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# Impact of teacher communication skills on students' classroom engagement in mathematics learning

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*Abstract.* The study investigated teachers' communication skills in relation to students' classroom engagement in mathematics learning. The study area is Makurdi Local Government Area in Benue State, Nigeria. This study adopted a cross-sectional research design. A sample of 34 teachers and 204 students were drawn from twenty schools. Two researcher-structured instruments were used for data collection: Mathematics Teacher's Communication Skills Questionnaire (MTCSQ) and Students' Engagement in Mathematics Questionnaire (SEMQ). Descriptive statistics, analysis of variance, and independent t-tests were used to address the research questions and test the hypotheses. It was found that there is significant difference among the mean ratings on behavioural, and emotional engagements of students in mathematics classes taught by teachers with poor, fair, and good communication skills. There is no significant difference among the mean ratings on combined and cognitive engagements of students in mathematics classes taught by teachers with poor, fair, and good communication skills. Equally found was that the differences between male and female students' mean engagement in mathematics for poor, fair, and good communication skill classes were not statistically significant. It was then recommended that teacher communication skills should be fashioned in ways to accommodate and strengthen each component of students' engagement.

*Key words and phrases:* communication skills, behavioural engagement, cognitive engagement, emotional engagement, classroom engagement.

*MSC Subject Classification:* 97C70.

# Introduction

Teachers are among the most important factors in students' learning and school activities (Hattie, 2012). Teachers are at the center of giving instructions, guiding students' learning, and ensuring that students learn mathematics to the best of their ability. Mathematics teachers can enhance students' learning by ensuring good teacher-student communication in the classroom scenario, which will enable students to practice enough to become familiar with what they have learned. A teacher is like a mentor and a role model for the students; hence, guiding and directing students according to the binding principles that govern his/her credibility and position as a teacher is one of the most important roles to perform. This makes teachers responsible for imparting meaningful cognitive and academic knowledge to the students. Therefore, mathematics teachers will need communication skills to help students understand and comprehend. Teachers need to interact with students and communicate ideas to them, which is essential for establishing a good relationship between teachers and students (Ahmad et al., 2017). Audu and Achor (2003) argue that classroom interaction is an active encounter between teacher and student using verbal, gestural, and resource tools to achieve effective communication in a teaching-learning process. This statement underscores the significance of classroom communication in relation to knowledge/performance and potentially classroom activities/engagement. Communication is a two-way process that involves both receiving and expressing information. Teachers should be receptive to both verbal and non-verbal forms of communication and use this knowledge to communicate in a language and tone that reassures students that their needs and emotions are being supported. It is important for teachers to have good communication skills.

Classroom interaction is an active relationship and encounter between teacher and student, which includes initiation of meaningful classroom discussions (Cohors-Fresenborg et al., 2014), verbal communication, body signals, and resource instruments to promote effective communication in the teaching-learning scenario (Achor et al., 2019). Teachers can also extend communication from students to fellow teachers to keep abreast of new developments, ideas, and skills. Students expect their teachers to be both creative and knowledgeable individuals who foster healthy discussions and engagements in the classroom, and who instill autonomy in students and also promote self-reliance (Chory et al., 2014). It is important for teachers to possess a range of competencies, including these qualities.

Weak communication skills in teachers can not only disable teaching-learning processes but also limit students' academic progress. These skills include insufficient teacher-student relationships, inadequate feedback, poor active listening, insufficient non-verbal communication, and improper teacher-student communication. It is important for teachers to improve their communication skills to ensure a positive and effective learning environment for their students. Research suggests that some teachers may struggle to provide meaningful and sufficient responses to their students' questions, potentially leaving students' immediate problems unresolved (Adeleke et al., 2022). This gap created could be detrimental to students' engagement and performance in mathematics.

Kokkonen (2009) suggests that individuals possess a set of free behaviours and actions related to their resources, knowledge, and abilities. When an individual perceives a threat to his/her free behaviours or actions, he/she may experience psychological reactance (Ball & Goodboy, 2014; Mazer, 2013). In the context of a classroom, this theory suggests that if a teacher uses forceful language or imposes strict rules, students may feel their freedom is being threatened and may react negatively. When a teacher uses unclear language, a student may perceive it as negative communication and react by refusing to follow instructions (LaBelle et al., 2013; Ball & Goodboy, 2014), and thereby exempting from classroom engagement. Effective classroom communication is one of the essential teacher qualities that existing literature refers to as 'effective teaching', and it is claimed that effective teachers should possess many different features, such as good communication, management, and organization skills (Bambaeeroo & Shokrpour, 2017; Kareva, 2011; Bella, 2013).

The better their communication skills, the more effectively the teachers can perform tasks of knowledge transmission; this in turn can lead to better academic performance for students. Poor communication skills may likely affect academic progress negatively. It could lead to students disliking school, lacking motivation, and disengaging from class activities. People are not aware of the fact that besides their verbal communication, the non-verbal gestures also transmit a potent message. Haneef et al. (2014) state that more often non-verbal communication occurs unconsciously. The body language, eye contact, physical appearance, and tone of voice provides meaningful information to the audience. The use of non-verbal technique is needed to show students that the teacher is alert and cares about their well-being (Chianson & Otor, 2015). Non-verbal communication is deemed more reliable and effective in comparison to verbal communication, as it gives additional support to the verbal communication (Akinola, 2014).

According to Caruso et al. (2017), good communication skills encompass creating safe learning with supportive relationships, encouraging more teamwork, nonverbal communication, active listening, giving feedback (Teachers Collegesj, 2019; Howell et al., 2014), creating a sense of humour and using technical skills (Segrist & Hupp, 2015), and good teacher-student interaction. Establishing good communication between students and their teachers is the basis for successful learning and teaching processes. Communication is more than words, and it is important for teachers to understand the non-verbal messages they are sending and receiving in the classroom (Sutiyatno, 2018). Mathematics teachers' spoken and non-spoken gestures count, as this can facilitate the communication of subject matter to students in order to enhance classroom learning and student engagement.

