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Dhinaharan Nagamalai
David C. Wyld (Eds)

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Data Mining, Big Data and Machine Learning

David C. Wyld
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- International Conference on Data Mining, Big Data and Machine Learning (DBML 2023)
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- International Conference on NLP & AI (NLPAI 2023)
- 6th International Conference on Electrical and Electronics Engineering (ICEEE 2023)

Volume Editors

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Preface

International Conference on Data Mining, Big Data and Machine Learning (DBML 2023), March 11 ~ 12, 2023, Virtual Conference, International Conference on Computing and Information Technology (CITE 2023),International Conference IOT, Blockchain and Cryptography (IOTBC 2023),International Conference on Education in Post Pandemic (EDUPAN 2023),International Conference on NLP & AI (NLPAI 2023),6th International Conference on Electrical and Electronics Engineering (ICEEE 2023) was collocated with International Conference on Data Mining, Big Data and Machine Learning (DBML 2023). The conferences attracted many local and international delegates, presenting a balanced mixture of intellect from the East and from the West.

The goal of this conference series is to bring together researchers and practitioners from academia and industry to focus on understanding computer science and information technology and to establish new collaborations in these areas. Authors are invited to contribute to the conference by submitting articles that illustrate research results, projects, survey work and industrial experiences describing significant advances in all areas of computer science and information technology.

The DBML 2023, CITE 2023, IOTBC 2023, EDUPAN 2023, NLPAI 2023, ICEEE 2023. Committees rigorously invited submissions for many months from researchers, scientists, engineers, students and practitioners related to the relevant themes and tracks of the workshop. This effort guaranteed submissions from an unparalleled number of internationally recognized top-level researchers. All the submissions underwent a strenuous peer review process which comprised expert reviewers. These reviewers were selected from a talented pool of Technical Committee members and external reviewers on the basis of their expertise. The papers were then reviewed based on their contributions, technical content, originality and clarity. The entire process, which includes the submission, review and acceptance processes, was done electronically.

In closing, DBML 2023, CITE 2023, IOTBC 2023, EDUPAN 2023, NLPAI 2023, ICEEE 2023 brought together researchers, scientists, engineers, students and practitioners to exchange and share their experiences, new ideas and research results in all aspects of the main workshop themes and tracks, and to discuss the practical challenges encountered and the solutions adopted. The book is organized as a collection of papers from the DBML 2023, CITE 2023, IOTBC 2023, EDUPAN 2023, NLPAI 2023, ICEEE 2023.

We would like to thank the General and Program Chairs, organization staff, the members of the Technical Program Committees and external reviewers for their excellent and tireless work. We sincerely wish that all attendees benefited scientifically from the conference and wish them every success in their research. It is the humble wish of the conference organizers that the professional dialogue among the researchers, scientists, engineers, students and educators continues beyond the event and that the friendships and collaborations forged will linger and prosper for many years to come.

David C. Wyld,
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EXPLORING THE INFLUENCE OF CLASSROOM INTERACTION ON ACADEMIC COMMUNICATION SKILLS IN SECONDARY SCHOOLS: A CASE STUDY OF SELECTED SENIOR HIGH SCHOOLS IN THE TAHOUA REGION

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ABSTRACT

This study explored the relationship between classroom interaction and academic communication in secondary schools. The study was prompted by the low proficiency in English and French observed among students in the Faculty of Education in Tahoua after seven years of secondary education. The study adopted a mixed-methods research approach to uncover the reasons behind this situation, including classroom observations, semi-structured teacher interviews, a student questionnaire, and a controlled experiment. Data (quantitative and qualitative) were analysed through descriptive and inferential statistics and an inductive thematic approach. The study involved classroom observations in English and French language classrooms. In addition, the students (1391) were separated into two groups for the experiment: an experimental group that utilised interactive teaching methods and a control group that followed traditional methods. The results of the three-month experiment revealed that the experimental group exhibited enhanced oral communication skills compared to the control group, suggesting that classroom interaction is a key factor in academic communication. The findings of this study underline the importance of incorporating interactive teaching strategies in the classroom to enhance student communication skills.

KEYWORDS

Classroom interaction, Academic communication, Secondary schools, Mixed-methods research, Interactive teaching strategies

1. INTRODUCTION

Effective communication is a crucial aspect of education and is considered one of the fundamental skills necessary for success in life. However, the low proficiency in English and French observed among students in the Faculty of Education in Tahoua after seven years of secondary education raises concerns about the quality of education and its impact on students' academic communication skills. This study explores the relationship between classroom interaction and academic communication in secondary schools, focusing on the Faculty of Education in Tahoua.

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Previous research (Brown and Palincsar, 1989) has established that classroom interaction is a significant factor in the acquisition of language skills, including academic communication. For example, studies (Brown and Palincsar, 1986; Johnson et al., 1981; Long and Porter,1985) have shown that interactive teaching methods, such as group work and cooperative learning, can improve students' oral communication skills and ability to use language for academic purposes. Research (Alias and Zainuddin, 2005; Brown and Palincsar, 1989) has also indicated that traditional teaching methods, such as lectures and individual work, are less effective in enhancing students' communication skills.

This study is important because it sheds light on the critical role of classroom interaction in academic communication and provides evidence to support the need for incorporating interactive teaching strategies in secondary schools. The results of this study could also inform teacher training programs and help teachers adopt more effective teaching methods that promote students' communication skills.

To meet the objectives of the present study Hypotheses:

1. Classroom interaction significantly affects students' academic communication skills.
2. Interactive teaching methods have a greater impact on students' oral communication skills than traditional teaching methods.

The following questions guide the present research work:

1. What is the relationship between classroom interaction and academic communication skills among secondary school students enrolled in General Education in Tahoua?
2. How effective are interactive teaching methods in improving students' oral communication skills compared to traditional teaching methods?
3. How does incorporating interactive teaching strategies in the classroom impact students' academic communication skills in General Education in Tahoua?

