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A Gender-Based Analysis of Classroom Interaction Practices: The Effect Thereof on University Students' Academic Performance

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Abstract. The need to optimize student interactions in universities for enhanced academic performance has been a subject of debate and discussion in different academic fora. A number of studies have shown that students, both male and female, can assert themselves academically if they are provided with opportunities for active participation and interaction with their lecturers and peers for both the horizontal and the vertical sharing of knowledge. The purpose of this study, therefore, was to investigate the gender-based interaction practices of science, mathematics and technology university students, and how these interactive patterns influence their academic performance. Using a quantitative approach located in the post-positivist paradigm, the study employed a structured questionnaire to collect the data from a sample of 1285 students from three universities. The results of the study showed that institutional practices, lecturers, parents, peers, learning content and artifacts, as well as the classroom environment, have a significant influence on the gender-based interaction practices of university students. Furthermore,, the results showed that the levels of interaction have a significant influence on the academic performance of university students, according to gender. As a main recommendation, it was proposed that universities should come up with gender-equity policies that would guide how the universities and their stakeholders could cater for the issues of gender equity.

Keywords: classroom environment; gender; gender equity; higher education; institutional practices; STEM

1. Introduction

The issues of gender and gender equity in all the facets of life including education, have become a topical issue the world over. Governments worldwide have come up with policies that promote the equal and equitable participation of men and women, girls and boys, in the economic spheres that include education. In the context of Zimbabwe, "Since 1980, a number of policies and strategies have been put in place, in order to promote gender equity in education; and these have included the introduction of education for all, free primary education, and the attraction of international agencies that support education in the country"

(Chabaya & Gudhlanga, 2013, p.1). While these and other policies have contributed to a significant increase in the education of girls, thereby achieving gender equity in the participation of girls in education, there is still work in progress, particularly in Science, Technology, Engineering and Mathematics (STEM), subjects in which only 19% of female students are enrolled, compared to 39% of male students (World Economic Forum, 2018).

Gender-based interactions in the science, mathematics and technology classrooms have been the subject of extensive research and debate over a number of decades, owing to their importance in the teaching and learning processes (Howe & Abedin, 2013). These interactions, as social skills, have also been viewed in a number of studies, as being critical for enhancing the academic performance of university students (Consuegra, 2015). Among the reasons for gender-based differences in the levels and patterns of interactions between male and female students in universities, there are certain practices in the educational institutions themselves. Hurtado (2021), in his study, found that educational institutions continue to develop and reinforce, through their practices, gender segregation, stereotypes and discrimination via the teaching methods they use and the content developed in science, mathematics and technology textbooks.

This was also confirmed by Elliot (2010), whose findings showed that educational institutions have become active agents in the perpetuation of the gender-based behavioural differences between male and female students, as a result of the nature of the task assignments they give to students and the methodologies they use during instruction. In the context of Zimbabwe, the issue of gender disparity in the 22 universities is not a new phenomenon; yet the problem still continues unabated (Guzura & Chigora, 2021). Despite the existence of gender inequity in universities in Zimbabwe (Guzura & Chigora, 2021), there is no study known to the researchers that has been conducted to establish how gender inequity in higher education affects gender-based interaction levels and the academic performance of students. This study, therefore, is an attempt to bridge the research gap; and it is guided by the following research questions: (i) What factors promote the gender-based interactive practices of students in universities in Zimbabwe? (ii) How significantly do these factors influence the gender-based interaction levels of students in the local universities? (iii) Is there any significant relationship between the gender-based interactive levels of university students and their academic performance?

2. The concept of gender and gender differences

The concept of gender can be understood in two ways, either as a biological composition of the body, or as a socialisation-related attribute (Elliot, 2010). As a biological attribute, Consuegra et al. (2016) found that gender plays a very minimal role in the behavioural differences between men and women, and, in the context of the current study, between male and female students. In the same study, Consuegra et al. (2016) found that rather, it is gender as a socialisation attribute that inflates the minor biological differences out of proportion, by causing serious gender-based differences in the behaviour of men and women. Elliot (2010) also found that the socialisation-related gender-based view is the

reason why women are regarded as homemakers, who are mostly responsible for parenting, while men are regarded as wage earners.

Socialisation in this case is defined as the unconscious and sometimes conscious process by which people learn to behave in a certain way, as a result of their interactions with other actors (parents, peers, lecturers and others) and via socialisation agents, such as the media, textbooks and others (Halimi et al., 2016). Gee (2000) defined gender as the kind of person one is recognised as being, at a given time and place. The issues of time and place are the descriptors of gender, which imply that each person has multiple identities connected not to their biological attributes, but rather, to their socially assigned roles and positions (Consuegra et al., 2016). A person's gender, therefore, from a sociological perspective, relates to interactions and symbolic behaviours in the social sphere; while from a physiological point of view, it relates to the issues of masculinity and femininity (Vantieghem et al., 2014). Bigler et al. (2013) are of the view that while nature (biology that determines the sex of the student) and nurture (environmental factors, such as socialisation, that define the gender of a person through role assignment) act together in reciprocal causal, and interactive ways, to produce gender-based differences in the behaviour of male and female students, it is nurture that contributes more significantly to gender-based differences. This, therefore, means that it is how boys and girls are socialised at home, and how female and male students are socialised at school, that pose the greatest challenge to dealing with the problem of educational inequity in universities.

3. Theoretical and conceptual frameworks informing hypotheses and their formulation

This study used the socio-cultural theory developed by Vygotsky (1978), as a theoretical lens. The theory deals with the social construction of knowledge; and it is premised on the belief that social experience plays a dominant role in human development in general, and in knowledge acquisition in particular (Kurt, 2020). Based on the fact that interaction is a social skill (Voyer & Voyer, 2014), this theory has been found to be particularly relevant to this study. According to Vygotsky (1978), true human development is not from the individual to the social, but rather it is from the social to the individual. As a result, the theory maintains that social settings and learning are interrelated (Kurt, 2020).

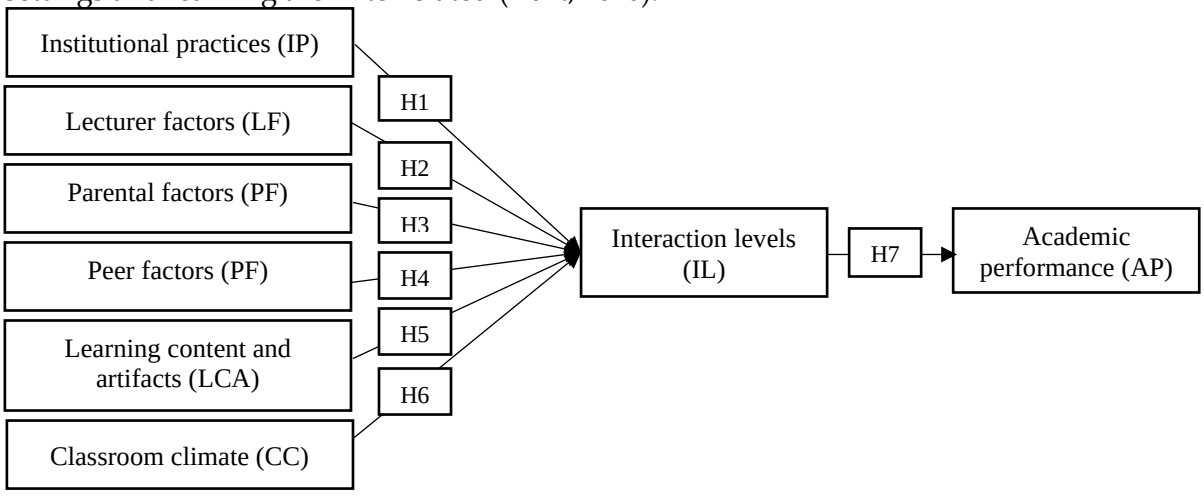

Figure 1: The research model

The theory demonstrates that for effective teaching and learning, lecturers must act as facilitators, who engage students in guided interactions, comprehensive thoughtful discussions and the creation of collaborative communities of learners (Polly et al., 2020; Kurt, 2020; Ibañez & Pentang, 2021). Polly et al. (2020, p.2) found that learning "awakens a variety of internal development processes that are only able to operate when a student interacts with others." This is perhaps the reason why Matusov (2015) argued that we cannot understand cognitive development without first understanding the social and historical context within which it is situated. Based on the theoretical and conceptual frameworks, a research model (Figure 1), was developed. Figure 1 demonstrates that the factors that include institutional practices, lecturer factors, parental factors, peer factors, learning content and artifacts, as well as the classroom climate, may have a significant effect on the interaction levels of boys and girls in the classroom; while furthermore, the interaction levels may have a significant effect on the academic performance of the students.

