their sample was undergraduate students who were more self-regulated and could work independently, unlike elementary students in this study.

Klimova (2014) used the product and process-oriented approach to improve students' writing skills. The product approach presents a model text to the learners and guides them to study its structure, organization of ideas, and linguistic features. The learners then try to produce a similar text. In comparison, the process approach focuses on idea generation through brainstorming, group discussion, and practice. The author found no significant difference in students' writing performance between both approaches. However, this finding cannot be generalized due to the small sample size and short intervention time.

The research by Kaur (2015) on exploring the challenges in writing argumentative essays found that Thai students faced difficulty in writing a valid thesis statement. The main reason was the lack of familiarity and practice with this genre. They found the traditional teaching and memory-based assessment accountable for weakness in argumentative writing. Mahmood et al. (2021) also concluded a similar result for Pakistani students' weakness in persuasive writing.

Persuasive writing in the EFL context also varies based on the learners' first language. Bacha (2010) identified that one reason for Arabic-speaking students' weakness in persuasive writing was the structural difference between Arabic and English persuasive writing styles. The claim usually comes at the end in Arabic, and the refutation is not always needed. Bacha (2010) introduced persuasive writing to Arabic-speaking students through the 'essays' technique that involved five steps: building the context, modeling and deconstructing texts, constructing texts jointly, constructing texts independently, and linking related texts. The method effectively improved persuasive writing; however, it was non-interactive concerning students' participation and reported frequent confrontations during the class.

In a recent study, Mahmood et al. (2021) analyzed 50 persuasive essays of Pakistani learners and concluded that language learners were unfamiliar with the linguistic features of persuasive writing. Their analysis revealed that the persuasive essays were merely descriptive accounts and lacked convincing arguments. A possible reason for this weakness might be attributed to the traditional mode of instruction (Faize & Nawaz, 2020) and a lack of sufficient knowledge of the English language, structure, and its functional use (Sajid & Siddiqui, 2015).

In Pakistan, reading and writing are usually more emphasized in the curriculum than listening and speaking (Faize, 2011). Despite that, the students are weak in English and face difficulty in persuasive writing. Scientific argumentation is a potential avenue to help students improve their persuasive writing abilities by simultaneously channeling the cognitive, epistemic, and social aspects of writing. The cognitive aspect helps provide a valid reason for the claim and avoids baseless generalization. The epistemic provides evidence for supporting claims based on scientific theories and knowledge, while the social aspect focuses on students' mutual interaction and respecting the opposing views (Duschl, 2008).

Scientific argumentation can be understood as a structure and a dialogic process (Mikeska & Lottero-Perdue, 2022). The structural aspect refers to argument construction using certain key components. The most common structure involves a claim, supporting evidence, and a counter-argument or a rebuttal (Jin & Kim, 2021; Faize & Akhtar, 2020). A claim refers to decision-making for or against a topic/issue. Evidence supports a claim, while a rebuttal provides evidence to counter the opposing claim. A good rebuttal convinces the opponent to revise one's claim and accepts the other's argument (Toulmin, 1958). However, constructing a rebuttal is not simple; students find it the most challenging component despite practice (Foong & Daniel, 2013; Osborne et al., 2004). A rebuttal reflects high-order thinking skills (Chang & Chiu, 2008) and thus adds to the quality of an argument (Erduran et al., 2004).

On the other hand, the dialogic aspect of scientific argumentation refers to supporting one's argument while criticizing, debating, and listening to counter-arguments. This makes it a linguistically social interaction (Wang, 2020) which improves students' conceptual understanding of the relationship between the data and the statement and encourages group discussion (Rohayati., Anshori, & Sastromiharjo, 2023). In this study, we considered both the structure and the process aspects of scientific argumentation to study persuasive writing skills.

Scientific argumentation is useful in argument construction (Faize & Akhtar., 2020). According to Hewson and Ogunniyi (2011) such as indigenous knowledge (IK, when the students were taught through scientific argumentation in South African schools, they actively and enthusiastically participated in the lessons. The students learned to respect differences of opinion, which helped them generate new ideas and knowledge. Thus, engagement in scientific argumentation helped the students decide about an issue and support it with evidence.