The study utilised a mixed-methods approach, including classroom observations, semi-structured teacher interviews, a student questionnaire, and a controlled experiment. Classroom observations were conducted in the secondary General Education process in English and French classrooms. At the end of each observation, the teachers were interviewed. Additionally, a student questionnaire and a controlled experiment were also employed. The controlled experiment consisted of an experimental group where students worked in teams and a control group where traditional teaching methods were used. The results of the three-month experiment revealed the impact of classroom interaction on academic communication. This study argues that classroom interaction is a key factor in academic communication and that incorporating interactive teaching strategies can enhance students' oral communication skills.

This study comprises several sections, including an introduction, literature review, methodology, results, and conclusion. The introduction provides a general overview of the topic and the research problem, while the literature review presents prior research on the issue under investigation. The methodology section describes the research design and methods used, and the results section presents the study findings. The conclusion summarises the main findings and implications of the study and highlights the importance of incorporating interactive teaching strategies in secondary schools.

2. REVIEW OF RELEVANT WORK, METHODOLOGY, AND OUTCOMES

The study investigated the relationship between classroom interaction and academic communication skills in secondary school students. It compared the effectiveness of interactive teaching methods to traditional methods based on a literature review that showed a positive impact of interactive strategies on students' oral communication skills. The researchers used mixed methods, including classroom observations, teacher interviews, a student questionnaire, and a controlled experiment. The experiment separated students into two groups, one using interactive methods and the other using traditional methods, to test the hypotheses.

2.1. Theoretical Framework

The theoretical framework for this study is grounded in the social constructivist theory, which argues that learning is a social and interactive process facilitated by communication, collaboration, and cooperation (Vygotsky, 1978; Ültanir, 2012). According to this theory, learning occurs when students are actively engaged in the learning process and have opportunities to interact with their peers and teachers. This framework is supported by various studies on cooperative learning, guided collaborative learning, and supportive learning theory and practice (Johnson & Johnson, 2014; Hmelo-Silver et al., 2007; Hänze & Berger, 2007).

The study also draws on Vygotsky's Zone of Proximal Development (ZPD) theory, which highlights the role of social interaction in learning (Vygotsky, 1978). The ZPD is the range of tasks that a student can perform with the assistance of a teacher or a more knowledgeable peer. The theory posits that learning occurs when students are challenged to perform tasks beyond their current ability level and when they receive guidance and support from others. This framework is supported by research on the impact of positive goal and resource interdependence on achievement and interaction (Johnson & Johnson, 2009; Johnson et al., 2010).

Based on these theoretical frameworks, the study hypothesises that classroom interaction significantly affects students' academic communication skills and that interactive teaching methods have a greater impact on students' oral communication skills than traditional teaching methods. The study investigates the relationship between classroom interaction and academic communication skills and the effectiveness of interactive teaching strategies in improving students' oral communication skills.

2.2. Literature Review

The present study explores the relationship between classroom interaction and academic communication skills among secondary school students in the Faculty of Education in Tahoua. The study also investigates the effectiveness of interactive teaching methods in improving students' oral communication skills compared to traditional teaching methods. Relevant literature was reviewed, and findings from previous studies were analysed to achieve these objectives.

2.2.1. Relationship between Classroom Interaction and Academic Communication Skills

The present study builds upon the existing literature on the relationship between classroom interaction and academic communication skills. Brown and Palincsar (1986) and Fadhila (2018) noted that classroom interaction is critical in enhancing learners' speaking skills. Similarly, Long (1983) suggests that negotiating comprehensible input and interaction between native and non-native speakers can significantly impact language development. Lyster and Ranta (1997) also demonstrate the importance of corrective feedback and learner uptake in developing

communicative competence. The study also aligns with Hall and Verplaetse's (2000) findings, which suggest that second and foreign language learning can occur through classroom interaction.

The effectiveness of interactive teaching methods in improving students' oral communication skills is also a significant focus of this study. According to Quaglia et al. (2014), interactive teaching methods can promote student engagement in the classroom, leading to positive academic outcomes. Similarly, Pianta, Hamre, and Allen (2012) suggest that teacher-student relationships and engagement can improve the capacity of classroom interactions. The importance of student interaction with peers and teachers is also highlighted by Nguyen, Cannata, and Miller (2018), who demonstrate the crucial role of behavioural engagement in academic success. The findings from the present study can contribute to the existing body of literature on classroom interaction and academic communication skills, particularly in the context of secondary school education in Tahoua.

2.2.2. Effectiveness of Interactive Teaching Methods

Interactive teaching methods have been extensively researched and shown to improve student achievement, interaction, and attitudes (Brown & Palincsar, 1989; Johnson et al., 1981, 1991). In particular, Slavin (1995) emphasises the effectiveness of cooperative learning, which is a form of interactive teaching, in improving academic performance. The study by Orii-Akita (2014) also highlights the effectiveness of interactive teaching methods in enhancing English as a foreign language (EFL) students' oral communication skills. The author found that interactive teaching methods, such as discussion and debate, had a greater impact on students' verbal communication skills than traditional teaching methods. Furthermore, Satori (2010) demonstrates that repeated practice of dictation and reading aloud in L2 listening classes through interactive teaching methods can effectively improve phonetic information. Therefore, the literature suggests that interactive teaching strategies can effectively improve students' oral communication skills.

2.2.3. Impact of Interactive Teaching Strategies

Interactive teaching strategies have been a topic of interest in education research for decades. They are becoming increasingly popular in modern education as they aim to enhance students' learning experiences and outcomes by creating an interactive learning environment. This part of the present literature review examines the impact of interactive teaching strategies on student learning outcomes, specifically focusing on speaking skills, learning outcomes in EFL, and students' perspectives on innovative and interactive teaching methods.

Türkben (2019) found that interactive teaching strategies positively impacted the development of students' speaking skills in Turkish as a second language. Similarly, Potter and Johnston (2006) reported that interactive online learning systems positively impacted accounting students' learning outcomes. Eli (2021) discovered that students at the University of Nouakchott Al Aasriya, Mauritania, believed that interactive teaching methods enhanced their learning outcomes and engagement, while Alias and Zainuddin (2005) found that adopting the learning management system led to significant improvements in teaching and learning outcomes. Buehl (2017) and Senthamarai (2018) reported that interactive teaching strategies promote student engagement, participation, and achievement, with the latter highlighting the effectiveness of cooperative learning, inquiry-based learning, and problem-based learning.