3.1. Institutional practices as determinants of gender-based interaction differences

Educational institutions, such as universities, are expected to provide all students, male and female alike, with equal opportunities to interact with their lecturers, peers and content, for enhanced academic performance. Institutional practices are defined as opportunities that institutions create and provide for all students to be able to effectively learn (Ziskin et al., 2010), Such opportunities include teaching and learning practices, recruitment practices, promotion practices, support and development practices, orientation and residential-life practices, among others (Ziskin et al., 2010). Interaction, being a social skill, is critical for the academic performance of students (Voyer & Voyer, 2014); and it needs to be nurtured by educational institutions.

Without a clearly articulated institutional vision and policy that guides institutional practices on gender-equity issues in university classrooms, charting the right direction, in order to facilitate equity in the participation of both male and female students in the learning process in universities, this becomes a challenge (OECD, 2015). Chapman (2015) established that gender-based socialisation practices in higher educational institutions continue to ensure that female students are made aware that they are unequal to male students. This has serious ramifications on their self-esteem, confidence, motivation and ultimately on their academic performance (Hurtado, 2021).

As a result of these institutional practices that continue to promote inequity, classroom practices also by extension, continue to ensure, through the teaching methodologies used, examples selected to clarify concepts, and the technology artifacts used, whereby female students understand their lower academic rank, when compared to male students.

Bigler et al. (2013, p.1) in their study found that the institutional "experiences afforded to both male and female students affect gender differentiation, both directly by providing differential skills practice and reinforcement, and indirectly

by providing inputs that lead to students being socialised and behaving in gender-differentiated ways."
H_1: Institutional practices have a significant influence on the gender-interaction levels of university students during lessons.

3.2. Lecturers as determinants of gender-based interaction differences
Consuegra et al. (2016) also established that, just like parents' expectations of their children, the expectations of lecturers of students have a significant influence on their interaction levels and on their academic performance. Lecturers relate to the academics tasked with the teaching of students in colleges and universities. Howe and Abedin (2013) found that the gender-based character of the expectations of lecturers of students has a very high influence on how male and female students participate in learning, as well as on the students' future behaviour after school. In their separate studies, Consuegra et al. (2016), Hurtado (2021) and Gustavsen (2019) found that lecturers tend to have differential expectations of male and female students' academic performance, as well as to behave and communicate differentially towards male and female students. All these expectations have significant effects on the self-esteem, achievement motivation, level of aspiration, classroom conduct and levels of interaction of both male and female students during lessons (Consuegra et al., 2016).

Howe and Abedin (2013) also found that lecturers tend to give more opportunities to male students for participating in learning activities; and they would more likely select a male student instead of a female student, when both raise their hands at the same time to answer a question. This behaviour by lecturers has a significant effect on the self-esteem, confidence and motivation of female students to participate in classroom activities (Mullen et al., 2015). Hassaskah and Zamir (2013), in their published work on gender-based interactive differences between male and female students in universities, also found that lecturers' attitudes and expectations of the genders have a significant influence on their behaviour towards the levels to which female students can, or should, participate in class, when compared to the levels at which male students participate.

These atypical assumptions about the levels of interaction between male and female students are, therefore, the reason why many of the research findings have demonstrated that female students' participation levels in class are generally and deliberately made lower than those for male students – by their lecturers.
In another study, Sadker et al. (2009) found that instead of interacting with all the students, lecturers tend to spend two thirds of their teaching time interacting with male students, and also that lecturers are more likely to interrupt a female student and allow male students to take over a discussion, or an explanation of a concept. Such a behaviour demeans female students; and it significantly affects their self-esteem and interaction levels in class. Weiler (2009) also established that in science and mathematics courses, lecturers tend to mostly direct their gaze towards male students, and to call male students to go to the front to perform demonstrations, when compared to female students, thereby indicating that the sciences and mathematics courses are not for female students, but for male students.

Carlana (2019), in her study, further found that lecturers grade male students better than female students, especially in these science, mathematics and technology courses, with male students consequently getting higher grades than female students on answers similar to the ones that female students would have provided. These practices have serious negative implications for the confidence, self-esteem and participation levels of female students in such courses. Nevertheless, Pentang et al. (2021) have shown that male and female university students are given equal opportunities to select any field of specialization.
H_2: Lecturers have a significant influence on gender-interaction levels of university students during lessons.

3.3. Parents as determinants of gender-based interaction differences

Parents represent the primary socialising agents from the birth of a child to adulthood (Hurtado, 2021; Consuegra et al., 2016; Gustavsen, 2019). In their study, Halimi et al. (2016) found that because parents are responsible for transmitting sex roles to their children from early years on, they influence both the general, as well as the educational expectations of their children in terms of how actively the child would participate in life in general and in school, and in how much of academic performance, they set the bar for themselves to achieve.

Mullen et al. (2015) found that parents who socialise their daughters to become timid, and to look inferior to their brothers, contribute to the development of timid and inferior tendencies, and hence to low levels of participation and interaction in class from girls. In a similar study, Consuegra et al. (2016) found that parents tend to transmit feelings and behaviours of subservience to their daughters that have negative future implications on how the girls will interact with others in life in general, and also in school classrooms in particular.
H_3: Parents have a significant influence on gender-based interaction levels of university students during lessons.

3.4. Peers as determinants of gender-based interaction differences

Peers represent a referent group, that is, a group with which a student interacts for most of the time during and after school hours (Gustavsen, 2019). Consuegra et al. (2016) argue that peers represent a critical social group in the gender-socialisation process, which exerts a big influence on a student's attitudes, general behaviour and interaction levels in classrooms. Separate studies by Consuegra et al. (2016) and Gustavsen (2019) found that if a student's peer group represents a vibrant and active group that would always actively participate in school and class activities, the student would be socialised to be active and to participate actively in school and class activities, and vice versa. In a similar study, Nusche (2015) found that the levels of interaction of students in the classroom also depend on their perceptions of how they are perceived by their peers.

In the same study, it was found that male students are easily influenced by their peers to either participate or not to participate, when compared to female students, whose participation is because of their love of learning.
H_4: Peers have a significant influence on gender-based interaction levels of university students during lessons.

Learning content and artifacts as determinants of gender-based interaction differences

Content represents the information that students learn; while artifacts relate to the objects made by human beings, typically one of cultural, technological or historical interest (Förtsch et al., 2020). Content in textbooks and artifacts in science and technology that are used for learning in universities has been found to have a significant effect on the gender-interaction levels of male and female students in universities (Witt & Hofmeister, 2015). Goode et al. (2020) aver that content that stereotypes men and boys as technically oriented, and women and girls as not, has for a long time been one of the reasons for the perpetuation of gender differences in the levels of interaction of students in university classrooms. Fortsch and Gartig (2020) also found that gender stereotypes, stereotype threats and gender roles, as shown in textbooks, technology artifacts and other learning materials contribute significantly to the differences in the levels of participation in class by male and female students.