The main terms in this work are defined and explained as follows: *communication skills* which refer to behaviours through which a person can relate information with others in a way that leads to positive responses and avoid negative ones (Nakagawa et al., 2019). Mathematics teachers need to be aware if they possess proper communication skills, since this will favour their interactions with students to help them succeed in class activities. With proper measuring instruments, teachers can rate and even categorize their communication skills. In their study, Nourein et al. (2021) showed that communication skills can be rated and categorized as excellent, very good, fair, poor, and very poor to have a meaningful analysis of communication skills categorization. *Student engagement* refers to the degree of attention, curiosity, interest, optimism, and passion that students show in the classroom when they are learning or being taught, which extends to the level of motivation they have acquired, which could lead to effective learning and progress in their education (Bernstein, 2022). Fisher et al. (2020) and Cooper (2014), in their various works, outlined three dimensions of students' engagement as behavioural, emotional, and cognitive engagements. *Behavioural engagement* focuses on active participation and willingness to be involved in learning processes as well as academic, social, and co-curricular activities (Nguyen et al., 2018). Indicators are that they show up on time, turn in their homework, and bring the materials they need for class. They participate in class discussions, do what their teacher says, and always try their best. *Emotional engagement* focuses on the level and nature of students' reaction to teachers, classmates, academics, and school. It can be viewed as students' positive outlook on their educational experiences. Students can be said to be emotionally engaged when they treat their teachers and classmates with respect and approach schoolwork with optimism. Emotional engagement is characterized by how students are feeling about their learning. Teachers can get a good idea of students' emotional engagement in the way students participate in discussions, by the questions they ask and how they seek help, and by how they express curiosity (Wilson, 2021). Building positive relationships and creating a student-centered learning environment increases emotional engagement. Cognitive engagement focuses on how much students accept to invest their time and dedication to learning. Students' cognitive engagement involves students putting mental effort and cognitive processes to work during academic tasks and also participating and being active in the classroom (Sesmiyanti, 2016). Cognitive engagement is also focused on students' engagement with task at hand, effort, persistence, and experience of flow or been completely absorbed by a given class activity (Rotgans & Schmidt, 2011). This is also when students try to learn as much as they can, by paying attention in class and also asking thought-provoking questions. These dimensions of engagement may be affected by how well the teacher is able to effectively communicate with students.

Findings of research on teacher communication skills and students' performance are as follows: Shalian (2021) found out that there is a positive relationship in academic adjustment in the relationship between teacher communication skills and students' academic well-being. Relatedly, Obilor (2020) found that speaking, listening, attitude, gestures, and facial expressions, as components of a teacher's communication skills, influence students' performance to a high extent. Also, Khan et al. (2017) found that communication skills have a significant role in the academic achievement of students. These works find teacher communication skills a major factor that influences students' achievement/performance. Other works not dwelling on students' performance/achievement but on communication skills have the following findings: Afzal et al. (2021) found that teachers' communication styles enriched with empathy and genuine feedback were influencing factors engaging students in constructive academic behaviour. Likewise, Horan et al. (2012) found that instructor classroom communication influences students' emotional responses, which leads to specific approach or avoidance behaviours such as cognitive learning, affective learning, and motivation. Also, Nourein et al. (2021) in their study found that demographic and education-related characteristics underpinned medical students' attitudes towards communications skills compared to dental students. While some of these researches addressed generic communication skills, the present work is rather focused on constituents or aspects of teacher communication skills, which include giving students a safe and supportive environment, encouraging teamwork, non-verbal communication, active listening, giving feedback, and teacher-student interaction. Another variable considered in this study is gender and how different genders' engagement can be affected by teacher communication skills. Due to societal norms, students' engagement in mathematics is bedeviled with stereotypical ideologies, where mathematics is viewed as the male domain, thereby assigning less strenuous roles, subjects, and class tasks to female students. One prominent belief is that women have lower self-confidence in mathematics, which leads to higher mathematics anxiety, may tend to underperform in higher-pressure and time-constrained situations compared to male students (Arias et al., 2023). While males are attributed favourably to mathematics-related tasks of spatial reasoning, perseverance while faced with challenges, systematic and logical thinking, and being very confident in approaching mathematical tasks (Dersch et al., 2022). These stereotypical norms cause constraints in female students' passion to engage in mathematics activities and tasks, thereby promoting a more gender-unfriendly mathematics environment.

## Theoretical framework related to the study

This work focuses on four theories, there are: communication accommodation theory by Giles (2016), social cognitive theory by Bandura (1986), emotion regulation theory by Gross (1998), and gender schema theory by Bem (1981). These theories have a clear relatedness between teacher communication and students' behavioural, emotional, and cognitive engagements.

*Communication Accommodation Theory* (Giles, 2016) suggests that individuals usually adjust their communication style in order to accommodate or align with that of others, especially in social settings. In the classroom context, teachers who utilize and try to fine-tune their communication skills to match students' learning preferences, abilities, emotions, and cultural backgrounds are likely to achieve positive rapport and foster gleeful engagement among their students.

In the same vein, *Social Cognitive Theory* (Bandura, 1986) emphasizes the mutual or complementary interaction between cognitive processes, behaviour, and environmental influences. In the context of teacher communication, this theory would suggest that students observe and learn from teachers' communication behaviours, which in turn alter or impact their own engagement in class. Teachers who model clear communication by engaging in active feedback, active listening, encourage teamwork, and show empathy when teaching can enhance students' observational learning and promote positive behavioral, emotional, and cognitive engagement.

Also, *Emotion Regulation Theory* (Gross, 1998) focuses on how individuals handle and curb their emotional experiences. The quality of teacher communication skills can play a crucial role in how students will manage their emotions, as it is more likely they can regulate their emotions when the classroom environment is conducive and provides support for their emotional needs. Teachers who use empathetic communication, active listening, positive teacher-student interaction, and active feedback can help students keep check on their emotions, whereby stress levels, class anxiety, cognitive overload, and students' classroom disengagement can be minimized. This will significantly help to promote positive emotional engagement in the learning process.

In addition, the *Gender Schema Theory* (Bem, 1981) underscores male and female students' engagement, positing how individuals become gendered in society and how gender-related behaviours are transmitted or maintained. This theory focuses on the impact of societal norms and cultural expectations in shaping gender identity and influencing behaviour from an early age. At a young age, children grow up learning about gender roles and expectations through socialization agents such as parents, peers, teachers, and the media. By implication, male and female students may react to teacher communication differently due to their internalized gender schemas. Teachers who use inclusive communication practices that challenge stereotypes can encourage equal engagement across genders. Hence, teacher communication can either reinforce or challenge these schemas.

By integrating these theoretical perspectives, there is considerable theoretical evidence that teacher communication skills have a glaring role to play in launching students' positive engagement across multiple dimensions to enhance the teaching-learning process and optimize learning outcomes.

## Statement of the problem

The continued poor performance of students in mathematics in Makurdi Local Government Area is a matter of great concern to teachers, parents, and the students themselves (WAEC Chief Examiner's Report, 2021, 2022). The poor performance of students in mathematics has demotivated students and hastened the possibility of students downgrading the importance of mathematics in their daily lives. Students have tended to adopt a lackadaisical attitude towards mathematics as a result of their failure in the subject. This may have led to low levels of students' engagement in the classroom.