Scientific argumentation develops students' critical thinking (Faize, 2015) and enables them to think like scientists (Passmore & Svoboda, 2012). However, its use in improving persuasive writing skills has not been considered. This research investigates the prospect of using scientific argumentation to improve students' persuasive writing skills. Based on this objective, our null hypothesis states no effect of scientific argumentation on students' persuasive writing skills. Moreover, this study would explore students' reflections on scientific argumentation, highlighting its strengths and problems encountered during argument construction. The development of persuasive writing skills through scientific argumentation can serve as an aid for English teachers. The findings of this research may help in improving the teaching of persuasive writing and encourage the use of scientific argumentation in language teaching.

To achieve the research objectives, we conceptualized scientific argumentation as a structure and a social process in this study. Structurally, we used the Grounds Competency Argument Pattern (GC-AP), which considers an argument consisting of a claim, grounds, and rebuttal (detail mentioned in the Data Analysis section). As a process, we took scientific argumentation as a social activity where opportunities are created for the students to form arguments by providing explanations and critiquing opposing views. Such a process relates to the social constructivism of Vygotsky (1978), which states that every function in the child's development appears on the social level

and, later, on the individual level. Once a child goes through or experiences social interaction, learning occurs at the individual level, leading to cognitive development. Based on this theory, scientific argumentation involves students working in groups with different activities. The most knowledgeable peer in the group also scaffolds during this mutual interaction.

Methodology

Participants

The participants were 24 students of grade VIII studying compulsory English in a private school in Rawalpindi (a major city in Pakistan). The students' ages were between 12 to 14 years (mean 13.6 years), with 14 girls and 10 boys. According to the school record, all students belonged to the lower middle class.

Research design

This research used a within-subject quasi-experimental design that involved the same participants in all conditions, thus controlling the problem of subject variables or non-equivalent groups. However, to control the influence of history, maturation, and instrumentation, we chose a time-series design that takes repeated measurements before and after intervention and offers a robust research design (Gravetter & Forzano, 2019). A series of pre-tests and post-tests provided more information about the data trend before and after the intervention than a single pre and post-test measurement.

Research instrument

We used three pre-tests and three post-tests to assess the quality of students' persuasive writing skills. Each test asked the participants to write on an instructor-selected topic related to persuasive writing. There was no word limit; however, credit was awarded on the argument's quality. These texts were checked and graded using the GC-AP model (detail in the analysis section).

We also conducted a semi-structured interview with ten randomly selected students. Each interview lasted 10 to 15 minutes. The interview identified students' experience with scientific argumentation, the challenges in constructing arguments, and ways to improve scientific argumentation.

A panel of experts consisting of two Ph.Ds. and two subject specialists (teachers that taught persuasive writing for more than five years) validated both the instruments (tests and semi-structured interview), which were then pilot tested on a smaller sample of grade eight in another school. We edited some items for language clarity in both the instruments. To minimize the researchers' bias in grading persuasive writing texts, one of the researchers and a subject expert separately marked all the texts for marking reliability. The coefficient of inter-rater reliability between the researcher's and the subject expert's marking was $\alpha = .85$, $p = .000$, which was acceptable.

Data analysis

We used Foong and Daniel's (2013) Grounds Competency Argument Pattern (GC-AP) to analyze and grade students' persuasive writing texts. GC-AP proposes a simple marking way by looking for three main components in a persuasive text: claim, grounds, and rebuttal. A claim indicated students' point of view or stance in favor or against a topic. A ground consisted of examples, elaboration, opinion, facts, or backing for supporting a claim. A poor ground contained a single example or elaboration, while a rich ground provided more than one example, justification, or explanation to defend a claim. A rebuttal or refutation was also categorized into weak and strong based on quality and relevance. Table 1 shows the components and the assigned score to measure the quality of a persuasive text.

Table 1

The scoring pattern for analysing argument quality.