In their study also, Witt and Hofmeister (2015) found that gender differences in the use of technology by male and students during lessons, are as a result of technology designers, who play a key role in gendering technology artifacts, when they integrate designs into technology products with assumptions about skills, motives and traits of potential users, who in most cases are expected to be males. These content- and artefact-based stereotypes have deep social and cultural roots; and they have a significant impact on how male and female students rate their skills and knowledge, and consequently on how much they are comfortable, when participating actively during lessons (Fortsch et al., 2020).

H_5: Learning content and artifacts have a significant influence on gender-based interaction levels of university students during lessons.

3.5. Classroom climate as a determinant of gender-interaction differences

The classroom environment is one of the influential factors in the development of gender differences in the interaction levels between male and female university students (Gustavsen, 2019). Classrooms are defined as "dynamic, complex social systems with unique processes (reciprocal interactions), persons (unique attributes and skills), and contexts (environmental influences) that affect the development of students and their participation in learning' (Gustavsen, 2019, p.2). As a result of the complex nature of classrooms and their environments, different students behave differently; and it is these differences that need to be effectively managed by the lecturers, in order to ensure adequate and equal interaction during the learning process by both male and female students.

Caribay (2015) argued that the classroom climate can potentially affect students' engagement (interaction) and their academic performance, particularly if students feel segregated, discriminated against and disrespected. In his study, Caribay (2015) further established two types of classroom climates that influence student interaction, namely, the explicitly marginalising climate and the implicitly marginalising climate. The explicitly marginalising climate is hostile, unwelcoming and discriminating, in which the lecturers and/or other students, are clearly discriminatory and disdainful of female students. On the other hand, the implicitly marginalising climate is characterised by subtle and indirect

postures and remarks of a demeaning and discriminatory nature against female students in the classroom.

Hurtado (2021) found that classroom climates that are negative or discriminatory against female students affect their self-esteem and preparation for class, self-confidence, and their motivation to participate, regardless of their ability. Pervin et al. (2021) also opine that, on the other hand, a warm and welcoming learning environment that provides students with a feeling of control and security, helps students to be more engaged, active and satisfied, thereby leading to better academic performance. These findings show that both male and female students, who have feelings of control and security, do better in school.
H_6: Classroom climate has a significant influence on gender-based interaction levels of university students during lessons.

3.6. Interaction levels as determinants of academic performance
Interaction relates to opportunities for students, and/or students and lecturers, to ask each other questions, discuss, or reflect on topics in the classroom (Wei, 2021). On the other hand, academic performance is the outcome of the knowledge gained, which is assessed by the marks allocated by a teacher, and/or the educational goals set by students and teachers to be achieved over a specific period of time (Narad & Abdullah, 2016). Student interaction levels have been linked in a number of studies for academic success (Aguillon et al., 2020; Casper et al., 2019; Ballen et al., 2019). Academic performance, as it relates to the achievement of learning goals by students (Hurtado, 2021; Carlana, 2019; Harbin et al., 2020). Dana (2020) established that gender-classroom interaction can either obstruct or promote the academic performance of students.

In their studies on gender differences in academic performances between male and female university students, Pervin et al. (2021) and Aristovinik et al. (2020) found that students with higher levels of interaction, whether male or female, demonstrated higher levels of academic achievement in their areas of study than those with lower levels of interaction. Gopal and Singh (2021), Martin (2021), Mensink and King (2020) and Almaiah and Alyoussef (2019) found that lecturers who actively interact more with either male or female students by providing them with timely responses to questions, timely feedback, and also by ensuring that the students get more access to participation opportunities than other students, contribute significantly to gender-academic performance by their students. Other studies by Hashemi (2021), Terblanche et al. (2021), Oviawe (2020) and Ansari and Khan (2020) also found that high levels of interaction between lecturers and students, and between students themselves, contribute to the development of positive self-esteem, motivation and satisfaction among students, which in turn lead to enhanced academic performance.

Studies by Ndirika and Ubani (2017) and Oludipe (2012) however, found no significant relationship between the levels of student interaction and academic performance, according to gender. This was also confirmed in separate studies by Knight et al. (2016) and Cooper et al. (2018), who also found that the levels of interaction in class did not have any significant influence on the academic performance of students in universities.

H_7: Gender-based interaction levels have a significant influence on the academic performance of university students.

4. Materials and Methods

4.1. Research design and approach

A cross-sectional survey design that employed a quantitative approach located in the post-positivist paradigm was used in the study. The study was guided by the deductive theory. The study was conducted in 2021 at three selected universities in Bindura, a town that is about 100 kilometres from Harare, the capital city of Zimbabwe.

Research participants and sampling procedures

The study was conducted at three universities located in the town of Bindura as research sites. A sample for the study was drawn from students in academic faculties training students in sciences, mathematics and technology at each of the three universities. The total number of students in these academic faculties was 11000 – from first year to final year students. Using the Research Advisors' (2006) sample size table at a 99% level of confidence and a 3.5% margin of error, the sample size for the study was determined as 1285 students. Using proportional representation, each of the three universities had institutional samples distributed, as follows: X1=217; X2=739 and X3=329. Stratified random-sampling strategy was used to select the students for each institutional sample from the academic faculties.

The researcher first requested permission from the offices of the Deputy Registrars Academy, to carry out the study at the three universities; and permission was granted. Thereafter, the Deputy Registrars Academy then liaised with the Deans of the academic faculties at their universities, in order to facilitate the selection of the institutional samples to participate in the study, according to the guidelines of the researcher, and in line with COVID-19 protocols. After institutional samples were established and the emails of the participants were given to the researcher, a total of 1285 questionnaires were distributed online through the emails of the selected students. Being an online survey, two weeks were allowed for the completion and return of the completed questionnaires, in line with the minimum recommended time for the administration of online surveys of 12.21 days (Ilieva et al., 2002).

A further one week was allowed as the follow-up period. After three weeks, a total of 460 completed questionnaires were returned, giving a return rate of 35.8%, which was considered acceptable, as it met the minimum recommended return rate of 33% for online surveys. Based on the returned completed online questionnaires, the demographic profiles of the respondents were analysed, as shown in Table 1.

Table 1: Demographic profiles of participants

Demographic factor	Items	%
Gender	Female	56
	Male	44
Age	≤20 years	9
	21-30years	61
	> 30years	30
Educational level	1st year	32
	2nd year	31
	3rd year	20
	Final year	17

The results in Table 1 show that most of the students (56%) enrolled at the three universities were females, which shows that the three universities have turned a leaf with regard to the issues of gender equity. 70% of the students at the universities were 30 years and below in age, which is consistent with the fact that most of the students (63%) at the universities are either in their first year or in their second year of studies.

4.2. Instrument design

The study used the Student-Interaction and Academic-Performance Questionnaire (SIAPQ) developed by the researcher and adopted from the Lecturer-Student-Relationship Questionnaire (TSRQ) Rating Scale and the literature review. The questionnaire has 8 sections with 68 items, as follows: Institutional practices (IP) – 7 items; Lecturer factors (LF) – 34 items; Parent factors (PF) – 6 items; Peer factors (PE) – 4 items; Learning content and artifacts (LCA) – 4 items; Classroom climate (CC) – 6 items; Interaction levels (IL) – 4 items; and Academic performance (AP) – 3 items. A 5-point Likert scale with scales from Almost never (AN-1), Seldom (SE-2), Sometimes (SO-3), Often (OF-4), and Always (AL-5) was used in the design of the questionnaire. The proof of the instrument used in the study is shown in Appendix A, which shows the constructs, their items, the item codes and the item sources; while Appendix B shows a structured questionnaire. It is also shown in the sections of the questionnaire that most of the questions are under the lecturer factors; since most of the learning occurs in the classroom under the lecturer.

