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## Zimbabwean high school teachers' perception of the 4Cs: Perspectives on 21st-century learning and innovation skills

**Ottilia Goto** 

Department of Curriculum Studies, Faculty of Education, University of Johannesburg, Johannesburg, South Africa

**Jameson Goto** 

Department of Science and Technology Education, Faculty of Education, University of Johannesburg, Johannesburg, South Africa

jgoto@uj.ac.za

### Abstract

The development of 21st-century competencies such as collaboration, critical thinking, creativity and innovation, and communication (4Cs) has become central to preparing students for future life and the world of work. In this study, we investigated teachers' conceptions of the 4Cs in selected Zimbabwean high schools, using the Partnership for 21st Century Learning (P21) framework. Ninety-three teachers from 4 high schools participated in this study. Structural equation modelling results indicated that teachers endorsed collaboration first, followed by communication, critical thinking, creativity, and innovation. Black teachers had greater and statistically significant means than non-Black teachers for collaboration and communication, while the practical subjects taught significantly influenced creativity and innovation. The findings provide policymakers with insight to advocate for and design curricula that balance the 4C skills equally, and for teachers to review their instructional strategies to incorporate critical thinking, creativity, and innovation, which are pivotal in preparing students for the unpredictable world of generative artificial intelligence and their future success. Teachers may need support through professional development focused on the 4Cs.

**Keywords:** collaboration; communication; creativity and innovation; critical thinking; generative artificial intelligence

### Introduction

The explosion of Generative Artificial Intelligence (Gen AI) in the form of large language models in the teaching and learning field has fuelled the need for teachers to be well-versed in the 4Cs to intelligently equip their students for 21st-century learning demands (Jauhiainen & Guerra, 2023; Teng, Yin, Wang & Yang, 2024). Artificial intelligence (AI) emphasises the need for teachers to value creativity and critical thinking so that they can impart the 4C skills to their students (Walter, 2024). Furthermore, employers expect shortages of 4C skills in the future and the job market needs to drive the global markets (Bakhshandeh, 2021; Bhat & Gupta, 2024; Coetzer, 2018; Levin-Goldberg, 2012). Other benefits of the 4Cs are that they enhance students' academic performance and prepare students to work efficiently in the future (Brubaker, 2023; Tamela & Dwi, 2021). Historically, learning has been based on content knowledge transmission with rote learning, especially in countries with developing economies (Care, Kim, Vista & Anderson, 2018; Joynes, Rossignoli & Fenyiwa Amonoo-Kuofi, 2019; Rusdin & Ali, 2019). While this approach may ensure coverage of the syllabi, it tends to neglect the development of higher-order thinking skills and creativity (Joynes et al., 2019). Consequently, the students are ill-prepared for the demands of future life and the world of work. Hence, there is a need for a pedagogical shift to empower students for future life and the world (Kapkir, 2024).

Several authors (Chimbi & Jita, 2021a; Madondo, 2020; Moyo & Hadebe, 2018) report that Zimbabwean teachers are still stuck in their traditional approaches to teaching. In addition, the teachers struggle to adapt to the student-centred pedagogies demanded by the Zimbabwe Curriculum Framework (Chimbi & Jita, 2021b; Madondo, 2020). Moreover, implementing the 4Cs requires an in-depth knowledge of the learning area and teachers' experience, which are now lacking because of the brain drain of experienced teachers resulting from Zimbabwe's economic meltdown (De Villiers & Weda, 2017; Mapolisa & Tshabalala, 2013). However, experienced teachers may resist embracing the student-centred pedagogies that foster the acquisition of the 4Cs because, as students themselves, they were taught through traditional and conservative top-down strategies. Bedir (2019) and Hartono, Sofendi, Mirizon, Salim, Abdelgani and Elsyed (2020) attribute the resistance to change to older teachers who do not want to change their traditional ways of doing things, despite the teachers being cognisant of the importance of the 4Cs. Consequently, the resistance to teaching using student-centred methodologies curtails the development of the 4Cs (Chimbi & Jita, 2021a, 2021b; Madondo, 2018, 2020; Morrison, 2008; Moyo & Hadebe, 2018; Nyamayedenga & De Jager, 2021).

In a country like Zimbabwe, which is going through an economic meltdown, resources to support the integration of 4Cs are hard to come by (Madondo, 2020; Nyamayedenga & De Jager, 2021; Wekwete, 2020). Poor connectivity or the lack of stable connectivity in Zimbabwe inhibits teachers from upskilling themselves using online resources (Wekwete, 2020).