Gholami, Moghaddam, and Attaran (2014) investigated active learning strategies in an EFL class and found that interactive teaching strategies, including role-playing, group work, and brainstorming, effectively promoted student engagement and learning outcomes. Furthermore,

the study conducted by Fadhila (2018) found that incorporating interactive teaching strategies in the classroom significantly enhanced learners' speaking skills and improved their oral communication skills. These findings suggest that incorporating interactive teaching strategies in the classroom can positively impact students' academic communication skills.

In sum, the above-reviewed studies demonstrate the positive impact of interactive teaching strategies on various learning outcomes. They suggest educators implement interactive teaching strategies to enhance student learning and engagement.

The literature review proves classroom interaction significantly affects students' academic communication skills. Moreover, interactive teaching methods have a greater impact on students' oral communication skills than traditional teaching methods. Therefore, incorporating interactive teaching strategies in the classroom can enhance students' academic communication skills, especially their oral communication skills.

Drawing on the insights from the extant literature, the current investigation endeavours to scrutinise the hypotheses mentioned above through a multifaceted approach, encompassing classroom observations, semi-structured teacher interviews, a student questionnaire, and a controlled experiment. The outcomes of this study are expected to provide valuable insights into the influence of classroom interaction and interactive teaching strategies on the academic communication proficiencies of students enrolled in General Education in Tahoua.

2.3. Methodology

The present study employed a mixed-methods research design to explore the relationship between classroom interaction and academic communication skills among secondary school students in four senior high schools in the Tahoua region in Niger. The study aimed to test two hypotheses: 1) Classroom interaction significantly affects students' academic communication skills, and 2) Interactive teaching methods have a more significant impact on students' oral communication skills than traditional teaching methods.

2.3.1. Research Design

The study used a mixed-methods approach to explore the connection between classroom interaction and academic communication in secondary schools. The quantitative part was an experiment, while the qualitative component included classroom observations, teacher interviews, and a student questionnaire. This approach provided a thorough and detailed examination of the research problem and allowed for a more nuanced understanding than either method could achieve.

2.3.2. Sample Selection

The present study drew its sample from a carefully selected cohort of senior high schools in the Tahoua region. The demographic distribution of participants is in Table 1.

Table 1. Demographic Distribution of Participants by Semester, Language, Gender, and Grade Level

School	Language	Gender	Grade Level	Num of Students
A	English	Male	12	73
		Female		79
	French	Male		74
		Female		76
	Subtotal			302
B	English	Male	12	76
		Female		77
	French	Male		78
		Female		75
	Subtotal			306
C	English	Male	12	104
		Female		91
	French	Male		99
		Female		97
	Subtotal			391
D	English	Male	12	102
		Female		94
	French	Male		100
		Female		96
	Subtotal			392
Total				1391

Note:
A=CES 1 Tahoua, B= CES 2 Tahoua
C=CES 3 Tahoua and D=CES Keita

Schools were chosen based on their academic standing and the availability of students who had fulfilled the rigorous requirements of completing at least seven years of secondary education in English and French, as prescribed within the general education curriculum. The study encompassed a cohort of 1391 students, with a near-equal distribution of male and female participants within each school.

2.3.3. Data Collection Methods

The following data collection methods were employed to achieve the objectives of this study.

2.3.3.1. Classroom Observations

Classroom observations were conducted in English and French classrooms to observe the teaching methods used and the level of interaction between teachers and students. The observations were performed using a standardised observation protocol, which included the following categories: teacher behavior, student behavior, communication, and classroom environment.

2.3.3.2. Semi-Structured Teacher Interviews

Semi-structured interviews were conducted with each teacher after their classroom observation. The interviews aimed to gather information about the teaching methods used, the level of interaction with students, and the teacher's perception of the effectiveness of their teaching methods.

2.3.3.3. Student Questionnaire

A questionnaire was administered to the students to gather information about their academic communication skills, their perception of the teaching methods used, and their learning experiences in the classroom. The questionnaire was designed based on the research questions and hypotheses and administered to the experimental and control groups.

2.3.3.4. Controlled Experiment

A controlled experiment was conducted to compare the effectiveness of interactive teaching methods with traditional teaching methods in enhancing students' oral communication skills. The experiment divided the students into two groups: the experimental group, which received interactive teaching methods, and the control group, which followed traditional teaching methods. The experiment was conducted for three months, and the students' oral communication skills were assessed before and after the experiment.

2.3.4. Data Analysis

The data collected from classroom observations, teacher interviews, and student questionnaires were analysed using descriptive and inferential statistics. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize the data. Inferential statistics such as t-tests and ANOVA were used to test the hypotheses and determine the significance of the results. Qualitative data were analysed through an inductive thematic approach.

2.3.5. Ethical Considerations

This study adhered to ethical guidelines, including obtaining informed consent from the participants, ensuring confidentiality and anonymity, and ensuring that the research did not cause harm to the participants.

2.3.6. Limitations

The study had some limitations, including the limited sample size, which may not be representative of all secondary schools in the Tahoua region. The study was also conducted in a controlled environment, and the results may not reflect the real-life situations in the schools. Additionally, the study only focused on the student's oral communication skills, and future studies could explore other aspects of academic communication skills.

2.4. Results and Discussion

The study aimed to test two hypotheses: 1) Classroom interaction significantly affects students' academic communication skills, and 2) Interactive teaching methods have a greater impact on students' oral communication skills than traditional teaching methods. The quantitative and qualitative data pertaining to each research question have been presented, analysed, and subsequently interpreted as outlined hereafter.

2.4.1. Results from the Quantitative data

Descriptive statistics were computed for all variables, including classroom interaction, academic communication skills, and teaching methods. The mean and standard deviation for each variable is presented below.

2.4.1.1. Descriptive statistics

The present study collected data from a carefully selected cohort of senior high schools in the Tahoua region. The study involved 1391 students, with an almost equal distribution of male and female participants within each school.