Students' non-participation in class is a sensitive factor that can hinder classroom activities. If students do not participate in class activities, the essence of the teacher's presence is questioned. Students, either male or female, will disengage from mathematics class activities if teacher communication tends to be one of the contentious factors. Students tend to prefer learning experiences that they perceive as enjoyable and pleasant, as favourable learning experiences can improve their performance, group participation, and active engagement in the classroom (Ní Fhloinn et al., 2016). If students find experiences unpleasant and dreadful, they may lack the enthusiasm to engage in them, especially if they are accompanied by poor communication. Students will gravitate towards classroom activities for which they have realistic high expectations, accompanied by healthy communication. Students learn to live and learn within the constraints of the teacher's standards, which builds confidence, motivation, persistence, and also engagement. Learner can lose focus and engagement if teachers fail to communicate and transfer knowledge to them effectively.

## Research questions

To address the statement of the problem, this study deals with student engagement in the mathematics classroom with regard to the teacher's communication skills. Specifically, the following research questions have been posed:

(1) How do students' mean combined engagement levels in mathematics differ between classes taught by teachers with poor, fair, and good communication skills?

(2) How do students' mean behavioural engagement levels in mathematics classes taught by teachers with poor, fair, and good communication skills differ?

(3) How do students' mean emotional engagement levels in mathematics classes taught by teachers with poor, fair, and good communication skills differ?

(4) How do students' mean cognitive engagement levels in mathematics classes taught by teachers with poor, fair, and good communication skills differ?

(5) How do male and female students' mean ratings in combined engagement in mathematics classrooms across the teachers with poor, fair, and good communication skills differ?

## Methodology

This study adopted a cross-sectional survey design, which basically collects and analyze data on certain attributes of varying sets of people who are of different ages or levels at about a particular time, for description of situations and establishment of frequencies in most cases about the entire population. Makurdi Local Government Area of Benue State, Nigeria was the study area. The population for the study was students in classes of senior secondary 2, and mathematics teachers from only co-educational schools in Makurdi Local Government Area. A sample of 34 teachers and 204 students (male =105, female= 99) was drawn from twenty schools. At the first stage, the 20 schools were selected using a purposive sampling method, thus only co-educational schools, schools with mathematics teacher with at least first degree and five years teaching experience were considered. The second stage was the selection of students using a simple random sampling procedure, where 'yes or no' was indicated on folded papers, with 50% of the folded papers containing 'yes' as selection rate from a total population of 408 students from the selected 20 schools, and 50% containing 'no'. Students who chose 'yes' (male=105, female=99) were automatically included in the study, while those who chose 'no' were not included in the study. The third stage was purposive sampling of all mathematics teachers in each of the selected schools as respondents for the study.

Two researcher-structured instruments were used for data collection, one for the teachers, and the other for the students, namely: the Mathematics Teacher's Communication Skills Questionnaire (MTCSQ) and the Students' Engagement in Mathematics Questionnaire (SEMQ). The MTCSQ in total has 48 items and is a Likert-scale instrument with four options ranging from Very High Extent (VHE=4 points), High Extent (HE=3points), and Moderate Extent (ME=2 points) to Low Extent (LE=1point). It has two sections, the first is the bio-data, section A, in which the researchers obtained some required information from teachers directly, and the second, section B covers six aspects of teacher communication skills with each having eight items, as shown in Table 1. The researchers observed the teachers while teaching and ticked features of the items from section B that mathematics teachers imbibed in the course of their teaching.

| **Aspects** | **Items** |
|---|---|
| (1) Safe environment and supportive relationship | *(a) address students' individual academic needs,*<br>*(b) know all students by their names,*<br>*(c) provide moral support for students,*<br>*(d) keep students safe from harm,*<br>*(e) make students know the importance of class contributions,*<br>*(f) support students' emotional needs,*<br>*(g) close gaps that may obstruct trust,*<br>*(h) let students know you are available for them.* |
| (2) Encourage teamwork | *(a) assign students to working teams,*<br>*(b) hold team members accountable for failure of a task,*<br>*(c) introduce new team members to already established groups,*<br>*(d) make students respect team members' ideas,*<br>*(e) let students know the value of team spirit,*<br>*(f) ensure that team members develop a sense of accommodation,*<br>*(g) provide teams with learning opportunities,*<br>*(h) clearly define roles and responsibilities for teams.* |
| (3) Non-verbal communication | *(a) use facial expressions to admit satisfaction,*<br>*(b) align body posture to classroom condition,*<br>*(c) change voice tone to show disapproval,*<br>*(d) use gesticulations to support class demonstrations,*<br>*(e) make frequent eye movements to maintain class attentiveness,*<br>*(f) pat students at the back to show they are doing a great job,*<br>*(g) smile to show approval, when necessary,*<br>*(h) nod head to encourage students' confidence.* |
| (4) Active listening | *(a) maintain eye contact when listening,*<br>*(b) give students undivided attention,*<br>*(c) respond to students if necessary while listening,*<br>*(d) ask questions only to ensure understanding,*<br>*(e) observe non-verbal messages sent across,*<br>*(f) keep an open mind, do not judge,*<br>*(g) do not interrupt by imposing solutions,*<br>*(h) give feedback after listening to students on students' request.* |
| (5) Giving class feedback | *(a) be specific with feedback,*<br>*(b) make feedback conversation bi-directional,*<br>*(c) be constructive with feedback,*<br>*(d) be timely with feedback,*<br>*(e) be objective with feedback,*<br>*(f) focus feedback on performance not personality,*<br>*(g) give feedback with a deep sense of empathy,*<br>*(h) avoid comparison during feedback.* |

| | |
|---|---|
| (6) Teacher-student interaction | *(a) motivate students through inspiring teaching,*<br>*(b) carry students along irrespective of background,*<br>*(c) view students as an important part of the class,*<br>*(d) allow students exercise control over their learning,*<br>*(e) guide students in positive direction for their personal growth,*<br>*(f) encourage students to appraise lessons objectively,*<br>*(g) call upon students in classroom decision making process,*<br>*(h) acknowledge students' efforts through praise.* |

*Table 1.* Aspects and contents of the Mathematics Teacher's Communication Skills Questionnaire (MTCSQ)

The Students' Engagement in Mathematics Questionnaire (SEMQ) is a 21-item, 3-component Likert-scale instrument with four options ranging from Strongly Agree (SA=4), Agree (A=3), Disagree (D=2), and Strongly Disagree (SD=1). This instrument was administered to the students. The instrument has two sections, section A requested information on students' biodata, while section B consisted of items on students' engagement in mathematics, considering three aspects of engagement with each aspect having seven items. The aspects are shown in Table 2.