In the study reported on here we investigated how Zimbabwean teachers from selected high schools perceived the teaching of 21st-century competencies, restricted to 4Cs. The study was guided by the following research question: How do the Zimbabwean teachers in selected high schools perceive the 4Cs?

The following reasons motivated us to do the study. Previous studies in Zimbabwe and beyond have concentrated on qualitative approaches to understanding the 4Cs but none have tried to measure the perceptions of the 4Cs for teachers using quantitative approaches (Chimbi & Jita, 2021a, 2021b; Madondo, 2018, 2020; Moyo & Hadebe, 2018; Nyamayedenga & De Jager, 2021; Wekwete & Higgs, 2024). In addition, the explosion of Gen AI has resulted in the availability of a labyrinth of information, making it pivotal for teachers to develop the 4Cs – particularly critical thinking – to effectively navigate, evaluate, and apply knowledge in teaching and learning contexts (Reihanian, Hou, Chen & Zheng, 2025).

#### Literature Review

In countries with developing economies, teachers depend heavily on teacher-centred pedagogies (Joynes et al., 2019; Rusdin & Ali, 2019), which impede the adoption of the 4Cs. Because of pressure from the parents and school heads, as well as time constraints to complete the syllabi, teachers use traditional teaching approaches rather than student-centred methods that empower students for the future (Kapkir, 2024; Nyamayedenga & De Jager, 2021; Wekwete, 2020). Although time-consuming, student-centred approaches such as enquiry-based learning and project-based learning trigger disorienting dilemmas, critical thinking and critical reflection, which stimulate the emergence of the 4Cs through student-teacher or student-to-student or student-to-content interaction (Mason, 2008; Morrison, 2008; Sumara & Davis, 2006). For instance, in studies where teachers used project-based learning (PBL), the teachers were able to successfully integrate the elements of the 4Cs into their teaching (Haniah, Ngadiso & Setyaningsih, 2021; Kembara, Rozak & Hadian, 2019; Levin-Goldberg, 2012; Ng, 2008; Ravitz, 2014).

Another challenge that inhibits the implementation of the 4Cs is that teachers lack knowledge about the integration thereof into their

teaching and assessment approaches, with some teachers being incompetent in using the 4Cs in their teaching and assessment (Care et al., 2018; Niu, Niemi, Harju & Pehkonen, 2021; Selman & Jaedun, 2020). Consequently, due to their “incompetency and capacity gap”, the teachers resort to what serves them well: the traditional talk-and-chalk method (Mpaso, 2018:69), which may impede the nurturing of the 4Cs.

Several authors have posited that the availability of resources such as curriculum guidelines, open resources, connectivity, technology and professional development courses for both pre-service and in-service teachers are important in the integration of the 4Cs into teaching (Haryani, Cobern, Pleasants & Fetters, 2021; Kapkir, 2024; Nyamayedenga & De Jager, 2021; Selman & Jaedun, 2020). The converse may result in a poor conception of the 4Cs.

Niu et al. (2021) report that graduates from teacher education know the educational theory but struggle with applying 21st-century skills (4Cs) to their actual teaching. For instance, many graduates from Kenyan higher education institutions found teaching critical thinking difficult, although critical thinking skills are taught in their teacher education colleges (Ongesa, 2020). Ongesa (2020) reports that the teachers’ poor interpretation of critical thinking and pedagogy contributed to Kenya’s critical thinking gap. On the contrary, Mishra and Mehta (2017) report that critical thinking is the second easiest skill to teach after creativity and innovation, yet it is the second most critical skill in the 21st century.

Several authors have ranked the perception of the 4Cs by in-service and pre-service teachers. In developed and developing countries, collaboration has been strongly endorsed. However, critical thinking and creativity have been endorsed poorly in developing countries compared to developed countries. Table 1 shows the ranking of the 4Cs in several studies conducted in developed and developing countries.

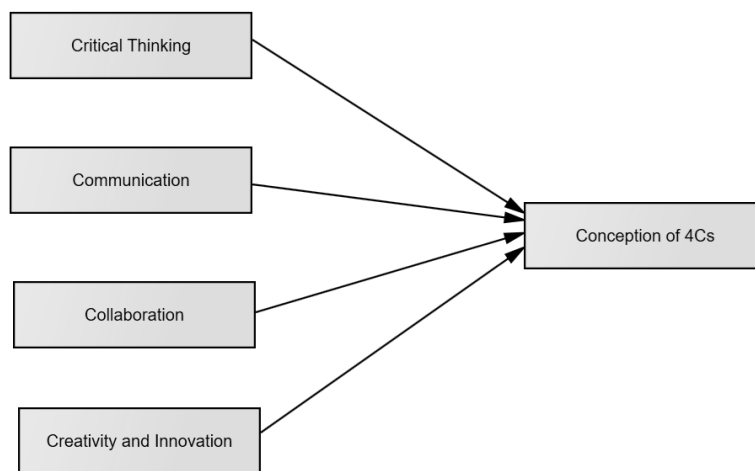
**Table 1** Literature on the ranking of the 4Cs