4.3. Measurement of the model assessment

The researchers used the following data-validation tools for the measurement-assessment model: the normality test, the non-response bias test, the common-method bias test, the convergent validity and the discriminant-validity assessment.

4.3.1. The normality test

SPSS version 24 was used for normality testing. Based on the results, the observations of the Q-Q plots, the box plots and the histograms demonstrated that the data were normally distributed. This was further confirmed by using the Z-scores, calculated by using the SPSS version 24. The results showed that all the Z-

scores (n = 460), ranged between -2.58 and +2.58 at a 1% level of significance, thus confirming the data normality (Pallant, 2016; Hair et al., 2017).

4.3.2. The common-method bias

The common-method bias (CMB), also called the common-method variance (CMV) was used to assess the potential threat to the validity of the data. This is done to assess whether variations in responses are caused by the design of the instrument, or by the actual predispositions of the respondents that the instrument attempts to expose (Jordan & Troth, 2020; Jakobsen & Jensen, 2015; Podsakoff et al., 2012). Using Herman's single-factor test, also called the Herman's one-factor test, to assess any CMB in the data, the principal-component analysis in SPSS version 24 was conducted to examine the unrotated factor solution, in order to obtain the number of items with eigenvalues of less than 1 that explain the aggregate variance (Fuller et al., 2016; Jordan & Troth, 2020; Williams & McGonagle, 2016).

The results showed that there was no threat of CMB in the data; as the total variance extracted by one factor was 33.7%, which was below the recommended threshold of 50%; and none of the factors explained a variance of more than this threshold (Ankitha & Basri, 2019; Jordan & Troth, 2020; Podsakoff et al., 2012).

4.3.3. The non-response bias

The non-response bias test (NBT), also called the participation-bias test (PBT), was used to assess whether there was any threat of the results being non-representative; because a significant number of people in the survey sample had failed to respond and disproportionately possessed some traits that affected the results (Cheung et al., 2017). The researcher used the method recommended by Whitehead, Groothuis and Blomquist (1993) and Armstrong and Overton (1977) to assess the NBT. Using this method, the researcher compared the means of each of the first 100 entries of responses against those of the last 100 entries; and the results were not significantly different, confirming that the data were free of the threat of non-response bias.

4.3.4. The convergent validity

To measure convergent validity for the data, the researcher used model-fit indices, the standardised factor loadings (λ), and the individual item reliability (squared-multiple correlations) (I_α), Cronbach's alpha (α), composite reliability (CR_α), critical rations (CR), and the average variance extracted (AVE).

Table 2: Convergent validity assessment using model fit indices

Construct	**Absolute fit measures**			**Incremental fit measures**		**Parsimonious fit measures**	
	$\chi 2/df$	GFI	AGFI	NFI	TLI	CFI	RMSEA
Institutional practices (IP)	2.044	0.964	0.941	0.975	0.969	0.931	0.043
Lecturer factors (LF)	1.961	0.985	0.933	0.981	0.971	0.927	0.044
Parents factors (PF	1.992	0.974	0.936	0.979	0.982	0.944	0.041

Peer factors (PE)	2.331	0.984	0.941	0.975	0.980	0.947	0.046
Learning content and artifacts (LCA)	2.055	0.986	0.951	0.983	0.969	0.933	0.043
Classroom climate (CC)	2.319	0.979	0.946	0.974	0.982	0.937	0.045
Interaction levels (IL)	1.993	0.981	0.936	0.985	0.981	0.943	0.042
Academic performance (AP)	2.351	0.985	0.921	0.974	0.979	0.935	0.044
Recommended values	≤3.000	>0.950	>0.900	>0.950	>0.950	>0.900	<0.080
Sources	Bagozzi and Yi (1988)	Hooper et al. (2008)	Chau and Hu (2001)	Chin and Todd (1995)	Kline (2005)	Bagozzi and Yi (1988)	Browne and Cudeck (1993)

Notes: *χ2/df – Chi-square divided by degrees of freedom; GFI-Goodness of fit index; AGFI-Adjusted goodness of fit index; NFI-Normed fit index; TLI-Tucker-Lewis's index; CFI-Comparative fit index; RMSEA-Root mean square error of approximation*

The results in Table 2 show that, after removing outlier items, which had a standardised loading of less than 0.6, all the indices satisfied the minimum recommended requirements. The outlier items that had factor loadings that were less than 0.6, and were removed from the data were IP3, IP5, LF5, LF6, LF12, LF13, LF14, LF26, LF32, PF1, PF5, and LCA1. The final results on the assessment of the model fit indices, therefore, confirmed the presence of convergent validity.

Table 3: λ, I_α, CR, α, CR_α, AVE, TL, VIF

Construct	Items	λ	I_α	CR	α	CR_α	AVE	TL	VIF
Institutional practices	IP1	0.815	0.631	-	0.819	0.833	0.621	0.347	4.113
	IP2	0.741	0.703	21.338***					
	IP4	0.753	0.822	19.085***					
	IP6	0.819	0.659	18.277***					
	IP7	0.844	0.733	15.119***					
Lecturer factors	LF1	0.910	0.855	-	0.855	0.920	0.633	0.391	2.059
	LF2	0.929	0.641	27.447***					
	LF3	0.833	0.663	26.148***					
	LF4	0.821	0.644	24.307***					
	LF7	0.837	0.758	23.088***					
	LF8	0.762	0.705	22.316***					
	LF9	0.808	0.810	21.113***					
	LF10	0.813	0.728	20.433***					
	LF11	0.752	0.803	20.128***					
	LF15	0.755	0.655	20.016***					
	LF16	0.733	0.772	19.449***					
	LF17	0.769	0.812	19.217***					
	LF18	7651	0.671	19.022***					
	LF19	0.825	0.663	17.649***					
	LF20	0.716	0.701	17.341***					
	LF21	0.826	0.825	17.220***					
	LF22	0.735	0.726	17.019***					

	LF23	0.811	0.669	16.920***					
	LF24	0.736	0.817	15.227***					
	LF25	0.746	0.801	15.104***					
	LF27	0.802	0.714	14.287***					
	LF28	0.734	0.654	12.992***					
	LF29	0.728	0.647	12.317***					
	LF30	0.818	0.704	11.427***					
	LF31	0.726	0.811	9.285***					
	LF33	0.772	0.651	8.662***					
	LF34	0.810	0.763	8.115***					
Parent factors	PF2	0.781	0.706	-	0.759	0.815	0.701	0.417	5.044
	PF3	0.858	0.735	18.503***					
	PF4	0.803	0.771	16.219***					
	PF6	0.851	0.649	15.288***					
Peer factors	PE1	0.775	0.715	-	0.913	0.920	0.647	0.425	4.958
	PE2	0.824	0.723	20.316***					
	PE3	0.819	0.802	19.709***					
	PE4	0.827	0.648	17.335***					
Learning content and artifacts	LCA2	0.771	0.784	-	0.817	0.823	0.625	0.452	3.620
	LCA3	0.722	0.722	15.729***					
	LCA4	0.709	0.639	14.228***					
Classroom climate	CC1	0.755	0.664	-	0.791	0.803	0.644	0.401	1.429
	CC2	0.705	0.718	12.881***					
	CC3	0.833	0.703	9.283***					
	CC4	0.729	0.665	8.517***					
	CC5	0.815	0.741	6.551***					
	CC6	0.747	0.641	5.910***					
Interaction levels	IL1	0.805	0.829	-	0.927	0.931	0.609	0.319	3.337
	IL2	0.910	0.733	19.427***					
	IL3	0.739	0.727	17.319***					
	IL4	0.802	0.641	16.662***					
Academic performance	AA1	0.772	0.746	-	0.844	0.857	0.640	0.328	4.272
	AA2	0.779	0.808	28.336***					
	AA3	0.805	0.713	25.137***					

Notes: *TL – Tolerance level, VIF – Variance inflation factor, CR is fixed, significant at ***p < .001*

The results in Table 3 were used to evaluate whether the assumptions of multicollinearity were not violated, as well as to assess convergent validity. Tolerance levels (TL) and the variance-inflation factor (VIF) were used to assess whether the assumptions of multicollinearity were not violated in the study. For all the constructs, the results in Table 3 show that TL < 1 and VIF < 10, confirming that the assumptions of multicollinearity were not violated in the study (Chatterjee & Hadi 2013; Saunders et al., 2012).