First, construct validation was done for SEMQ and MTCSQ using factor analysis. This was based on the extraction method of principal component analysis. The rotation method of Varimax with Kaiser Normalization was used. The reason for the choice of construct validation was because students' power to think consists of several almost uncorrelated functioning parts known as factors, which could be identified through a technique known as factor analysis. The item selection was done using the rotated component matrix. The items with factor loading of 0.35 and above on any of the factors were identified and selected to be part of the final form of the instruments, and those that failed to load up to 0.35 were discarded. Therefore, items 4 on SEMQ, and 10 and 13 on MTCSQ, which failed to load up to 0.35 were discarded. Thus, 21 and 48 items survived for SEMQ and MTCSQ, respectively.

Both MTCSQ and SEMQ were trial-tested using ten schools with fourteen teachers and eighty students not being part of the main study, in order to establish the reliability coefficients of the instruments. Cronbach's alpha coefficients of the instruments were found to be 0.72 and 0.81, respectively. The instruments were given out to three experts to ascertain face validity, after which method of lesson observation was used to collect data from teachers via the MTCSQ, while students selected for the study were given the SEMQ to fill.

| Aspects | Sample Items |
|---|---|
| (1) Behavioural engagement | *(a) I attend mathematics classes on time,*<br>*(b) I turn-in mathematics homework as at when due,*<br>*(c) I participate in class discussions,*<br>*(d) I obey my teacher at all times,*<br>*(e) I bring materials for classwork as requested by my teacher,*<br>*(f) I listen attentively in class,*<br>*(g) I accept to lead teamwork when instructed by my teacher.* |
| (2) Emotional engagement | *(a) I have a strong belief that I will do well in mathematics when I participate in class activities,*<br>*(b) I feel happy answering questions in mathematics class,*<br>*(c) I feel no anxiety during class presentations,*<br>*(d) I am enthusiastic about doing mathematics classwork,*<br>*(e) I express myself fearlessly during class discussions,*<br>*(f) I trust my teacher's judgement of my performance in class activities,*<br>*(g) I feel excited when I am corrected during class discussions.* |
| (3) Cognitive engagement | *(a) I read mathematics content ahead of time,*<br>*(b) I share meaningful ideas during class discussions,*<br>*(c) I solve mathematics problems and give results before my teacher does,*<br>*(d) I answer questions correctly in mathematics class,*<br>*(e) I assist my classmates solve difficult problems in mathematics,*<br>*(f) I persistently solve mathematics questions in class until I get the answers right,*<br>*(g) I pay close attention to details to get accurate answers in classwork.* |

*Table 2.* Students' Engagement in Mathematics Questionnaire (SEMQ)

Reliability tests were further run for SEMQ and MTCSQ with the main data collected. This was to ensure consistency with earlier information collected in trial-testing. Thus, SEMQ has index of 0.83 and the sub-components are: Behavioural Engagement = 0.72; Emotional Engagement = 0.56; Cognitive Engagement = 0.76. For MTCSQ, the reliability coefficient was 0.94, while the sub-components are: Safe Environment and Supportive Relationship = 0.78; Encouraging Team Work = 0.95; Non-Verbal Communication = 0.82; Active Listening = 0.73; Giving Class Feedback = 0.76, and Teacher-Student Interaction = 0.76.

Results collected from the MTCSQ helped the researchers to categorize 8 teachers as good, 21 teachers as fair, and 5 teachers as poor in communication skills. Mean and standard deviation were used to answer the research questions. Analysis of Variance and independent t-test were used as inferential statistics to test the hypotheses at 0.05 level of significance, where necessary, post-hoc analyses were added.

# Results

## Research questions

Based on the results of the MTCSQ, the teachers were categorized into one of three groups, 8 teachers fell under good, 21 teachers fell under fair, and 5 teachers fell under poor category according to their communication skills. Following the work of Nourein et al. (2021), this categorization was done on the basis of mean scores, with 1.00–1.99 considered as poor communication skills, 2.00–2.99 rated as fair communication skills, and 3.00–4.00 as good communication skills.

This categorization was then used to sort the data from the SEMQ in order to answer the research questions. Research Questions 1–5 were answered by comparing students' mean scores and standard deviation on the SEMQ and its dimensions between the different groups. While ANOVA statistics was used to confirm the mean differences in Questions 1–4, an independent t-test was used to test related data for Question 5.

| **A: Test of Homogeneity of Variances for t-test** | | | | Remark |
|---|---|---|---|---|
| Classroom Engagement Level | | | | |
| *Levene Statistic* | *df1* | *df2* | *Sig.* | not significant |
| .385 | 1 | 201 | .536 | |
| **B: Test of Homogeneity of Variances for ANOVA** | | | | |
| Classroom Engagement Level | | | | |
| *Levene Statistic* | *df1* | *df2* | *Sig.* | not significant |
| .385 | 1 | 201 | .536 | |

*Table 3.* Levene's test of homogeneity

The data for the main analysis using t-test and ANOVA were first subjected to Levene's test of homogeneity in Table 3. Prior to conducting the t-test and ANOVA, Levene's test was performed to assess the homogeneity of variances. The test was not significant ($p = .536$), indicating that the assumption of equal variances was met. Thus, the independent t-test and the ANOVA were deemed appropriate for subsequent analysis. 'A' is for the t-test, while 'B' is for the ANOVA, and both have shown that the differences among the means were not significant.

*Research Question 1.* How do students' mean combined engagement levels in mathematics differ between classes taught by teachers with poor, fair, and good communication skills?

Students grouping was done based on their teachers' communication skills. This led to 24 students falling under teachers categorized as "poor", 87 with "fair", and 93 with "good" communication skills. Then mean scores from the SEMQ were calculated. To answer the first research question, all 21 items from the student questionnaire were taken into account. Results from Table 4 show that, overall, students' mean engagement scores were slightly higher in classes with poor teacher communication skills (3.43), followed by fair communication skills (3.39), and lastly, good communication skills (3.38). From the table, the standard deviation of students' engagement in classes of teachers with good communication skills (0.34) was more homogenous, meaning the data sets of this category were more clustered about the mean compared to the other two categories.

| **Mathematics Teacher Communication Skills** | | **Students' Combined Engagement** | | **Behavioural Engagement** | | **Emotional Engagement** | | **Cognitive Engagement** | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | *Mean* | *SD* | *Mean* | *SD* | *Mean* | *SD* | *Mean* | *SD* |
| Poor | 24 | 3.43 | .37 | 2.95 | .39 | 2.95 | .39 | 3.31 | .45 |
| Fair | 87 | 3.39 | .36 | 3.32 | .29 | 3.30 | .25 | 3.20 | .37 |
| Good | 93 | 3.38 | .34 | 3.39 | .38 | 3.40 | .36 | 3.28 | .35 |

*Table 4.* Mean and standard deviation scores on students' engagement with teacher's communication skills