Component	Assigned Score
Claim (1) only	1
Claim (1) + Poor ground (1)	2
Claim (1) + Rich ground (2)	3
Claim (1) + poor ground (1) + Weak rebuttal (1)	3
Claim (1) + rich ground (2) + Weak rebuttal (1)	4
Claim (1) + poor ground (1) + strong rebuttal (2)	4
Claim (1) + rich ground (2) + strong rebuttal (2)	5

The following example illustrates the scoring pattern on one persuasive topic: "The need for school uniform" from a student's text.

School uniforms should be mandatory for all students (claim: score 1). It is more comfortable for students to get ready for school by wearing the same uniform (ground: score 1). Many people think that uniform takes away students' freedom, but its benefits are more as it makes them responsible, recognizable, and shows equality (strong rebuttal, score 2).

The above write-up scored four per the criteria mentioned in Table 1. We used IBM SPSS ver. 25 (Reg.) for analyzing quantitative data and thematic analysis for the interview data. Thematic analysis is a method for 'identifying, analyzing, and reporting patterns (themes) within the data'. We used Creswell and Poth's (2016) guidelines for extracting themes by transcribing data, coding, and then evolving themes.

Procedure

The researchers administered three pre-tests before the intervention. Each pre-test was conducted with a gap of two days. The students were taught other content during the gap to cover the syllabus. Each pre-test consisted of a topic to assess persuasive writing skills before the intervention.

The intervention phase engaged students in scientific argumentation through different activities (mentioned in the next section). Scientific argumentation involved students in knowledge construction through active engagement, decision making, and critical thinking. We followed Vygotsky's social constructivism, in which the teacher facilitates the flow of thoughts and students are the active participants. The instructor was one of the authors that conducted all the activities. The intervention phase covered five lesson plans of 30 minutes each. To minimize the teacher's bias, the lesson plans were systematically planned and covered different topics and activities in scientific argumentation. The activities were based on Vygotsky's (1978) social development theory, which states that an individual full cognitive development requires social interaction. The students worked in small groups of two to four, and the teacher guided them as the more knowledgeable other (MKO). Finally, the students practiced individually on the selected topics.

The intervention phase covered five activities in scientific argumentation. Each activity was performed in a separate lesson and was named by the researchers according to the nature of the activity. We reserved five lessons to conduct these activities related to scientific argumentation. Afterwards, three post-tests were taken with a time gap of at least two days. Each post-test consisted of a topic to assess students' persuasive writing skills. The symbolic representation of the quasi-experimental design is given below.

T1	T2	T3	Intervention	T4	T5	T6
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Where T1, T2, and T3 were pre-tests and T4, T5, and T6 were post-tests.

List of activities to develop argumentation skills

We conducted the following activities during the intervention phase to familiarize students with scientific argumentation. Each activity was performed in a separate lesson.

A. Difference between facts and opinions

The students were guided to distinguish between facts and opinions during this lesson. We gave students cut pieces of different English newspapers and asked them to identify paragraphs related to facts and opinions. The students were encouraged to give justifications for their decision. This activity was performed in groups of two to four under the teacher's guidance.

B. Guided research

The students were given a short article to identify the components of scientific argumentation in it. This activity helped the students understand the necessary components and structure of scientific argumentation. Later, the teacher held a class discussion to clarify the concept to students facing difficulty with the components.

C. Battle bars

The students were asked to pick a chocolate from a variety of chocolates presented to them. Those choosing the same chocolates were grouped. Each group was asked

to write a paragraph justifying their choice, such as the price of the chocolate, taste, advertising appeals, ease of consumption, the reasons for not choosing the other chocolates, etc. The paragraph included a claim, supporting evidence, and counter-arguments.

D. Teacher as a model writer

The teacher acted as a model writer to help students write an argumentative passage. The teacher wrote the topic on the whiteboard and made separate columns for claim, grounds, and rebuttal. The students helped the teacher write a claim, supporting evidence, and a rebuttal. The teacher guided the students to arrange their ideas and thoughts. Proper instructions were given to the students to write an argumentative essay.