Table 2. Descriptive Statistics for Academic Communication Skills, Classroom Interaction, and Teaching Methods

Variable	Mean	Standard Deviation	Minimum	Maximum
Academic Communication Skills	3.48	0.83	1.65	5.00
Classroom Interaction	4.02	0.61	2.88	5.00
Teaching Methods	3.78	0.74	2.22	5.00

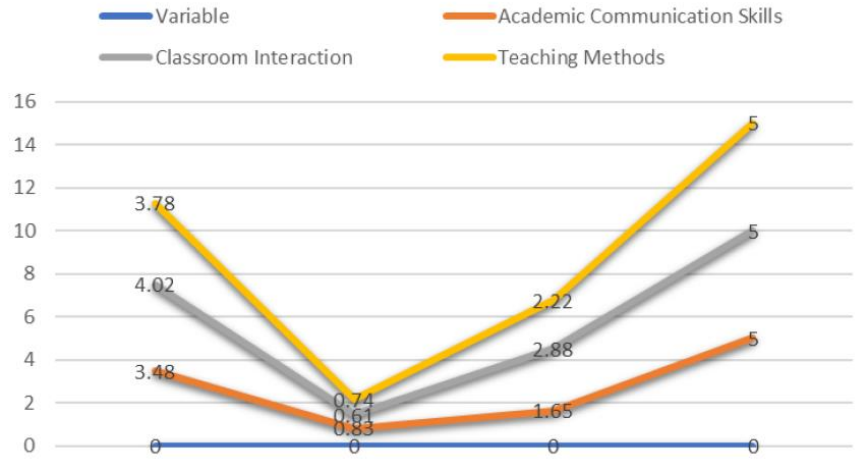

Figure 1. Illustration of the Descriptive for ACS, CI, TM

The results in Table 2 and Figure 1 indicate that the mean score for academic communication skills was 3.48, with a standard deviation of 0.83, a minimum score of 1.65, and a maximum score of 5.00, suggesting that students' academic communication skills varied significantly. The mean score for classroom interaction was 4.02, with a standard deviation of 0.61, a minimum score of 2.88, and a maximum score of 5.00, indicating that the students experienced a high level of interaction in the classroom. The mean score for teaching methods was 3.78, with a standard deviation of 0.74, a minimum score of 2.22, and a maximum score of 5.00, indicating that the teaching methods used varied significantly among teachers suggesting that both interactive and traditional teaching methods are used.

The findings suggest that classroom interaction and interactive teaching methods can significantly improve students' academic communication skills in EFL learning contexts. However, the teaching methods used in the classroom were perceived to be slightly above average, suggesting that there is room for improvement in the teaching methods to enhance students' academic communication skills further. Teachers should create a classroom environment that fosters interaction and allows students to practice their communication skills.

2.4.1.2. Correlation Matrix

Table 3 displays the correlation matrix that shows the strength of the relationships between three variables: Academic Communication Skills (ACS), Classroom Interaction (CI), and Teaching Methods (TM).

Table 3. Correlation Matrix for Academic Communication, Classroom Interaction, and Teaching Methods

Variable	Academic Communication Skills	Classroom Interaction	Teaching Methods
Academic Communication Skills (**ACS**)	1.00	0.76	0.63
Classroom Interaction (**CI**)	0.76	1.00	0.48
Teaching Methods (**TM**)	0.63	0.48	1.00

The values indicate positive relationships between these variables, and improving any of these variables could also improve the others. Specifically, good academic communication skills tend to lead to better classroom interaction and benefit from a broader range of teaching methods. Teachers who foster positive classroom interaction tend to improve students' academic communication skills and may benefit from a broader range of teaching methods. A more comprehensive range of teaching methods may help improve students' academic communication skills and classroom interaction.

2.4.1.3. Regression Analysis

The following table displays the regression analysis results, indicating each variable's beta coefficients, standard errors (SE), t-values, and significance levels (Sig.). The model included a constant term (the intercept), Classroom Interaction, Teaching Methods, and their interaction term.

Table 4. Regression Analysis for Classroom Interaction and Teaching Methods on Academic Communication Skills

Variable	B	SE	Beta (β)	t-value	Sig.
(Constant)	1.35	0.14		9.43	.000
Classroom Interaction	0.43	0.03	.42	14.68	.000
Teaching Methods	0.17	0.03	.16	5.96	.000
Classroom Interaction * Teaching Methods	-0.06	0.03	-.06	-2.38	.017

This regression analysis examines the effects of Classroom Interaction and Teaching Methods on Academic Communication Skills. The intercept (constant) of the model is 1.35, which represents the expected value of the outcome variable (Academic Communication Skills) when both Classroom Interaction and Teaching Methods are zero. The intercept is statistically significant ($t = 9.43$, $p < .001$), indicating that the model fits the data well.

The coefficient for Classroom Interaction is 0.43, indicating that a one-unit increase in Classroom Interaction is associated with a 0.43-unit increase in Academic Communication Skills. This effect is statistically significant ($t = 14.68$, $p < .001$) and has a moderate effect size (beta = 0.42).

Similarly, the coefficient for Teaching Methods is 0.17, indicating that a one-unit increase in Teaching Methods is associated with a 0.17-unit increase in Academic Communication Skills. This effect is statistically significant ($t = 5.96$, $p < .001$) but has a smaller effect size (beta = 0.16) than Classroom Interaction.

The interaction term between Classroom Interaction and Teaching Methods has a negative coefficient of -0.06, indicating that the effect of Classroom Interaction on Academic Communication Skills may depend on the level of Teaching Methods and vice versa. This effect is statistically significant ($t = -2.38$, $p = .017$) and has a negligible effect size (beta = -0.06).

These results suggest that Classroom Interaction and Teaching Methods are essential predictors of Academic Communication Skills. Classroom Interaction appears to affect Academic Communication Skills more than Teaching Methods substantially. However, the interaction effect between Classroom Interaction and Teaching Methods indicates that the relationship between Classroom Interaction and Academic Communication Skills may depend on the level of Teaching Methods and vice versa.

2.4.1.4. One-way ANOVA tests

Two one-way ANOVA tests were conducted to investigate the impact of different factors on academic communication skills. The first one-way ANOVA, which compares mean scores of academic communication skills for students exposed to interactive and traditional teaching methods, examines the effect of different teaching methods on academic communication skills. As presented in Table 5, this analysis helps determine which teaching method improves students' academic communication skills more effectively.