When testing for convergent validity, λ, Iα, CR, α, CRα and AVE were used. The data were first cleaned of outliers, as indicated above. The internal consistency reliability of the data was confirmed by the fact that for all the constructs, the coefficients for Iα > 0.06 (Nunnally, 1978; Segars, 1997) and the coefficients of α and CRα were also all greater than 0.7 (Nunnally, 1978; Segars, 1997) thus satisfying the minimum recommended values for internal consistency reliability. For factor loadings, all loadings satisfied the minimum recommended value of λ

> 0.6 (Bagozzi & Yi, 1988). The results also show that all the critical ratio values satisfied the recommended values of CR > 2; and they were significant at p < 0.001 (Segars, 1997). Also, all AVE values satisfied the minimum recommended value of AVE > 0.5 (Fornell & Larcker, 1981). Based on the fact that all the metrics λ, Iα, CR, α, CRα and AVE satisfied the recommended values, as demonstrated above, convergent validity was confirmed in the data.

Table 4: Measurement of discriminant validity

	CR	AVE	MSV	Max R (H)	IP	LF	PF	PE	LCA	CC	IL	AP
IP	0.833	0.621	0.357	0.841	**0.788**							
LF	0.920	0.633	0.235	0.925	0.241	**0.796**						
PF	0.815	0.701	0.208	0.822	0.109	0.227	**0.837**					
PE	0.920	0.647	0.318	0.936	0.096	0.135	0.217	**0.804**				
LCA	0.823	0.625	0.261	0.830	0.117	0.220	0.335	0.228	**0.791**			
CC	0.803	0.644	0.317	0.915	0.105	0.169	0.212	0.155	0.485	**0.802**		
IL	0.931	0.609	0.304	0.939	0.119	0.091	0.173	0.207	0.144	0.144	**0.780**	
AP	0.857	0.640	0.295	0.861	0.217	0.115	0.215	0.193	0.316	0.205	0.614	**0.800**

Notes: *CR-Composite reliability, AVE- Average variance extracted, MSV-Maximum shared variance, Max R (H)-Maximum reliability, Bold diagonal values represent the square roots of AVE.*

Two methods were used in Table 4 to assess the discriminant validity of the data. The comparison between MSV and AVE shows that the AVE values are greater than the MSV values, demonstrating the presence of discriminant validity in the data (Wheaton et al., 1977). Also, a comparison between square roots of AVE (bold diagonal values) and corresponding inter-construct correlations shows that the square roots of AVE values are greater than the corresponding inter-construct correlations, thereby again confirming the presence of discriminant validity in the data (Segars, 1997).

4.4. The data analysis

Descriptive statistics were used for summarizing the data. The data were validated by using the normality test, the non-response bias test, the common-method bias test, convergent validity and discriminant-validity assessment. Inferential statistics (AMOS Version 24) were used to test the relationships between the dependent variable and the independent variables.

5. The results

5.1. Hypotheses testing

The researchers first evaluated whether the model fit indices were acceptable before testing the hypotheses by using the AMOS version 24. The results showed that the model-fit indices were acceptable, as they were within the recommended values: $\chi 2/df = 1.972$, GFI= 0.973, AGFI= 0.933, NFI = 0.966,TLI = 0.941, CFI = 983, and MSEA = 0.0478 (Hair et al., 2017; Hooper et al., 2008). The path coefficients were thereafter assessed.

Table 5: The path coefficients

Hypotheses	IV	DV	Unstandardised estimates	SE	CR	Standardised estimates	R^2
HI	PP	IL	0.338	0.071	6.119	0.309***	0.52
H2	LF	IL	0.445	0.082	7.045	0.374***	0.48
H3	PF	IL	0.191	0.065	2.331	0.073*	0.55
H4	PE	IL	0.245	0.221	3.713	0.118**	0.57
H5	LCA	IL	0.319	0.093	4.338	0.237***	0.39
H6	CC	IL	0.331	0.075	9.149	0.527**	0.51
H7	IL	AP	0.291	0.084	6.914	0.371***	0.62

Notes: significant: *p<0.05, **p<0.01, ***p < 0.001, DV – dependent variable, IV – Independent variable, CR – Critical ratio, R^2 – Coefficient of determination

The results in Table 5 show that all the latent variables have a significant influence on the gender- interaction levels of university students IP ($\beta = 0.309$; $p < 0.001$), LF($\beta = 0.374$; $p < 0.001$), PF($\beta = 0.073$; $p < 0.05$), PE($\beta = 0.118$; $p < 0.01$), LCA($\beta = 0.237$; $p < 0.001$), and CC($\beta = 0.527$; $p < 0.01$). As a result, H1, H2, H3, H4, H5 and H6 were therefore supported. These results also show that CC has the highest influence on the interaction levels of students, followed by LF, IP and LCA, respectively. PF has the lowest influence on the interaction levels of university students during learning. The results further show that IL has a significant influence on AP ($\beta = 0.371$; $p < 0.001$), hence H7 was supported.

Table 5 further shows the explanatory power of the latent variables with regard to the interaction levels by university students, as shown. The results show that IP explains 52% of variation in the interaction levels of university students during lessons. Other factors that include LF contribute 48%, PF contributes 55%, PE contributes 57%, LCA contributes 39% and CC contributes 51% of the variation to the interaction levels of university students. Also, interaction levels contribute 52% to the variation in the academic performance of university students. The model as a whole contributes 67% of the variation in the academic performance of university students due to the interaction levels.

6. Discussion

The institutional practices in universities have a significant influence on gender-based interaction differences among university students. This suggests that where universities have gender-equity policies and guidelines, all students, whether male or female, would actively and equally participate in their lessons. With clear policies and guidelines, the levels of interactions in universities would therefore not favour one specific gender group of students over another. However, where a university does not have policies and guidelines on gender equity, it has been shown in a number of studies (Hurtado, 2021) that male students are mostly favoured, with more opportunities to participate and interact with the teachers or among themselves during lessons, especially in STEM subjects. OECD (2015) established that many universities do not have gender-equity policies to guide both lecturers and students on the correct conduct in classes.

Another study by Chapman (2015) also found that gender-socialisation practices in higher educational institutions continue to ensure that female students are

made aware that they are unequal to male students. This was confirmed by Bigler et al. (2013), who in his study found that higher institutions continue to socialise students in gender-differentiated ways, which according to Hurtado (2021) leads to the segregated and stereotyped students developing low self-esteem, low levels of confidence and motivation, and little desire to interact during the lessons.

Lecturers have a significant influence on the interaction levels of university students. Teaching practices by lecturers that include the nature of the feedback they give to both male and female students, the teaching methods they use, and the nature of content they use when teaching, all play a significant role in the gender-interaction patterns of university students. If lecturers use teaching methods with examples that demean female students, these methods always give more opportunities for male students to participate in class, and to use content that stereotypes female students. The end result is that female students would not have the confidence and motivation to actively participate and interact with both the lecturers and other students in the class.