E. Four corner debates

The teacher wrote a statement on the board and then pasted four pieces of paper in four corners of the classroom with the tags somewhat agree, strongly agree, strongly disagree, and somewhat disagree. The students were asked to stand in any corner according to their level of agreement with the statement. A debate was conducted among the students. The students, strongly agreeing or strongly disagreeing, tried to convince students who were somewhat agreeing or somewhat disagreeing. The debate ended with students standing in the two corners of strongly agreeing or strongly disagreeing. However, a few students retained their original position.

After the group activities, we involved students in individual assignments related to persuasive writing. The individual performance of students in persuasive writing was monitored and evaluated.

Results of quantitative data

The researchers took three pre-tests at different intervals to find consistency in students' performance. This was followed by the intervention phase and three post-tests at different intervals. The duration of each interval was two days. Table 2 shows the results of descriptive statistics with mean scores, standard deviation, and F-value. The mean scores were lower in all three pre-tests compared to the three post-tests. This implied weak performance in the pre-tests, which improved during the post-tests. Our next point of interest was to compare the mean scores of the three pre-tests to find if the means differed significantly or not.

A repeated-measures ANOVA with a Greenhouse-Geisser correction indicated no significant differences in the means of the three pre-tests: $F(1.51, 33.18) = 2.94, p = .08$. Similarly, we found no significant differences in the means of the three post-tests scores using repeated measure ANOVA; $F(1.51, 33.18) = .565, p = .54$. These two results implied that the students performed consistently lower in the pre-tests and significantly higher in the post-tests.

To measure the impact of our intervention program, we compared the means of the three pre-tests with the three post-tests. The repeated measure ANOVA determined a significant difference between the means of the three pre-tests and the three post-tests; $F(3.41, 75.01) = 13.66, p = .000$.

Table 2

Descriptive statistics of the pre-tests and the post-tests with F-value.

	Mean	SD	F-value		
Score Pre-Test 1	2.96	.638	}	2.94	}
Score Pre-Test 2	2.61	.783			
Score Pre-Test 3	3.04	.706			
Score Post-Test 1	3.78	.795	}	.565	
Score Post-Test 2	3.91	.900			
Score Post-Test 3	4.00	.798			

*Significant at .0001

As there were three pre- and three post-tests, we used the Post hoc test to determine which of the means differed significantly. Table 3 shows the pair-wise comparison of the six tests (1,2,3 represents the three pre-tests, and 4,5,6 represent the three post-tests, respectively).

Table 3

Pair-wise comparison of the means of all the tests.

(I) factor1	(J) factor1	Mean Difference (I-J)	Sig.
1	2	.348	.119
	3	-.087	.492
	4	-.826*	.001
	5	-.957*	.001
	6	-1.043*	.000
2	4	-1.174*	.000
	5	-1.304*	.000
	6	-1.391*	.000
3	4	-.739*	.004
	5	-.870*	.002
	6	-.957*	.001
4	5	-.130	.601
	6	-.217	.328
5	6	-.087	.539

*Significant at .01

Comparing the means of any two pre-tests using the Post hoc test revealed no significant difference. The same applied to the post-tests as well. However, significant differences were observed when the mean score of any pre-tests was compared with any post-tests. Thus, we found significant differences between pre-test 1 and the three post-tests 4, 5, and 6. Similarly, significant differences were recorded between pre-test 2 and the three post-tests; and between pre-test 3 and the three post-tests.

To analyze students' persuasive writing performance with time, we refer to Figure 1 showing the time-series design.

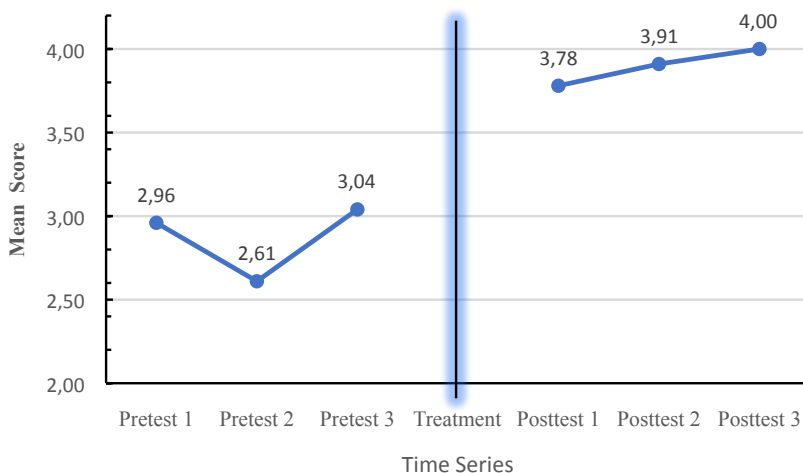


Figure 1. Participants' mean score on Pre-tests and Post-test on a time-series.