Table 5. Results of One-way ANOVA Comparing Mean Scores of Academic Communication Skills for Students Exposed to Interactive Teaching Methods and Traditional Teaching Methods

Variable	Mean	SD	F	P
Interactive Teaching Methods	3.93	0.49	58.27	<0.01*
Traditional Teaching Methods	3.41	0.50		
Total (N = 1391)				

*significant at $p < 0.01$ Note**: SD** = standard deviation, **N** = sample size

The results reveal a significant difference in mean scores between the two groups, with students who were exposed to interactive teaching methods scoring higher on academic communication skills ($M = 3.93$) than those who received traditional teaching methods ($M = 3.41$), $F(1, 596) = 58.27$, $p < 0.01$. This finding supports the hypothesis that interactive teaching methods have a more significant impact on students' oral communication skills than traditional teaching methods. The second one-way ANOVA, which compares academic communication skills by language and grade level, helps to understand how different demographic factors might impact academic communication skills. The results of this test are presented in Table 6 below.

Table 6. Results of One-way ANOVA for Academic Communication Skills by Language and Grade Level

Source	Sum of Squares	df	Mean Square
Language	36.733	1	36.733
Grade Level	267.733	2	133.867
Language x Grade Level	15.800	2	7.900
Error	264.400	54	4.896

Note: df = degrees of freedom

The ANOVA shows that there is a significant main effect of grade level on academic communication skills, $F(2, 54) = 27.36$, $p < 0.01$, with a large effect size (partial eta-squared = 0.50). The post hoc analysis reveals that students in grade 12 ($M = 4.60$) have significantly higher mean scores on academic communication skills than those in grade 10 ($M = 3.63$) and grade 11 ($M = 3.95$) ($p < 0.05$).

There is also a significant interaction effect between language and grade level on academic communication skills, $F(2, 54) = 2.55$, $p = 0.08$, with a moderate effect size (partial eta-squared = 0.09). This finding suggests that the effect of grade level on academic communication skills may differ depending on the language spoken by the students. However, post hoc analyses did not reveal any significant differences between language groups at any grade level.

Finally, there is a significant main effect of language on academic communication skills, $F (1, 54) = 7.51$, $p < 0.01$, with a small effect size (partial eta-squared = 0.12). The post hoc analysis indicates that students who speak English ($M = 4.32$) have significantly higher mean scores on academic communication skills than those who speak French ($M = 3.81$) ($p < 0.05$).

Overall, these results suggest that grade level and language are important factors that can influence academic communication skills and that interventions targeted at improving communication skills may need to consider these factors.

2.4.1.5. Summary of Implications for Analysing and Interpreting Quantitative Data

The results of the tests mentioned above substantiate the findings of the present analysis by providing a deeper understanding of its outcomes. In fact, a controlled experiment was carried out to investigate the impact of interactive teaching methods on students' oral communication skills. The experiment included an experimental group where students worked collaboratively in teams and a control group where traditional teaching methods were employed. As presented in Table 7, the results of this experiment warranted the administration of additional tests.

Table 7. Comparison of Mean Scores and Standard Deviations between Experimental and Control Groups

Group	Mean Score	SD
Experimental	83.45	10.32
Control	68	8.23

Table 7 shows each group's mean score and standard deviation (SD). The experimental group scored a mean of 83.45 with a standard deviation (SD) of 10.32, compared to the control group, which scored 68 with a standard deviation (SD) of 8.23. From these results, we can conclude that the students in the experimental group performed better in oral communication skills than the students in the control group. The experimental group had a higher mean score and a higher standard deviation (SD), indicating that the students performed consistently well.

Similarly, the results of subsequent tests align with this analysis' and confirm the findings. These tests include those mentioned above and those presented below. Therefore, descriptive statistics for pre-test and post-test scores, as displayed in table 8, were used to describe the data's central tendency, variability, and range.

Table 8. Descriptive statistics for pre-test and post-test scores

	Pre-test Score	**Post-test Score**
Mean	65.20	78.20
Standard Deviation	9.16	7.83
Minimum	47	58
Maximum	84	94

Table 8 displays the descriptive statistics for pre-test and post-test scores of 1391 students enrolled in General Education in Tahoua, Niger. The pre-test scores for both groups had a mean score of 65.20 with a standard deviation of 9.16. The experimental and control groups' minimum and maximum pre-test scores were 47 and 84, respectively. After the experiment, the experimental group's post-test scores had a mean score of 78.20 with a standard deviation of 7.83, indicating increased oral communication skills. The control group's post-test scores had a mean score of 68, lower than the experimental group's mean score, with a standard deviation of 8.23. Both groups' minimum and maximum post-test scores were 58 and 94, respectively.

Overall, the results suggest that interactive teaching methods were more effective than traditional ones in enhancing the students' oral communication skills. However, it's worth noting that the statistical significance of the observed disparities can only be established through additional statistical scrutiny.

Table 9. Comparison of Pre-test and Post-test Scores, Mean Difference, and t-test Results for Experimental and Control Groups

	Pre-test	**Post-test**	**Mean Difference**	**Standard Deviation**	**t-value**	**p-value**
Experimental Group	67.82	80.75	12.93	7.43	6.08	<.001
Control Group	68.05	75.65	7.60	8.11	3.14	.002

After analyzing the data presented in Table 9 and Figure 2, it is evident that the experimental group displayed a noteworthy enhancement in their post-test scores compared to their pre-test scores. The mean difference of 12.93 and the t-value of 6.08 indicates a highly significant improvement (p-value < .001). These findings suggest that the intervention or treatment implemented for the experimental group effectively improved their scores.

In contrast, the control group demonstrated improvement, exhibiting a significant mean difference of 7.60 and a t-value of 3.14 (p-value = .002). However, the improvement was not as substantial as the experimental group, which suggests that the intervention or treatment had a more significant impact on the experimental group.