This is in line with the findings in earlier studies. In their separate studies, Consuegra et al. (2016), Hurtado (2021) and Gustavsen (2019) found that lecturers who have differential expectations of male and female students' academic performance tend to behave and communicate differently towards male and female students, thereby leading to differences in student-interaction levels. Consuegra et al. (2016) also are of the view that a differential approach to communication with male and female students by lecturers has significant effects on the self-esteem, achievement, motivation, level of aspiration, classroom conduct and the levels of interaction of both male and female students. In the context of the current study, the results showed that female students are mostly affected by the differential communication of the lecturers during lessons.

Parents have a significant influence on the gender-interaction levels of university students. Parents are referred to as the primary socialising agents (Hurtado, 2021; Gustavsen, 2019); and what they do and say to their children carries a lot of weight with regard to the children's present and future behaviours. If parents raise their children to be subservient, they will grow up to be subservient and rank themselves lower every time. The consequences of this will be that the children will, in future, lack confidence and develop a belief that certain behaviours are beyond them, and are for other people.

In the context of the current study, if girls are socialised by their parents to believe that boys are superior to them, they will grow to feel inferior to boys, then their participation levels in mixed-gender classes would also be affected. Mullen et al. (2015) found that parents who socialise their daughters to be timid and to look inferior to boys, contribute to the development of timid and inferior tendencies, and hence future low levels of participation and interaction in class by the child.
Peers have a significant influence on the gender-interaction levels of university students. These results suggest that the referent groups or friends that students associate with have a significant influence on how the students behave in general and participate during lessons in particular. If a student associates himself or

herself with peers that show little concern to active participation in class, the end result is that the student would also not actively participate; and his or her interaction levels would consequently be lower. The reverse is also true.

This is consistent with the findings of previous studies. Separate studies by Consuegra et al. (2016), Gustavsen (2019) and Ibañez and Pentang (2021) found that if a student's peer group represents a vibrant and active group that always actively participates in school and class activities, the student would be socialised to be active and to participate actively in school and class activities, and vice versa. In his study, Nusche (2015) also found that the levels of interaction of students in the classroom depend on their perceptions of how they are perceived by their peers.
Learning content and artifacts have a significant influence on the gender-interaction levels of university students. This suggests that if students develop perceptions from the learning materials that their lecturers use to teach them that they are either capable or incapable of performing well in their lessons, then their feelings would accordingly develop into attitudes that suggest they would participate more in class or not, respectively. If, for example, the content and artifacts that lecturers use when teaching present male students are superior to female students, as has been shown in a number of studies, female students would begin to accept it as true; and they would lose confidence, leading to their low levels of interaction during lessons.

Goode et al. (2020) established that content that stereotypes men and boys as technically oriented, and women and girls as not, is one of the reasons for the perpetuation of gender differences in levels of participation and interaction in university classrooms. According to Fortsch et al. (2020), content- and artifact-based stereotypes in university learning materials have deep social and cultural roots that have a significant influence on how male and female students rate their skills and knowledge, and thus on the extent to which they would be comfortable when participating actively during lessons.

The classroom climate has a significant influence on the gender-interaction levels of university students. This suggests that if the classroom climate is conducive to learning, that is, if it makes students feel safe and appreciated, they feel that they get equal opportunities to contribute to class discussion just like all other students, and they are valued by not only other students, but by the teacher as well, gender-interaction levels would be lower. However, if on the other hand, students feel segregated, their interaction levels would also be lower, since such students would feel demotivated. This is consistent with Caribay (2015), who found that the classroom climate can potentially affect student engagement (interaction) and academic performance, particularly if students feel segregated, discriminated against and disrespected.

This is also confirmed in a study by Hurtado (2021) who found that classroom climates that are negative or discriminatory against female students affect their preparation for class, self-confidence and interaction levels, regardless of their ability. On the other hand, Pervin et al. (2021) argue that a warm and welcoming

classroom climate provides students with a feeling of control; and security helps students to be more engaged, active and satisfied, thereby leading to better academic performance.

Interaction levels have a significant influence on the academic performance of students. This suggests that when students get opportunities to interact between and among themselves, as well as with the teacher, they share knowledge, support each other and hence understand concepts better, leading to enhanced academic performance. During interactions, concepts are clarified and made simple to understand; and this improves the academic performance of the students. This is consistent with the findings of past studies. Separate studies by Peervin et al. (2021), Witt and Hofmeister (2015), Carlana (2019), Gopal and Singh (2021), Goodle et al. (2020) and Forsch and Gartig-Daugs (2020) found that male students tend to perform better than female students in sciences, mathematics and technology; because the lecturers favour the male students with regard to opportunities to participate actively in class.

Female students were also found to have higher levels of interaction in arts subjects; and they tended to perform better than male students academically in those subjects (Oviawe, 2020; Asaf & Zahoo, 2017). Studies by Knight et al. (2016), Ndirika and Ubani (2017), Cooper et al. (2018) and Pentang et al. (2021) however, found no significant relationship between academic performance and the levels of interaction in universities, according to gender. Studies by Ansari and Khan (2020), as well as those by Al-Rahmi et al. (2018) found that students with high levels of interaction had a greater likelihood of performing better academically.

7. Conclusions

The study sought to establish gender-interaction practices of university science, mathematics and technology students, as well as the influence of interaction levels on academic performance; and a number of conclusions were reached. Firstly, institutional practices are among the major factors in the perpetuation of gender differences in the interaction levels of students, due to the lack of gender-equity policies. Secondly, lecturer behaviours in the classroom affect the gender-interaction levels of students. A lecturer who gives equal opportunities for all students to participate during class raises the interaction levels of all students; while those lecturers who favour one gender group above another demoralise the shunned group, leading to low levels of interaction of the group discriminated during learning. Thirdly, the way parents raise and socialise their children has an effect on their future learning behaviour at school; as parents who raise their children to compete and stand tall all the time will develop their children into future students, who actively participate in school activities, such as active participation in class.

Fourthly, referent groups, such as peers, significantly influence how students participate in class. Highly active and motivated peers would motivate a student to also be highly active and motivated in class. Fifthly, some learning materials and artifacts in textbooks and other learning materials have a stereotyping effect and tend to affect the confidence and motivation of female students to actively

participate in learning. Sixthly, warm and welcoming classroom environments provide students with a sense of security and control that positively influences their levels of interaction during learning. Finally, interaction levels have a significant influence on the academic performance of all university students.

8. Recommendations

Universities need to develop gender-equity policies that act as guides to ensure equal opportunities by students in all institutional activities. It was also recommended that curriculum designers in universities need to develop learning materials that are gender neutral, in order to promote gender equity in the universities in general, and in classrooms in particular. Thirdly, parents, as the primary sources of socialisation, should use home practices that encourage their girl children not to look down upon themselves, but to believe that they can perform any activities as well as boy children.

Implications of the study

The study has implications for both policy and practice. With regard to policy, without clearly articulated policies on gender equity, universities will continue to face challenges in ensuring equity in education. With regard to practice, university lecturers need to ensure that they give both male and female students equal opportunities to participate in class. Such opportunities would ensure that all students can benefit from their learning and improve their academic performance.

Limitations

The study established the gender-interaction practices of university science, mathematics and technology students at three universities. It did not, however, go further to determine whether there are gender differences in the interaction levels and academic performance of students, according to each of the three areas of specialisation. Future studies could investigate this matter further.