The graph shows the trend lines representing the mean scores of the three pre and post-tests. The vertical line represents the time when the treatment was administered. The trend line shows higher means for the post-tests compared to the pre-tests. The mean score decreased in the second pre-test and then increased, but this fluctuation was not significant. The three post-tests' measurements provided strong evidence of intervention effect and eliminated the possibility of by chance increment if one measurement or one post-test was taken.

Results of qualitative data

The interview schedule with ten randomly selected students yielded the following qualitative data. We used pseudonyms to ensure the confidentiality of the data.

Students' reflection

The students were asked to reflect upon their experience with scientific argumentation. All the students expressed that involvement in scientific argumentation improved their concept and understanding of persuasive writing.

Aly: "My concept has improved due to this engagement, and now I can write good persuasive essays."

Hania: "I have learned to make proper claims in favor or against a topic. I also learned to think from others' perspectives and to write counter-arguments."

Abdullah: "I learned that first, we make a decision which is called a claim.... we also have to take care of the opposite views, and if someone says contrary to mine, then we have to answer that as well."

Six out of ten students mentioned that they understand all three components of scientific argumentation. These students expressed that involvement in scientific argumentation improved their understanding and helped them make decisions.

Challenges in scientific argumentation

When asked about the challenges during scientific argumentation, the students pointed out various issues. The major problem was writing a good rebuttal/counter-argument. The students also mention the difficulty in making a claim in argumentative writing as it involved critical thinking. Lastly, some students complained about the lack of background knowledge to construct an argument.

Gul: "I think evidence writing was difficult as I do not know everything."

Anjum: "Making claims was a bit difficult for me."

Naveed: "I feel like making a counter-argument was the difficult bit."

Suggestions for improvement

The students suggested that teachers should involve students in diverse and exciting class activities to improve their persuasive writing. The students reported that argument construction becomes very difficult sometimes; therefore, teachers should provide continuous guidance during argumentative sessions. Some students suggested that teachers give reading assignments before any argumentative sessions to enable students to collect background information about the topic.

Aria: "I think the students shall talk more often on social issues. They shall read a lot and search online to improve their background knowledge".

Some students suggested that other teachers shall also use scientific argumentation during classroom instruction. The more they practice scientific argumentation, the better they would learn and apply this in other subjects, especially sciences.

Fatima: "I want my science teacher to teach us science through scientific argumentation".

Discussion

The study aimed to explore whether students' persuasive writing can be improved through scientific argumentation. For this purpose, students' persuasive writing skills were evaluated through three pre-tests. The students performed consistently lower in the three pre-tests. It was found that the students struggled with writing a convincing argument. Most of the texts lacked proper evidence to support the argument. Mahmood

et al. (2021) also found that Pakistani students struggled with persuasive writing. The students write descriptive accounts in persuasive writing and thus lack persuasion. One reason for this weakness might be the lack of practice with persuasive writing. Kaur (2015) also reported students' weaknesses in persuasive writing due to a lack of practice with this genre.

The quality of persuasive writing improved after the intervention phase. The data in the time-series design eliminated the effect of practice/maturation as we found no significant difference in students' scores in the 2nd and 3rd pre-tests. The mean score rose sharply after the intervention plan and remained higher, showing that the improvement in the post-tests was not by chance or practice. This data led us to reject our null hypothesis and establish the effectiveness of scientific argumentation to improve persuasive writing skills. This finding is supported by Hassan et al. (2017). Royati et al. (2023) also found improvement in students' argument quality and epistemic beliefs when guided through scientific argumentation. The effectiveness of scientific argumentation in argument construction was also supported by Faize and Akhtar (2020). Scientific argumentation focuses on clear reasoning and prepares the students for the actual world beyond the school walls.