The observed difference among the means was further subjected to ANOVA to compare the students' data regarding the first research question.

| **Students Engagement** | | *Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* | *Eta Squared* |
|---|---|---|---|---|---|---|---|
| Combined Engagement | Between Groups | .041 | 2 | .021 | .178 | .843 | .002 |
| | Within Groups | 23.815 | 202 | .118 | | | |
| | Total | 23.856 | 204 | | | | |
| Behavioural Engagement | Between Groups | 3.728 | 2 | 1.864 | 15.222 | .000 | .132 |
| | Within Groups | 24.616 | 202 | .122 | | | |
| | Total | 28.344 | 204 | | | | |
| Emotional Engagement | Between Groups | 3.762 | 2 | 1.881 | 18.362 | .000 | .176 |
| | Within Groups | 20.589 | 202 | .102 | | | |
| | Total | 24.351 | 204 | | | | |
| Cognitive Engagement | Between Groups | .378 | 2 | .189 | 1.364 | .258 | .013 |
| | Within Groups | 27.830 | 202 | .138 | | | |
| | Total | 28.208 | 204 | | | | |

*Table 5.* ANOVA results on engagements of students in mathematics classes taught by teachers with poor, fair, and good communication skills

The results of this ANOVA, shown in Table 5, indicated no statistically significant group differences ($F_{2,\,202} = 0.178$; $p = .843 > 0.05$). Hence, we do not reject the null hypothesis, and therefore retained that there is no significant difference among the mean rating on combined engagements of students in mathematics classes taught by teachers with poor, fair, and good communication skills. The eta squared of .002 (or .2%) was considered, which means that the $F$ value of .178 can only be explained by an intangible fraction of the variance.

*Research Question 2.* How do students' mean behavioural engagement levels in mathematics classes taught by teachers with poor, fair, and good communication skills differ?

To answer the second research question, only the first aspect of the SEMQ (7 items) was used with the three components separated. Results from Table 4 show that students' behavioural engagement mean scores were higher in classes with good teacher communication skills (3.39), followed by fair communication skills (3.32), and lastly, poor communication skills (2.95). From the table, the standard deviation of students' behavioural engagement in classes of teachers with fair communication skills (0.29) was more homogenous, meaning the data sets of this category were more clustered about the mean compared to the other categories.

Comparing the groups in an ANOVA result indicates statistically significant differences (see Table 5, $F_{2,202} = 15.22$; $p = 0.00 < 0.05$). Hence, we reject the null hypothesis and conclude that there is significant difference among the mean ratings on behavioural engagements of students in mathematics classes taught by teachers with poor, fair, and good communication skills. The eta squared of .132 (or 13.2%) (as seen in Table 5) was considered moderate, which means that the $F$ value of 15.22 can be explained by a moderate fraction of the variance. The pairwise comparison in Table 6 indicates significant differences among pairs on individual groups, except between fair communication skills and good communication skills on behavioural engagement.

*Research Question 3.* How do students' mean emotional engagement levels in mathematics classes taught by teachers with poor, fair, and good communication skills differ?

To address the third research question, the second aspect of the SEMQ (7 items) was featured; mean values of the students' groups sorted by their teacher's communication skills are shown in Table 4. These results show that students' emotional engagement mean scores were higher in classes with good teacher communication skills (3.40), followed by fair communication skills (3.30) and lastly, poor communication skills (2.95). From the table, the standard deviation of students' emotional engagement in classes of teachers with fair communication skills

**Dependent Variable: Behavioural Engagement**
Bonferroni

| **Mathematics Teacher Communication Skills** (I) | (J) | *Mean Difference* (I-J) | *Std. Error* | *Sig.* | *Effect Size* |
|---|---|---|---|---|---|
| Poor | Fair | -.372 | .081 | .000 | .618 |
| | Good | -.441 | .080 | .000 | .624 |
| Fair | Poor | .372 | .081 | .000 | .618 |
| | Good | -.069 | .052 | .527 | .100 |
| Good | Poor | -.441 | .080 | .000 | .624 |
| | Fair | .069 | .052 | .527 | .100 |

*. The mean difference is significant at the 0.05 level.

*Table 6.* ANOVA results on engagements of students in mathematics classes taught by teachers with poor, fair, and good communication skills

(0.25) was more homogenous, meaning the data sets of this category were more clustered tightly around the mean compared to the other categories.

The results of the ANOVA to compare the groups are given in Table 5; they show statistically significant differences ($F_{2,\,202} = 18.36$; $p = 0.00 < 0.05$). Hence, we reject the null hypothesis and conclude that there is significant difference among the mean rating on emotional engagements of students in mathematics classes taught by teachers with poor, fair, and good communication skills. The eta squared of .176 (or 17.6%) from Table 5 was considered large, which means that the $F$ value of 18.36 can be explained by a large fraction of the variance. The pairwise comparison in Table 7 indicates significant differences among pairs on individual groups, except between fair communication skills and good communication skills on emotional engagement.

*Research Question 4.* How do students' mean cognitive engagement levels in mathematics classes taught by teachers with poor, fair, and good communication skills differ?

The fourth research question was answered by considering only the third aspect of the SEMQ (7 items). Results in Table 4 show that students' cognitive engagement mean scores were higher in classes with poor teacher communication skills (3.31), followed by good communication skills (3.28) and lastly, fair communication skills (3.20). From the table, the standard deviation of students' cognitive engagement in classes of teachers with good communication skills (0.35)

**Dependent Variable: Emotional Engagement**
Bonferroni

| **Mathematics Teacher Communication Skills** (I) | (J) | *Mean Difference* (I-J) | *Std. Error* | *Sig.* | *Effect Size* |
|---|---|---|---|---|---|
| Poor | Fair | -.346* | .074 | .000 | .618 |
| | Good | -.444* | .073 | .000 | .735 |
| Fair | Poor | .346* | .074 | .000 | .618 |
| | Good | -.097 | .048 | .127 | .181 |
| Good | Poor | .44393* | .073 | .000 | .735 |
| | Fair | .09746 | .048 | .127 | .181 |

*. The mean difference is significant at the 0.05 level. * = Significant at .05 level

*Table 7.* Multiple comparisons results on emotional engagement of students in mathematics classes taught by teachers with poor, fair, and good communication skills

was more homogenous, meaning the data sets of this category were more clustered tightly around the mean compared to the other categories.

Results in Table 5 show that the mean differences observed in Table 4 are not statistically different ($F_{2,\,202} = 1.36$; $p = .258 > 0.05$). Hence, we do not reject the null hypothesis and conclude that there is no significant difference among the mean ratings on cognitive engagements of students in mathematics classes taught by teachers with poor, fair, and good communication skills. The eta squared of .013 (or 1.3%) was considered low, which means that the $F$ value of 1.36 can be explained by a very low fraction of the variance.