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9. References

Aguillon, S. M., Siegmund, G., Petipas, R. H., Drake, A. G., Cotner, S., & Ballen, C. J. (2020). Gender Differences in Student Participation in an Active-Learning Classroom. *CBE—Life Sciences Education*, *19*(12), 1–10. https://doi.org/10.1187/cbe.19-03-0048

Almaiah, M. A., & Alyoussef, I. Y. (2019). Analysis of the effect of course design, course content support, course assessment and instructor characteristics on the actual use of E-learning system. *Ieee Access*, *7*, 171907–171922. http://doi.org/10.1109/ACCESS.2019.2956349

Ankitha, S., & Basri, S. (2019). The effect of relational selling on life insurance decision making in India. *International Journal of Bank Marketing*, *37*(7), 1505–1524. https://doi. org/10.1108/IJBM-09-2018-0236

Ansari, J. A. N., & Khan, N. A. (2020). Exploring the role of social media in collaborative learning – the new domain of learning. *Smart Learning Environments*, *7*(9), 1-16. https://doi.org/10.1186/s40561-020-00118

Armstrong, J. S., & Overton, T. S. (1977). Estimating non-response bias in email surveys. *Journal of Marketing Research*, *14*(3), 396–402. https://doi.org/10.1177/002224377701400320

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, *16*(1), 74-94. https://doi.org/10.1007/BF02723327

Ballen, C. J., Aguillon, S. M., Awwad, A., Bjune, A. E., Challou, D., Drake, A. G., & Cotner, S. (2019). Smaller classes promote equitable student participation in STEM. *BioScience*, *69*(8), 669–680. http://doi.org/10.1093/biosci/biz069

Bigler, R., Hayes, A. R., & Hamilton, V. (2013). *The Role of Schools in the Early Socialization of Gender Differences*. https://www.child-encyclopedia.com/sites/default/files/textes-experts/en/2492/the-role-of-schools-in-the-early-socialization-of-gender-differences.pdf.

Caribay, J. C. (2015). *Creating a positive classroom climate for diversity.* https://equity.ucla.edu/wp-content/uploads/2016/06/CreatingaPositiveClassroomClimateWeb-2.pdf

Carlana, M. (2019). Implicit stereotypes: Evidence from teachers' gender bias. *The Quarterly Journal of Economics*, *7*, 1163–1224. http://doi.org/10.1093/qje/qjz008

Casper, A. M., Eddy, S. L., & Freeman, S. (2019). True grit: Passion and persistence make an innovative course design work. *PLoS Biology*, 17(7), 1-10. http://doi.org/10.1371/journal.pbio.3000359

Chabaya, O., & Gudhlanga, E. S. (2013). Striving to achieve gender equity in education: a Zimbabwean experience. Zimbabwe Journal of Educational Research (ZJER), 25(1), 123-148. https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/8922

Chapman, A. (2015). *Gender Bias in Education*. http://www.edchange.org/multicultural/index.html

Cheung, K. L., Klooster, P. M., Smit, C. et al. (2017). The impact of non-response bias due to sampling in public health studies: A comparison of voluntary versus mandatory recruitment in a Dutch national survey on adolescent health. *BMC Public Health*, *17*, 276. https://doi.org/10.1186/s12889-017-4189-8

Consuegra, E., & Engels, N. (2016). Effects of professional development on teachers' gendered feedback patterns, students' misbehaviour and students' sense of equity: results from a one-year quasi-experimental study. *British Educational Research Journal*, *42*(5), 802-825. https://doi.org/10.1002/berj.323

Cooper, K. M., Downing, V. R., & Brownell, S. E. (2018). The influence of active learning practices on student anxiety in large-enrollment college science classrooms. *International Journal of STEM Education*, *5*(23), 1– 18. http://doi.org/10.1186/s40594-018-0123-6

Dana, A. (2020). An Investigation into Female Students' Less Participation in English Language Class: Waja Kero Junior Primary School Grade 8 Students in Focus. *Research on Humanities and Social Sciences*, *10*(5), 20-27. http://doi.org/10.7176/RHSS/10-5-03

Elliot, L. (2010). The myth of pink and blue brains. *Educational Leadership*, *68*(3), 32-36. https://www.researchgate.net/publication/296597224_The_myth_of_pink_and_blue_brains

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.2307/3151312

Förtsch, S., Gärtig-Daugs, A., & Buchholz, S. (2020). Keep IT Going, Girl!: An empirical Analysis of Gender-Career Chances and Career Aspirations Among German Graduates in Computer Sciences. *International Journal of Gender, Science and Technology*, *10*(2), 265-286. http://genderandset.open.ac.uk/index.php/gender

Fuller, C. M., Simmering, M. J., Atinc, G., Atinc, Y., & Babin, B. J. (2016). Common methods variance detection in business research, *Journal of Business Research*, *69*(8), 3192-3198. https://doi.org/10.1016/j.jbusres.2015.12.008

Gee, J. P. (2000). Identity as an Analytical Lens for Research in Education. Review of Research in Education, *25*, 99-125. https://doi.org/10.2307/1167322

Goode, J., Ivey, A., Johnson, S., Ryoo, J., & Ong, C. (2020). Racing to computer science for all: How teachers learn about equity in professional development. *Computer Science Education*. https://doi.org/10.1080/08993408.2020.1804772

Gopal, R., Singh, V., & Aggarwal, A. (2021). Impact of online classes on the satisfaction and performance of students during the pandemic period of COVID 19. *Education and Information Technologies, 7*, 1-25. https://doi.org/10.1007/s10639-021-10523-1

Gustavsen, A. M. (2019). Gender differences in academic achievement: A matter of contextual classroom influence? *International Journal of Research*, *8*(1), 1–20. http://doi.org/10.5861/ijrse.2018.2013

Guzura, T., & Chigora, P. (2012). Gender Equality in Institutions of Higher Learning in Zimbabwe: A Case of Midlands State University's Experience with Female Advancement, 2004-2007. *Global South Sephis e-magazine*, *8*(2), 22- 28. https://www.researchgate.net/publication/306223839

Hair, J. F., Jr., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. A. (2017). Primer on partial least squares structural equation modelling (PLS-SEM) (3rd ed.). Sage Publication, London.

Halimi, M., Consuegra, E., Struyven, K., & Engels, N. (2016). The Relationship Between Youngsters' Gender-Role Attitudes and Individuals, Home, and School Characteristics: A Review. *SAGE Open,* July-September 2016, 1–19. http://doi.org/10.1177/2158244016656230

Harbin, B., Roberts, L. M., Nelson, R., & Purcell, C. (2020). *Teaching Beyond the Gender Binary in the University Classroom.* Vanderbilt University Center for Teaching. https://cft.vanderbilt.edu/guides-sub-pages/teaching-beyond-the-gender-binary-in-the-university-classroom/

Hashemi, A. (2021) Effects of COVID-19 on the academic performance of Afghan students' and their level of satisfaction with online teaching, *Cogent Arts & Humanities*, 8(1). http://doi.org/10.1080/23311983.2021.1933684

Hassaskhah, J., & Zamir, S. R. (2013). *Gender-Teacher–Student Interactions in English Language Classrooms: A Case of Iranian College Context*. Sage Open, 1–11. http://doi.org/10.1177/2158244013502986

Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: guidelines for determining model fit. *Electronic Journal of Business Research Methods*, *6*(1), 53-60. http://arrow.dit.ie/libart/4

Howe, C., & Abedin, M. (2013). Classroom dialogue: A systematic review across four decades of research. *Cambridge Journal of Education*, *43*(3), 325–356. https://doi.org/10.1080/0305764X.2013.786024

Hurtado, M. E. (2021). *Gender inequality in higher education persists*. https://www.universityworldnews.com/page.php?page=UW_Main

Ibañez, E. D., & Pentang, J. T. (2021). Socio-constructivist learning and teacher education students' conceptual understanding and attitude toward fractions. *Indonesian Research Journal in Education*, *5*(1), 23-44. https://onlinejournal.unja.ac.id/irje/article/view/12187

Ilieva, J., Steve B., & Nigel, M. H. (2002). Online Surveys in Marketing Research: Pros and Cons. *International Journal of Market Research*, *44*(3), 361–382. http://doi.org/10.1177/147078530204400303

Jakobsen, M., & Jensen, R. (2015). Common Method Bias in Public Management Studies. *International Public Management Journal*, *18*(1). 1-13. http://doi.org/10.1080/10967494.2014.997906

Jordan, P. J., & Troth, A. C. (2020). Common method bias in applied settings: The dilemma of researching in organizations. *Australian Journal of Management*, *45*(1), 3–14. https://doi.org/10.1177/0312896219871976

Knight, J. K., Wise, S. B., & Sieke, S. (2016). Group random call can positively affect student in-class clicker discussions. *CBE—Life Sciences Education*, *15*(4), 1–11. http://doi.org/10.1187/cbe.16-02-0109

Kurt, S. (2020). *Lev Vygotsky – Socio-cultural Theory of Cognitive Development in Educational Technology*. https://educationaltechnology.net/lev-vygotsky-sociocultural-theory-of-cognitive-development/

Martin, A. M. (2021). Instructor qualities and student success in higher education online courses. *Journal of Digital Learning in Teacher Education*, 37(1), 65–80.