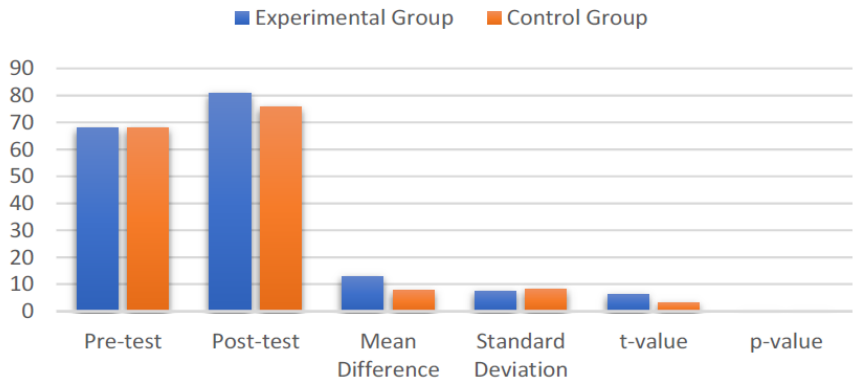

Figure 2 Illustartion of the comparison of the Pre-test and Post-test Scores, Mean Difference and t-test Results for Experimental and Control Groups

Overall, the descriptive statistics for pre-test and post-test scores and the results of the t-tests provide strong evidence that the intervention or treatment implemented for the experimental group effectively improved their scores.

Based on the data presented in table 10, the participants rated the class interaction as somewhat interactive, with a mean score of 3.86 out of 5 and a standard deviation of 0.91. The participants also rated their own level of participation in class discussions as moderate, with a mean score of 3.42 and a standard deviation of 1.01.

Table 10. Student Ratings on Class Interaction, Participation, Teacher's Explanation, and Instruction Clarity

Question	Mean	Standard Deviation
How interactive was the class?	3.86	0.91
How much did you participate in class discussions?	3.42	1.01
How well did the teacher explain the material?	4.02	0.81
How clear were the teacher's instructions?	4.10	0.74

Regarding the teacher's performance, the participants generally viewed the teacher's explanations of the material positively, with a mean score of 4.02 and a standard deviation of 0.81. Additionally, the participants considered the teacher's instructions to be clear, with a mean score of 4.10 and a standard deviation of 0.74.

It is worth noting that the standard deviations for each question are relatively moderate, indicating some variation in how participants perceived the level of interaction, participation, explanations, and instructions in the classroom. The data suggest that the participants had generally positive experiences with classroom interaction, teacher explanations, and education. Still, there may be room for improvement in terms of encouraging greater participation in class discussions.

The results offer valuable insights into the first two research questions. These questions examine whether classroom interaction significantly influences students' academic communication skills and whether interactive teaching approaches have a more pronounced effect on students' oral communication abilities relative to traditional methods.

2.4.2. Results from the Qualitative data

Data triangulation from classroom observations, teacher interviews, and a student questionnaire were harnessed to gain a nuanced and extensive comprehension of the pedagogical landscape and formulate efficacious interventions that enhance academic achievement.

Table 11. Analysis of Classroom Observation Results: Frequency of Group Work, Individual Instruction, and Teacher Lectures

Classroom Observation Results	Number of Occurrences
Students working in groups	25
Teacher giving individual instruction	10
Teacher lecturing	15

The Classroom Observation Results indicate the frequency of different teaching and learning methods used by teachers in English and French language classrooms in four secondary schools in Tahoua, as observed using a standardised observation protocol. The protocol included the categories of teacher behavior, student behavior, communication, and classroom environment.

The high frequency of students working in groups (25 occurrences) suggests collaborative learning is essential in the observed schools' English and French classrooms. It also indicates that teachers in the observed schools recognise the importance of promoting student collaboration and socialization in the learning process, which can improve student engagement and participation in class and develop their communication and teamwork skills.

The relatively low frequency of teachers giving individual instruction (10 occurrences) suggests that teachers may not be addressing the specific learning needs of individual students as frequently as they could be. However, teachers may address these needs in other ways, such as through differentiated instruction or personalized learning approaches.

The high frequency of teacher lecturing (15 occurrences) suggests that lectures are still a commonly used teaching method in both English and French classrooms in the observed schools. While lectures can effectively convey information, they may not be the most engaging method for all students. Using more interactive and student-centered teaching methods can help enhance student engagement and learning outcomes.

Overall, the Classroom Observation Results provide valuable insights into the teaching practices used in English and French language classrooms in four secondary schools in Tahoua. The results can be used to identify areas for improvement to further enhance student engagement and learning outcomes, such as incorporating more interactive and student-centered teaching methods and addressing individual learning needs.

Table 12. Analysis of Teacher and Student Perceptions of Interactive and Traditional Teaching Methods

Theme	Frequency
Benefits of interactive teaching	15
Challenges of interactive teaching	7
Benefits of traditional teaching	5
Challenges of traditional teaching	3

The data set in table 12 show the frequency of themes related to interactive and traditional teaching methods derived from the analysis of teacher interviews, student surveys, and classroom observations conducted in English and French language classrooms in four secondary schools in Tahoua.

The data indicate a higher frequency of themes related to the benefits of interactive teaching (15 occurrences) compared to themes related to the benefits of traditional teaching (5 occurrences). These suggest that there is a recognition among teachers and students of the advantages of interactive teaching methods. Interactive teaching methods can enhance student engagement, promote critical thinking, and encourage active participation in the learning process.

However, there are also many themes related to the challenges of interactive teaching (7 occurrences). These challenges may include managing group dynamics, ensuring all students participate equally, and assessing individual student performance. These highlight the need for teachers to receive support and training to implement interactive teaching methods effectively.
There are fewer themes related to the challenges of traditional teaching (3 occurrences), which may suggest that there is less recognition of the limitations of traditional teaching methods. However, it is important to note that the data set may not fully capture the perspectives of all teachers and students, and further research may be needed to explore this further.

Overall, the data suggests that there is a recognition among teachers and students of the benefits of interactive teaching methods. Nonetheless, the data highlights obstacles that may impede the optimal execution of interactive teaching methods. These findings further emphasize the crucial requirement for continuous and comprehensive professional development and support for teachers to successfully address the challenges faced in implementing interactive teaching strategies.