Study cited (Author & year)	Construct	Rank	Description	Country
(Niu et al., 2021) N = 227	Collaboration	1	Finnish student teachers on the perception of 4C	Finland
	Communication	-		
	Critical thinking	2		
	Creativity	-		
(Niu et al., 2021) N = 227	Collaboration	1	Finnish student teachers on the application of 4Cs	Finland
	Communication	-		
(Wattanavorakijkul, 2019) N = 43	Collaboration	2	Tertiary teachers designing English courses	Indonesia
	Communication	1		
	Critical thinking	3		
	Creativity	4		
(Rusdin & Ali, 2019) N = 84	Collaboration	1	Fostering 4Cs	Malaysia
	Communication	4		
	Critical thinking	3		
	Creativity	2		
(Mishra & Mehta, 2017) N = 518	Collaboration	2	School teachers and university students	United States of America (USA) +international community
	Communication	2		
	Critical thinking	1		
	Creativity	4		
(Oktaviani, Slamet, Setyosari, Ulfa, Nofaizzi, Putra & Kass, 2019)	Collaboration	1	Teachers' perception of the skills in science, technology, engineering, and mathematics (STEM) subjects	Indonesia
	Communication	1		
	Critical thinking	4		
	Creativity	2		

**Conceptual Framework**

The Partnership for 21st Century Learning (P21) framework was used to frame the study. The P21 helps teachers to integrate the 4C skills into the core subjects. In this study we concentrated on the

learning and innovation theme, which covers the 4Cs: critical thinking, communication, collaboration and creativity. According to Pardede (2020), the elements of the 4Cs are closely related. Figure 1 shows the conceptual elements of the framework.



**Figure 1** The elements of the 4Cs (Goto & Goto, 2024)

**Critical thinking skills and related literature**

Critical thinking is associated with high-order thinking skills epitomised in Bloom’s taxonomy (Joynes et al., 2019). The teacher’s role is to teach students how to analyse and synthesise information (Hartono et al., 2020; Joynes et al., 2019; Ojo, 2019; Pardede, 2020; Partnership for 21st Century Learning, 2011; Selman & Jaedun, 2020). Teachers can use authentic assessment, technology and project-based strategies to nurture critical thinking and creativity (Levin-Goldberg, 2012). Zhai,

Wibowo and Li (2024) emphasise the need for teachers to have critical thinking skills in the wake of the large language models (LLMs) to discern and curate unreliable information, especially when students plagiarise using LLMs.

Large classes are characteristic of government schools in Zimbabwe, and teachers tend to use teacher-centred teaching approaches (Nyamayedenga & De Jager, 2021; Wekwete, 2020), thereby curtailing the development of critical

thinking skills (Almulla, 2015; Elfatihi, 2017; Wekwete & Higgs, 2024).

This resulted in the formulation of the following hypothesis:

$H_{CT}$ : Critical thinking does not influence the teachers' perception of the 4Cs.

#### *Collaboration and related literature*

Collaboration relies on interaction between students and students and the teacher, with the teacher facilitating and extending the students' cognitive abilities (Joynes et al., 2019). Mishra and Mehta (2017) report that collaboration was the most important skill and the most challenging knowledge domain to teach. Likewise, Mpas0 (2018) and Niu et al. (2021) posit that Malawian and Finnish teachers struggled to teach collaboration to large classes and provide feedback in teacher-centred and student-centred environments, respectively. Almulla (2015) posits that teachers use teacher-centred approaches when teaching large classes. However, Chimbi and Jita (2021a) report that the teacher's delivery method depends on the teacher's teaching philosophy rather than class size. In Zimbabwe, government schools have large classes (Nyamayedenga & De Jager, 2021; Wekwete, 2020) and the teachers may face difficulties in using collaboration in teaching the 4Cs.

We thus formulated the next hypothesis:

$H_{COL}$ : Collaboration does not influence the teachers' perception of the 4Cs.