Matusov, E. (2015). Vygotsky's Theory of Human Development and New Approaches to Education. In James D. Wright, *International Encyclopedia of the Social & Behavioral Sciences, 2nd edition*, *Vol 25*. Oxford: Elsevier, pp. 316–321. http://doi.org/10.1016/B978-0-08-097086-8.92016-6.

Mensink, P. J., & King, K. (2020). Student access of online feedback is modified by the availability of assessment marks, gender and academic performance. *British Journal of Educational Technology*, *51*(1), 10–22. http://doi.org/10.1111/bjet.12752

Mullen, A. L., & Baker, J. (2015). Participation without Parity in U.S. Higher Education: Gender, Fields of Study, and Institutional Selectivity. *NASPA Journal about Women in Higher Education, 8*(2), 172–88. https://doi.org/10.1080/19407882.2015.1057167

Narad, A., & Abdullah, B. (2016). Academic Performance of Senior Secondary School Students: Influence of Parental Encouragement and School Environment. *Rupkatha Journal of Interdisciplinary Studies in Humanities Special Issue, 8*(2), 12-19. http://doi.org/10.21659/rupkatha.v8n2.02

Ndirika, M. C., & Ubani, C. C. (2017). Effect of peer tutoring teaching strategy and academic achievement of secondary school biology students in Umuahia education zone, Nigeria. *IOSR journal of research method in education*, *7*(3), 72-78. https://www.iosrjournals.org

Nunnally, J. (1978). *Psychometric Theory, 2nd ed*. New York, NY: McGraw-Hill. http://hdl.handle.net/123456789/11061

Nusche, D. (2015). *The teaching workforce in the Flemish Community of Belgium* in OECD Reviews of School Resources: Flemish Community of Belgium OECD Publishing, Paris.

OECD. (2015), *The ABC of Gender Equality in Education: Aptitude, Behaviour, Confidence,* PISA, OECD Publishing. http://dx.doi.org/10.1787/9789264229945-en

Oludipe, O. I. (2012). Gender difference in Nigerian junior secondary students' academic achievement in basic science. *Journal of education and social science*, *2*(1), 93-99. https://www.researchgate.net/publication/256840488

Oviawe, J. I., Ezeji, S. C. O. A., & Uwameiye, R. (2015). Comparative effectiveness of three methods on the academic performance of students in building technology in Nigerian polytechnics. *European Scientific Journal, 11*(12), 274–285. https://www.researchgate.net/publication/340983236

Pentang, J. T., Ibañez, E. D., Subia, G. S., Domingo, J. G., Gamit, A. M., & Pascual, L. E. (2021). Problem-solving performance and skills of prospective elementary

teachers in Northern Philippines. *Hunan Daxue Xuebao, 48*(1), 122-132. http://jonuns.com/index.php/journal/article/view/500

Pervin, M. M., Ferdowsh, N., & Munni, I. J. (2021). Teacher-student interactions and academic performance of students. *Dhaka Univ. J. Biol. Sci.*, *30*(1), 87-93. https://doi.org/10.3329/dujbs.v30i1.51812

Podsakoff, P. M., MacKenzie, S.B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review Psychology*, *63*, 539-569. https://doi.org/10.1146/annurev-psych-120710-100452

Polly, D., Martin, F., & Guilbaud, T. C. (2020). Examining barriers and desired supports to increase faculty members' use of digital technologies: Perspectives of faculty, staff, and administrators. *Journal of Computing in Higher Education*, *7*(3), 1-8. https://doi.org/10.1007/s12528-020-09259-7

Research Advisors. (2006). *Sample size table*. http://research-advisors.com/index.php

Sadker, D., Sadker, M., & Zittleman, K. R. (2009). *Still Failing at Fairness: How Gender Bias Cheats Girls and Boys in School and What We Can Do About It*. New York, NY: Scribner. http://doi.org/10.1080/09540250903464773

Segars, A. (1997). Assessing the unidimensionality of measurement: a paradigm and illustration within the context of information systems research. *Omega International Journal of Management Science*, *25*(1), 107-121. https://doi.org/10.1016/S0305-0483(96)00051-5

Terblanche, W., Fakir, D., Chinyamurindi, W., & Mishi, S. (2021). Impact of self-esteem and student-and-lecturer interaction on academic performance in a chartered accounting programme, *Journal of Further and Higher Education*, *45*(4), 464-480. http://doi.org/10.1080/0309877X.2020.1781801

Vantieghem, W., Vermeersch, H., & Van Houtte, M. (2014). Transcending the gender dichotomy in educational gender gap research: The association between gender identity and academic self-efficacy. *Contemporary Educational Psychology*, *39*, 369-378. http://doi.org/10.1016/j.cedpsych.2014.10.001

Voyer, D. & Voyer, S. D. (2014). Gender differences in scholastic achievement: A meta-analysis. *Psychological Bulletin*, 140(4), 1174–1204. https://doi.org/10.1037/a0036620

Vygotsky, L. S. (1978). *Mind in Society: Development of Higher Psychological Processes.* http://www.parentcentredparenting.com/

Weiler, K. (2009). Feminist Analysis of Gender and Schooling. In A. Darder, M. Baltodano, & R. D. Torres, *The Critical Pedagogy Reader* (pp. 338–54). New York, NY: Routledge. http://doi.org/10.1007/BF00615157

Wheaton, B., Muthen, B., Alwin, D. F., & Summers, G. F. (1977). Assessing reliability and stability in panel models. *Sociological methodology*, *8*, 84-136. http://dx.doi.org/10.2307/270754

Wei, Y. (2021). Enhancing Teacher–Student Interaction and Students' Engagement in a Flipped Translation Classroom. *Front. Psychol.*, *12.* http://doi.org/10.3389/fpsyg.2021.764370

Whitehead, J. C., Groothuis, P. A., & Blomquist, G. C. (1993). Testing for Nonresponse and Sample Selection Bias in Contingent Valuation: Analysis of a Combination Phone/Mail Survey. *Economics Letters*, *41*(2), 215-230. https://doi.org/10.1016/0165-1765(93)90200-V

Williams, L. J., & McGonagle, A.K. (2016). Four research designs and a comprehensive analysis strategy for investigating common method variance with self-report measures using latent variables. *Journal of Business and Psychology, 31*, 339–359. https://doi.org/10.1007/s10869-015-9422-9

Witt, N., & Hofmeister, H. (2015). I just have to have it" or "It's enough for me"? Gender tendencies in attitudes towards and usage of mobile communication technology. *International Journal of Gender, Science and Technology*, *7*(1), 5-27. http://genderandset.open.ac.uk/index.php/genderandset

World Economic Forum. (2018). *Bridging the gender-equality gap in science at the Women's University in Africa*. https://www.idrc.ca/en/project/bridging-gender-equality-gap-science-womens-university-africa

Ziskin, M., Hossler, D., & Kim, S. (2009). The study of institutional practices related to student persistence. *J. College Student Retention*, *11*(1), 101-121. https://doi.org/10.2190/CS.11.1.f