*Research Question 5.* How do male and female students' mean ratings in combined engagement in mathematics classrooms across the teachers with poor, fair, and good communication skills differ?

The difference in means, standard deviations and independent t-test values for students taught by teachers with poor, fair, and good communication skills are displayed in Table 8. For the poor communication skill classroom (male = 11, female = 13), the mean of 3.507 and standard deviation of .386 were obtained for the male students, while the mean of 3.468 and standard deviation of .254 for the female students. From the table, too, the standard deviation of female students in the poor communication skill group was clustered tightly around the mean, and hence considered more homogenous compared to that of their male counterparts. The difference between their means was not statistically significant ($t = .283$, $p = .780 > .05$).

Furthermore, for the fair communication skill classroom (male = 37, female = 50), the mean of 3.365 and standard deviation of .255 were obtained for the male students, while the mean of 3.360 and standard deviation of .383 for the female students. From the table also, the standard deviation of male students in the fair communication skill group was clustered tightly around the mean and considered more homogenous compared to their female counterparts. The difference between their means was not statistically significant ($t = .064$, $p = .949 > .05$).

For the good communication skill classroom (male = 57, female = 36), the mean of 3.393 and standard deviation of .375 were obtained for the male students while mean of 3.378 and standard deviation of .371 were obtained for the female students. The table further shows that the standard deviation of female students in the good communication skill group clustered tightly around the mean, and therefore was considered more homogenous compared to their male counterparts. The difference between their means was not statistically significant ($t = 0.191$, $p = .849 > 0.05$).

The effect size for the independent t-test of difference between male and female students was .461 for poor communication skill class, 0.009 for fair communication skill class, and .025 for good communication skill class. Thus, the effect size of 46.1%, .9% and 2.5% were low except for poor communication skill class, though the difference was not statistically significant. The high effect size for the poor communication skill group when the difference between means was not significant could be a source of worry.

| **Communication Level of Teachers** | **Gender** | *N* | *Mean* | *SD* | *t* | *df* | *Sig(2-tailed)* | *Effect Size* |
|---|---|---|---|---|---|---|---|---|
| Poor | Male | 11 | 3.507 | .386 | .283 | 22 | .780 | .461 |
| | Female | 13 | 3.468 | .254 | | | | |
| Fair | Male | 37 | 3.365 | .255 | .064 | 85 | .949 | .009 |
| | Female | 50 | 3.360 | .383 | | | | |
| Good | Male | 57 | 3.393 | .375 | .191 | 91 | .849 | .025 |
| | Female | 36 | 3.378 | .371 | | | | |

Note: N = number of students

*Table 8.* Mean, standard deviation and t-test of male and female students' mean ratings in mathematics engagement across teachers with poor, fair, and good communication skills

## Discussion of findings

This study investigated the impact of teachers' communication skills – categorised as poor, fair, and good – on their students. While the results show no significant influence of teachers' communication skills on students' combined engagement and also on students' cognitive engagement due to teachers' communication skills, there is, however, a significant influence of teachers' communication skills on students' behavioural and emotional engagements. The finding on combined engagement is surprising, as Zhao (2018) found that teachers with good communication behaviours (sensitive to students' needs, considering students' perspectives, caring and nurturing) endeared students to be more engaged and enthusiastic about learning. Afzal et al. (2021) also published a finding that contradicts this study by showing that teachers' communication style, enriched with empathy and genuine feedback, was an influential factor in engaging students in constructive academic behaviour. The results of this study may have turned out this way probably because of other confounding factors that interfere with one or more of the components of students' engagement (behavioural, emotional, and cognitive) in class. That there was no significant difference in students' cognitive engagement due to teachers' communication skills deserves attention in this study, as it may be due to an engagement facilitator factor. An engagement facilitator guides groups and individuals through a process to address complex issues. They help people take responsibility, collaborate, and make decisions that are inclusive and respectful; provides the methods and means that enable groups and individuals to craft answers to complex issues without necessarily being a subject matter expert. The possibility of teachers not being knowledgeable enough or experts in the field but acting as mere guides perhaps could call for attention of future researchers.

Regarding the significant difference between the mean scores of students' behavioural engagement in mathematics classes taught by teachers with poor, fair, and good communication skills, this finding is not surprising. It is consistent with that of Barida and Muarifah (2018) who found significant relationship between teacher communication skills and students' well-being. The authors found that students with good self-development have a sense of progress, realised their capabilities and are able to use this to improve themselves and their behaviour in school or class. Students tend to direct positive behaviour towards what is favourable and are likely to withdraw and exhibit negative behaviour towards what is unfavourable.

Horan et al. (2012) found that teachers' classroom communication influences students' emotional responses, leading to specific approach or avoidance behaviours such as cognitive learning, affective learning, and motivation. This finding corroborates with the present finding that there is significant difference between the mean ratings of students' emotional engagement in mathematics classes taught by teachers with poor, fair, and good communication skills. Mathematics teachers who are able to communicate clearly by showing students that their well-being and concerns are their responsibility to address will definitely gain students' emotional approval. Students are expected to respond positively and productively emotionally to the demands of the lesson and classroom situations more likely than if the classroom scenario tampers with or takes a toll on their emotional needs. The findings of the study also revealed that there was no significant difference in the mean rating of students' cognitive engagement in mathematics classes taught by teachers with poor, fair, and good communication skills. This counters the findings of Obilor (2020) and Khan et al. (2017), whose work found in particular that speaking, listening, attitude, gestures, and facial expressions as components of teachers' communication skills influence students' performance to a great extent. Typically, students will be engaged in class discussions, be receptive to exchanging ideas, and want to engage in class activities when communication gaps are closed. Perhaps, communication gaps created by the teachers during lessons, whether deliberately or unconsciously, may have interfered with the findings. Since teachers are human and are not perfect, communication lapses and bridges may be created at some point in the class. These lapses could be due to the overwhelming nature of the teaching job, whereby the teacher is expected to teach exceptionally and impeccably, and at the same time, address students' challenges in class.

Finally, the results of the study showed that the difference in the mean mathematics engagement between male and female students in the poor communication skills class was not statistically significant. Furthermore, for the fair communication skill classroom, the result showed that the difference between the male and female students' mean mathematics engagement was not statistically significant. Also, for the good communication skill classroom, the result showed that the difference between the mean mathematics engagement of male and female students was not statistically significant. Consistently across the three levels of communication, male and female students' mathematics engagement did not differ significantly. This result is not consistent with that of Kessels and Van Houtte (2022), namely that female students are more successful and show more behavioural engagement at school than male students. These findings probably clarify that male students are not more inclined to use basic and deep learning strategies during learning activities, incorporate rote learning during learning, and strategize ways to plan, monitor and evaluate their learning. Nor are male students more motivated and enthusiastic about school mathematics activities than females. This finding is again not in agreement with the previous research that shows female students can use mathematical language better than male students (Alfarisyi & Sutiarso, 2020). Ní Fhloinn et al. (2016) provided explanation to this gender difference finding by asserting that female students tend to have difficulty understanding and interpreting the information presented in the questions, so they all focus on the final answer only, without checking the truth of the facts and concepts presented in the questions.