The interviews helped explore students' experience with scientific argumentation, the challenges encountered in constructing arguments, and ways to improve scientific argumentation. The students appreciated scientific argumentation being an interactive learning process. The students reported that scientific argumentation helped them in persuasive writing by focusing on the structural components such as claim, ground, and counter-argument. This makes it easy and exciting for them to construct a strong argument. Faize (2022) also found that students develop a deeper understanding and appreciation of knowledge through scientific argumentation. However, constructing an argument is not always an easy task. The students identified various challenges in scientific argumentation. Firstly, the lack of background knowledge about an issue. Without proper background or prior knowledge, one cannot make a valid claim and support it. This was justified as our sample was elementary-level students, and many lack sufficient knowledge at this level. This is in line with Qin and Karabacak (2010) because a claim is accepted when backed by supporting data; otherwise, it will be regarded only as an opinion. Ho et al. (2019) reported similar results for grade IV Taiwanese students during argument construction. The significance of prior knowledge in argument construction is also acknowledged by Grooms et al. (2018). They stressed a positive relationship between concept familiarity and argument quality. In this regard, giving relevant reading material to students as a home assignment may help develop a minimum knowledge base for scientific argumentation (Faize et al., 2018).

Moreover, the students found difficulty with writing a rebuttal. This was evident in students' persuasive text as very few could write strong rebuttals. Qin and Karabacak (2010) found rebuttal data with the lowest frequency in argumentative writing of Chinese students. Lammers et al. (2019) also reported a similar problem with undergraduate students. The difficulty with constructing rebuttals requires developing instructional approaches to train prospective teachers in scientific argumentation (McNeill & Krajcik, 2012).

Commenting on how to improve scientific argumentation, the students suggested that teachers shall use it frequently in class. Some students suggested that other teachers should also use it, especially the science teachers. The students in our study did not know that scientific argumentation was mainly used to teach science subjects and its use in persuasive writing was to extend its use in language teaching. Foong and Daniel (2013) and Faize (2015) also supported the transfer of scientific argumentation skills in other subjects. There is a dire need to educate and train language teachers with effective teaching strategies to teach argumentative writing to their students (Kaur, 2015). In this context, argumentation-based teaching strategies must be taught to the teachers for their professional development (Loucks-Horsley et al., 2009).

Limitations

We suggest some precautions in the generalizability of findings in this study. Firstly, the small sample size from one private school limits its applicability in a broader context. Secondly, we focused on the components mentioned in the students' persuasive writings and ignored English language proficiency regarding grammar and syntax while marking the scripts. Thirdly, this study was quasi-experimental with one group. We suggest that future studies involve a control group in the time-series design for greater credibility. Fourthly, this study focused on learners' writing skills and ignored their verbal skills. Often verbal argumentation is complex and better in quality than written argumentation. Future studies may also consider verbal argumentation along with the written mode and their inter-relationship.

Conclusion

This study aimed at improving the persuasive writing skills of grade VIII English learners using scientific argumentation. The results of three pre-tests showed students' weak performance in persuasive writing. The sample was then engaged in different activities related to scientific argumentation followed by three post-tests. The researchers found significant differences in students' pre-test and post-test scores indicating the effectiveness of scientific argumentation. The intervention activities guided students about the structure of a good argument. The students learnt how to make a claim and justify it through valid grounds. Besides, the intervention activities proved to be more engaging and interactive. The students liked the intervention activities and suggested that other teachers should also use them. However, the students also identified some problems in constructing arguments such as writing a strong rebuttal and the lack of background knowledge to support one's claim. The students suggested that their teachers should give them regular reading assignments to improve their background knowledge. Students' feedback on scientific argumentation provided useful insight about the intervention difficulties and would help the language teachers, educationists, and researchers to integrate scientific argumentation into language teaching and its regular application in developing students' persuasive writing skills.

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