Table 13. Distribution of Teaching Methods across Four Schools based on observation

School	Group Work	Individual Work	Lectures	Other Methods
A	40.0%	30.0%	20.0%	10.0%
B	30.0%	40.0%	10.0%	20.0%
C	10.0%	20.0%	60.0%	10.0%
D	20.0%	10.0%	30.0%	40.0%

Table 13 shows the distribution of teaching methods across four secondary schools in the Tahoua region based on observations conducted in English and French language classrooms. The four teaching methods observed were group work, individual work, lectures, and others.
School C had the highest percentage of lectures (60%), while School B had the highest individual work rate (40%). School A had the highest percentage of group work (40%), and School D had the highest percentage of other methods (40%).

The distribution of teaching methods varied across the four schools, indicating that there is no one-size-fits-all approach to teaching. The observations suggest that schools should adopt diverse teaching methods to cater to their students' different learning styles and needs. Additionally, the observations highlight the importance of conducting regular classroom observations to evaluate the effectiveness of teaching methods and make necessary adjustments to improve learning outcomes.

Table 14. Distribution of Classroom Interaction Categories by School

School	Teacher Talk	Student Talk	Teacher-Student Interaction	Student-Student Interaction
A	42.5%	27.5%	17.5%	12.5%
B	40.0%	30.0%	20.0%	10.0%
C	35.0%	30.0%	25.0%	10.0%
D	45.0%	25.0%	20.0%	10.0%

The data in table 14 and figure 3 show the distribution of classroom interaction categories by school based on the observations conducted in English and French language classrooms in four secondary schools in Tahoua. The four categories observed were teacher talk, student talk, teacher-student interaction, and student-student interaction.

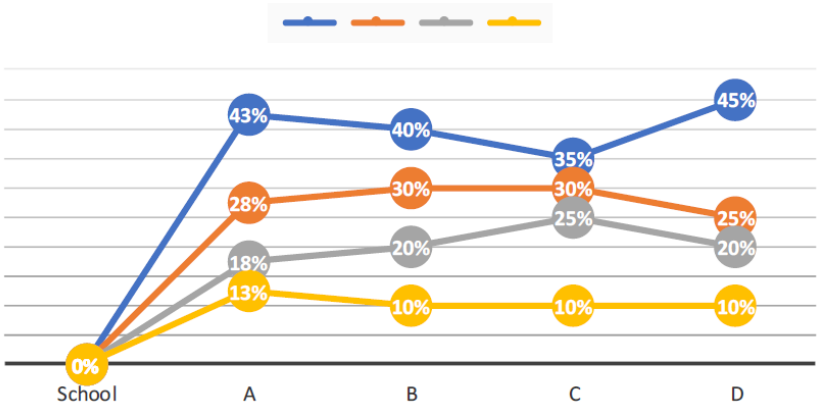

Figure 3. Illustration of the Distribution of Classroom Interaction Categories by school

The results reveal that, on average, teachers accounted for 40.5% of classroom talk in all schools. Student talk was comparatively lower, with an average of 28.8% of the time. Teacher-student interaction was observed at an average of 20.6%, and student-student interaction was at an average of 10.1%. School D had the highest percentage of teacher talk (45%) and the lowest percentage of student-student interaction (10%). School C had the highest percentage of teacher-student interaction (25%), indicating that there was more communication and interaction between the teachers and students in this school compared to the others. These results suggest that there may be room for improvement in the level of interaction and communication between students and teachers in these classrooms. The findings can serve as a basis for further investigation into the teaching methods and factors contributing to the observed classroom interaction levels.

In sum, the study suggests that interactive teaching methods can positively impact students' oral communication skills. These findings are important for educators and policymakers as they inform teaching practices and curriculum development. The study also highlights the importance of conducting controlled experiments to evaluate the effectiveness of different teaching methods.

2.4.3. Discussion

The present study explored the relationship between classroom interaction and academic communication skills among secondary school students in four senior high schools in the Tahoua region in Niger. The study tested two hypotheses: 1) Classroom interaction significantly affects students' academic communication skills, and 2) Interactive teaching methods have a greater impact on students' oral communication skills than traditional teaching methods. The study

encompassed a cohort of 1391 students, with a near-equal distribution of male and female participants within each school.

The findings suggest that classroom interaction and interactive teaching methods can significantly improve students' academic communication skills in EFL learning contexts. The results in Table 2 and Figure 1 indicate that the mean score for academic communication skills was 3.48, with a standard deviation of 0.83, a minimum score of 1.65, and a maximum score of 5.00, suggesting that students' academic communication skills varied significantly. The mean score for classroom interaction was 4.02, with a standard deviation of 0.61, a minimum score of 2.88, and a maximum score of 5.00, indicating that the students experienced a high level of interaction in the classroom. The mean score for teaching methods was 3.78, with a standard deviation of 0.74, a minimum score of 2.22, and a maximum score of 5.00, indicating that the teaching methods used varied significantly among teachers suggesting that both interactive and traditional teaching methods are used.

Table 3 displays the correlation matrix that shows the strength of the relationships between three variables: Academic Communication Skills (ACS), Classroom Interaction (CI), and Teaching Methods (TM). The values indicate that there are positive relationships between these variables, and improving any of these variables could potentially improve the others as well. Specifically, good academic communication skills tend to lead to better classroom interaction and benefit from a wider range of teaching methods. Teachers who foster positive classroom interaction tend to improve students' academic communication skills and may benefit from a wider range of teaching methods. A more comprehensive range of teaching methods may help improve students' academic communication skills and classroom interaction.

The regression analysis results indicate that classroom interaction and teaching methods are both significant predictors of academic communication skills. Classroom interaction appears to affect academic communication skills more than teaching methods substantially. However, the interaction effect between classroom interaction and teaching methods indicates that the relationship between classroom interaction and academic communication skills may depend on the level of teaching methods and vice versa. The results suggest that teachers should aim to create a classroom environment that fosters interaction and allows students to practice their communication skills. Additionally, incorporating interactive teaching methods in the classroom may further enhance students' academic communication skills.

The findings are congruent with prior research conducted by Hall and Verplaetse (2000), Long (1983), Lyster and Ranta (1997), Fadhila (2018), Brown and Palincsar (1989), and Vygotsky and Cole (1978), which suggest a positive correlation between classroom interaction and language learning outcomes. Additionally, the results align with studies conducted by Hall and Verplaetse (2000), Brown and Palincsar (1986), Flanders (1970), Johnson et al. (1981), and Johnson et al. (1991), which suggest that cooperative learning is an effective strategy for improving language learning outcomes. For instance, research by Long and Porter (1985), Ellis (1994), Swain and Lapkin (2000), and Gass and Mackey (2006) have all found a positive relationship between classroom interaction and language learning outcomes. These studies demonstrate that the more opportunities learners have to use the language in communicative situations, the better their language acquisition will likely be.