In line with the present study, Ní Fhloinn et al. (2016) reported that among students who engaged with mathematics support, no gender-based differences were observed in terms of the support's impact. Inferring that both male and female students perceived the experience as beneficial to their studies. They further found that although female students were more likely to state that mathematics support had been a huge help in coping with the mathematics demands of their course, overall, there was no evidence of gender disparity in terms of the self-reported impact of mathematics support from the students' perspective.

## Recommendation

Based on the findings of the study, we recommend that mathematics teachers should view students' engagement as a complex construct in which behavioural, cognitive, and emotional engagements complement each other and move pari passu to enhance students' learning. Therefore, the teacher's communication skills or style should be designed to include, accommodate, and enhance each component of students' engagement.

### Appropriateness of work for teaching mathematics and computer science

The teaching of mathematics in our country has come a long way without proper emphasis and careful attention given to the way mathematics teachers communicate the subject to students. The way mathematics is communicated to students is the way they will receive, accept, value, and want to engage in learning the subject, and this applies to any other subject such as computer science. The teacher who serves as communicator of this subject may sometimes neglect aspects that help to reassure students that they are doing well, they need improvement, they need more focus, and they need to work with teachers to make the teaching and learning process successful. Without these assurances and many others that come from teacher communication, students end up being withdrawn from class activities, which can lead to failure and less attention paid to the learning of mathematics, which could further hamper their knowledge of computer science. This work has exposed readers to three major aspects of students' engagement that need to be serviced; they are behavioural, emotional, and cognitive engagements. A close look at these components can simply tell that a considerable amount of active learning revolves around these aspects. These encompass the major sense and sensibility of students to help garner meaningful and progressive learning both in the learning of mathematics and computer science.

## References

Achor, E. E., Danjuma, I. M., & Orji, A. (2019). Classroom interaction practices and students' learning outcomes in physics: Implication for teaching-skill development for physics teachers. *Journal of Education and e-Learning Research*, *6*(3), 96–106. doi:10.20448/journal.509.2019.63.96.106.

Adeleke, F. F., Adesua, V. O., & Jimola, F. E. (2022). Communication skills and its influence on teacher effectiveness. *Universal Journal of Education Research*, *10*(3), 240–245. doi:10.13189/ujer.2022.100306.

Afzal, A., Arif, S., Rasul, I., & Chaudhry, M. S. (2021). Effect of teacher's communication styles on students' engagement. *Psychology and Education*, *58*(5), 5593–5604. http://psychologyandeducation.net/pae/index.php/pae/article/view/6461/5410

Ahmad, C. N. C., Shaharim, S. A., & Abdullah, M. F. N. L. (2017). Teacher-student interactions, learning commitment, learning environment and their relationship with student learning comfort. *Journal of Turkish Science Education*, *14*(1), 57–72. doi:10.12973/tused.10190a.

Akinola, O. A. (2014). The use of non-verbal communication in the teaching of English language. *Journal of Advances in Linguistics*, *4*(3), 428–433. doi:10.24297/jal.v4i3.2149.

Alfarisyi, D., & Sutiarso, S. (2020). Mathematical communication skills based on gender. *MaPan*, *8*(2), 300–314. https://doi.org/10.24252/mapan.2020v8n2a9

Arias, O., Canals, C., Mizala, A., & Meneses, F. (2023). Gender gaps in Mathematics and Language: The bias of competitive achievement tests. *PLoS ONE*, *18*(3), e0283384. https://doi.org/10.1371/journal.pone.0283384

Audu, T. A., & Achor, E. E. (2003). The role of questioning and wait-time interactional processes in science teaching and learning. *Journal of Science and Vocational Education*, *2*(2), 53–56.

Ball, H., & Goodboy, A. K. (2014). An experimental investigation of the antecedents and consequences of psychological reactance in the college classroom. *Communication Education*, *63*(3), 192–209. https://doi.org/10.1080/03634523.2014.918634

Bambaeeroo, F., & Shokrpour, N. (2017). The impact of the teachers' non-verbal communication on success in teaching. *Journal of Advances in Medical Education and Professionalism*, *5*(2), 51–59.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Prentice Hall.

Barida, M., & Muarifah, A. (2018). The role of teachers' communication skills on children's well-being in school. In *Proceedings of the International Conference on Child-Friendly Education* (pp. 478–482). Muhammadiyah Surakarta University.

Bella, J. (2013). *Teacher effectiveness and professional competency among higher secondary school teachers in Kottayam District, Kerala* [PhD dissertation, Andhra University]. http://hdi.handle.net/10603/8678

Bem, S. L. (1981). Gender schema theory: A cognitive account of sex typing. *Psychological Review*, *88*(4), 354–364. https://doi.org/10.1037/0033-295X.88.4.354

Bernstein, L. (2022). What is student engagement and why does it matter? [web blog]. Xello Inc. Retrieved from https://xello.world/en/blog/student-engagement/what-is-student-engagement/

Caruso, M., Colombi, A. G., & Tebbit, S. (2017). Teaching how to listen. Blended learning for the development and assessment of listening skills in a second language. *Journal of University Teaching and Learning Practice*, *14*(1), Article 14. http://ro.uow.edu.au/jutlp

Chianson, M. M., & Otor, E. E. (2015). Ensuring healthy teacher-student relationship in mathematics and science classes through strategic classroom management. *International Research in Education*, *3*(1), 93–102. http://dx.doi.org/10.5296/ire.v3i1.7000

Chory, R. M., Horan, S. M., Carton, S. T., & Houser, M. L. (2014). Toward a further understanding of students' emotional responses to classroom injustice. *Communication Education*, *63*(1), 41–62. doi:10.1080/03634523.2013.837496.

Cohors-Fresenborg, E., Kaune, C., & Zülsdorf-Kersting, M. (2014). *Klassifikation von metakognitiven und diskursiven Aktivitäten im Mathematik- und Geschichtsunterricht mit einem gemeinsamen Kategoriensystem* [Classification of metacognitive and discursive activities in mathematics and history lessons with a common system of categories]. Forschungsinstitut für Mathematikdidaktik.