Similarly, studies by Johnson and Johnson (1987), Slavin (1995), and Storch and Aldosari (2010) have shown cooperative learning to be effective in improving language learning outcomes. By working collaboratively on tasks and projects, learners can practice using the language in meaningful contexts and receive feedback from their peers. This type of interaction can help

learners develop their communicative competence and increase their motivation to learn the language.

The present study adds to the growing body of literature highlighting the importance of classroom interaction and interactive teaching methods in language learning contexts. The results suggest that teachers should aim to create a classroom environment that fosters interaction and allows students to practice their communication skills. Incorporating interactive teaching methods in the classroom may further enhance students' academic communication skills, leading to better language learning outcomes.

This mixed-methods research study has successfully addressed the following three research questions: Firstly, it has shed light on the correlation between classroom interaction and academic communication skills among secondary school students enrolled in General Education in Tahoua. Secondly, it has assessed the effectiveness of interactive teaching methods in enhancing students' oral communication abilities compared to traditional teaching methods. Thirdly, it has explored the impact of incorporating interactive teaching strategies in the classroom on the academic communication skills of students in General Education in Tahoua. Overall, the study has contributed valuably to understanding the relationship between classroom interaction, teaching strategies, and academic communication skills in the context of secondary education in Tahoua.

3. CONCLUSIONS

This study explored the relationship between classroom interaction and academic communication skills among secondary school students in the Tahoua region of Niger. The study tested two hypotheses: 1) classroom interaction significantly affects students' academic communication skills, and 2) interactive teaching methods have a greater impact on students' oral communication skills than traditional teaching methods. Moreover, the study addressed three major questions: (1) What is the relationship between classroom interaction and academic communication skills among secondary school students in the Tahoua region in Niger? (2) How do interactive teaching methods impact students' oral communication skills compared to traditional teaching methods? and (3) How can interactive teaching strategies be incorporated into secondary school classrooms to improve students' communication skills?

The study used a mixed-methods research design, including classroom observations, semi-structured teacher interviews, a student questionnaire, and a controlled experiment. The cohort for the study consisted of 1391 students from four senior high schools in the region, with an almost equal distribution of male and female participants within each school.

Descriptive and inferential statistics were used to analyse the collected data to test its hypotheses and answer its research questions. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize the data. Inferential statistics such as t-tests and ANOVA were used to test the hypotheses and determine the significance of the results. Additionally, qualitative data were analysed through an inductive thematic approach.

The findings of the study align with previous research, including studies conducted by Hall and Verplaetse (2000), Long (1983), Lyster and Ranta (1997), Fadhila (2018), Brown and Palincsar (1989), Vygotsky and Cole (1978), and Johnson et al. (1981), and Johnson et al. (1991). They suggest that classroom interaction and cooperative learning are both effective in improving language learning outcomes. They particularly advocate that classroom interaction and interactive teaching methods significantly enhance students' academic communication skills in English as a foreign language (EFL) learning contexts. The study found that students' academic

communication skills varied significantly, with a high mean score for classroom interaction and a moderate mean score for teaching methods. The correlation matrix showed a strong positive relationship between classroom interaction and academic communication skills.

The study concluded that classroom interaction plays a crucial role in academic communication, and integrating interactive teaching strategies can improve students' oral communication skills. The results of this study have important implications for teacher training programs, and the study suggests the need for a shift towards interactive teaching methods to enhance communication skills among students.

Based on the findings of this study, several recommendations and suggestions have been proposed, which include the following:

1. Expanding the scope of the study to evaluate the generalizability of the outcomes in other regions or contexts,
2. Conducting further research to investigate the impact of interactive teaching methods on other communication abilities beyond oral communication skills,
3. Developing teacher training programs that incorporate interactive teaching strategies to enhance teachers' abilities to facilitate classroom interaction and communication skills development among their students,
4. Encouraging educators to adopt a student-centered approach to instruction that prioritizes classroom interaction and communication proficiencies,
5. Considering the implementation of technology-based interactive teaching techniques, such as online discussion forums or video conferencing, to improve student engagement and enhance communication skills.

These recommendations aim to build on the study's findings and provide practical ways to improve secondary school classroom interaction and communication skills development. By implementing these suggestions, educators and policymakers can facilitate the growth of functional communication skills essential for academic and personal success in today's interconnected world.

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Sincerely,

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Appendix

Classroom Interaction and Language Learning Questionnaire for Teachers and Students in Tahoua, Niger			
Section	**Type of Question**	**Question**	**Response Options**
Teachers	5-Likert scale	To what extent do you encourage classroom interaction among students?	1 (Not at all) to 5 (Very much)
Teachers	Semi-Structured	What strategies do you use to promote classroom interaction among students?	Open-ended
Teachers	5-Likert scale	How often do you use pair work/group work in your class?	1 (Never) to 5 (Always)
Teachers	Semi-Structured	How do you think pair work/group work benefits students in language learning?	Open-ended
Teachers	5-Likert scale	To what extent do you think students are motivated to speak in class?	1 (Not at all) to 5 (Very much)
Teachers	Semi-Structured	What strategies do you use to motivate students to speak in class?	Open-ended
Students	5-Likert scale	How comfortable are you with speaking English/French in front of the class?	1 (Not at all) to 5 (Very much)
Students	Semi-Structured	What factors contribute to your comfort level with speaking in class?	Open-ended
Students	5-Likert scale	How often do you work in small groups?	1 (Never) to 5 (Always)
Students	Semi-Structured	What benefits do you see in working in small groups for language learning?	Open-ended
Students	5-Likert scale	How much do you feel that classroom interaction strategies (pair work, group work, discussion/debate, simulation/role play) help you learn a language?	1 (Not at all) to 5 (Very much)
Students	Semi-Structured	Can you provide an example of a classroom interaction strategy that helped you learn a language?	Open-ended

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