Cooper, K. S. (2014). Eliciting engagement in the high school classroom: A mixed-methods examination of teaching practices. *American Educational Research Journal*, *51*(2), 363–402. https://journals.sagepub.com/doi/10.3102/0002831213507973

Dersch, A. S., Heyder, A., & Eitel, A. (2022). Exploring the nature of teachers' math-gender stereotypes: The math-gender misconception questionnaire. *Frontiers in Psychology*, *13*, 820254. doi:10.3389/fpsyg.2022.820254.

Fisher, D., Frey, N., & Hattie, J. (2020). *The distance learning playbook, grades K-12: Teaching for engagement and impact in any setting.* Corwin. https://us.corwin.com/books/distance-learning-playbook-275865

Giles, H. (2016). Communication accommodation theory. In K. B. Jensen, E. W. Rothenbuhler, J. D. Pooley, & R. T. Craig (Eds.), *The International Encyclopedia of Communication Theory and Philosophy.* Wiley Online Library. https://doi.org/10.1002/9781118766804.wbiect056

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology*, *2*(3), 271–299. https://doi.org/10.1037/1089-2680.2.3.271

Haneef, M., Faisal, M. A., Alvi, A. K.,& Zulfiqar, M. (2014). The role of nonverbal communication in teaching practice. *Science International (Lahore)*, *26*(1), 513–517.

Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning.* Routledge.

Horan, S. M., Martin, M. M., & Weber, K. (2012). Understanding emotional response theory: The role of instructor power and justice messages. *Communication Quarterly*, *60*(2), 210–233. https://doi.org/10.1080/01463373.2012.669323

Howell, A., Caldarella, P., Korth, B., & Young, K. R. (2014). Exploring the social validity of teacher praise notes in elementary school. *The Journal of Classroom Interaction*, *49*(2), 22–32. https://www.jstor.org/stable/44735701

Kareva, V. (2014). The influence of classroom communication on students' commitment to the university. *European Scientific Journal*, *7*(26), 90–104.

Kessels, U., & Van Houtte, M. (2022). Side effects of academic engagement? How boys' and girls' well-being is related to their engagement and motivational regulation. *Gender and Education*, *34*(6), 627–642. doi:10.1080/09540253.2021.2011840.

Khan, A., Khan, S., Zia-ul-Islam, S., & Khan, M. (2017). Communication skills of a teacher and its role in the development of the students' academic success. *Journal of Education Practice*, *8*(1), 18–21. https://files.eric.ed.gov/fulltext/EJ1131770.pdf

Kokkonen, T. (2009). *Discourse between teacher and student: The effect of teacher's style of communication on learning environment as viewed in literature and the cinema* [Bachelor thesis, University of Jyväskylä]. https://urn.fi/URN:NBN:fi:jyu-200905251624

LaBelle, S., Martin, M. M., & Weber, K. (2013). Instructional dissent in the college classroom: Using the instructional beliefs model as a framework. *Communication Education*, *62*(2), 169–190. https://doi.org/10.1080/03634523.2012.759243

Mazer, J. P. (2013). Student emotional and cognitive interest as mediators of teacher communication behaviours and student engagement: An examination of direct and interaction effects. *Communication Education*, *62*(3), 253–277. https://doi.org/10.1080/03634523.2013.777752

Nakagawa, S., Fischkoff, K., Berlin, A., Amell, T. D., & Blinderman, C. D. (2019). Communication skills training for general surgery residents. *Journal of Surgical Education*, *76*(5), 1223-1230. https://doi.org/10.1016/j.jsurg.2019.04.001

Nguyen, T. D., Cannata, M., & Miller, J. (2018). Understanding student behavioral engagement: Importance of student interaction with peers and teachers. *The Journal of Educational Research. 111*(2), 163–174. Online version published in 2016. doi:10.1080/00220671.2016.1220359.

Ní Fhloinn, E., Fitzmaurice, O., Mac an Bhaird, C., & O'Sullivan, C. (2016). Gender differences in the level of engagement with mathematics support in higher education in Ireland. *International Journal of Research in Undergraduate Mathematics Education*, *2*, 297–317. https://doi.org/10.1007/s40753-016-0031-4

Nourein, A. A. E., Shahadah, R. F., Alnemer, M. A., Al-Harbi, S. S., Fadel, H. T., & Kassim, S. (2021). Comparative study of attitudes towards communication skills learning between medical and dental students in Saudi Arabia. *International Journal of Environmental Research and Public Health*, *18*(1), 128. doi:10.3390/ijerph18010128.

Obilor, E. I. (2020). Teachers' communication skills and students' academic performance. *International Journal of Advanced Academic and Educational Research*, *13*(4), 1–16.

Rotgans, J. I., & Schmidt, H. G. (2011). Cognitive engagement in the problem-based learning classroom. *Advances in Health Sciences Education*, *16*(4), 465–479. https://doi.org/10.1007/s10459-011-9272-9

Segrist, D. J., & Hupp, S. D. A. (2015). This class is a joke! Humour as a pedagogical tool in the teaching of psychology. Society for the Teaching of Psychology's Office of Teaching Resources. Retrieved from http://www.teachpsych.org/Resources/Documents/otrp/resources/segrist15.pdf

Sesmiyanti, S. (2016). Student's cognitive engagement in learning process. *Journal Polingua – Scientific Journal of Linguistics Literature and Education*, *5*(2), 48–51. doi:10.30630/polingua.v5i2.34.

Shalian, J. (2021). Relationship between teachers' communication skills and students' academic well-being with emphasis on the mediating role of academic adjustment in girls' high schools in Kashmar. *Journal of Management and Educational Perspective*, *3*(1), 139–167. https://dx.doi.org/10.22034/jmep.2021.282353.1056

Sutiyatno, S. (2018). The effect of teacher's verbal communication and non-verbal communication on students' English achievement. *Journal of Language Teaching and Research*, *9*(2), 430–437. http://dx.doi.org/10.17507/jltr.0902.28

Teachers Collegesj. (2019). What is the communication between teachers and students? Retrieved from https://teacherscollegesj.org/what-is-the-communication-between-teachers-and-students/

WAEC (2021). The West African Examinations Council Chief Examiner's Report. WAEC Press.

WAEC (2022). The West African Examinations Council Chief Examiner's Report. WAEC Press.

Wilson, J. (2021). Deepening students' emotional engagement. Moreland University. Retrieved from https://moreland.edu/resources/blog-insights/emotional-engagement-in-hybrid-learning

Zhao, Y. (2018). Achievement emotions as mediators of teacher communication behaviour and student participation – A Model construction. In Proceedings of the 3rd International Seminar on Education Innovation and Economic Management (SEIEM 2018) (pp. 375–378). doi:10.2991/seiem-18.2019.96.

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