#### *Communication and related literature*

Communication is necessary for collaboration, creativity, and critical thinking (Selman & Jaedun, 2020). The Partnership for 21st Century Learning (2011) defines communication as the art of expressing thoughts clearly and persuasively, which is a valued employment attribute. The role of the teacher is to motivate and guide students to articulate their opinions, to communicate coherent instructions, and to provide constructive feedback (Joynes et al., 2019; Selman & Jaedun, 2020). The availability of technology in schools enhances communication between teachers and students and between the teachers themselves (Elfatihi, 2017). However, Zimbabwean schools are poorly equipped with technology. Wekwete (2020) reports that Zimbabwean teachers teach large classes, but that large classes do not foster communication (Ametordzi, 2017), which resulted in the third hypothesis:

$H_{COM}$ : Communication does not influence the teachers' perception of the 4Cs.

#### *Creativity and innovation, and related literature*

Creativity is the capacity of students to create novel and polished products (Herrington & Herrington, 2006; Nakano & Wechsler, 2018; Ojo, 2019; Pardede, 2020; Rusdin & Ali, 2019; Selman &

Jaedun, 2020). The teacher's role is to foster creativity and innovation in the classroom. However, a lack of resources in practical subjects such as art and fully operational computer labs may inhibit teachers from using their creative prowess in teaching (Levin-Goldberg, 2012). In addition, science teachers may not have resources in their schools to support inquiry-based learning or PBL, thus stifling the emergence of students' creativity and innovation (Somphol, Pimsak, Payoungkiattikun & Hemtasin, 2022). Nevertheless, a lack of connectivity in Zimbabwean schools can aggravate this, limiting creative teachers from accessing creative content online. Ametordzi (2017) posits that large classes (as is the case in Zimbabwe) curtail the development of creativity and innovation since the teachers have no time to provide individualised feedback. Nevertheless, large classes challenge teachers to innovate (Trim, Thota, Liberatore, Richards, Anderson & Verts, 2017). This leads to the following hypothesis:

$H_{CI}$ : Creativity and innovation do not influence the perception of the 4Cs.

#### *The influence of moderators*

Several authors (Bezanilla, Galindo-Domínguez, Campo, Fernández-Nogueira & Ruiz, 2023; Hussain & Mrinalini, 2021; Liu, 2023; Niu et al., 2021) report that gender did not affect critical thinking. Jehan, Shahzada and Mustafa (2022) report that female English language teachers were more creative than their male colleagues. In addition, Kapkir (2024) reports that in language classes, teachers prioritised communication over other 4Cs, while McLure, Won and Treagust (2024) state that science teachers would prioritise problem-solving, an element of critical thinking, creativity and innovation. On the other hand, Harris and Carter (2021) report that arts subjects impact creativity and innovation.

#### **Methodology**

We used a cross-sectional quantitative research design, which is quicker and cheaper to apply than longitudinal methods (Singh, 2023).

#### *The Instrument*

The instrument was adapted from Ravitz (2014). The questionnaire has four 4C constructs. Two 5-point Likert scales were used (1 Not really; 2 To a minor extent; 3 To a moderate extent; 4 To a great extent; 5 To a very great extent) and (1 Never; 2 Rarely; 3 Sometimes; 4 Often; 5 Always).

#### *Instrument validity*

Content validity is the degree to which a measuring instrument measures what it is supposed to measure (Tavakol & Dennick, 2011). Content validity was checked by changing the wording of some of the Ravitz (2014) scale items to fit the Zimbabwean context.

### Participants

Ninety-three teachers from four high schools participated in the study. The number of participants was not evenly distributed across the schools, reflecting differences in staff availability and voluntary participation. Table 2 shows the participants' demographic information.

**Table 2** Participants' profiles

Demographic item	Frequency	%
Gender		
Male	56	60.2
Female	37	39.8
Race		
Black	81	87.1
Other	12	12.9
Age		
< 29	7	7.5
30–34	10	10.8
35–39	12	12.9
40–44	14	15.1
45–49	21	22.6
> 50	29	31.2
Professional development		
No	42	45.2
Yes	51	54.8
Subjects		
Science	44	47.3
Arts	25	26.9
Commercials	12	12.9
Practical	12	12.9
Qualifications		
Masters	12	12.9
Honours	30	32.3
Bachelor	39	41.9
Diploma	11	11.8
Certificate	1	1.1

**Table 3** The mean, standard deviation and ranking of the 4C elements

Construct	<i>M</i>	<i>SD</i>	Number of items	Rank
CT	3.645	0.702	3	3
COL	3.675	0.857	5	1
COM	3.649	0.749	4	2
CI	3.326	0.769	6	4

Note. CT = critical thinking; COL = collaboration; COM = communication; CI = creativity and innovation.

### Exploratory factor analysis

Exploratory factor analysis (EFA) using the principal axis factoring (PAF) with the Promax rotation option was employed to check for the unidimensionality of the items in each construct. Loadings that were low and less than 0.3 were discarded. For instance, items COL1 and COM1 were removed. Table 4 shows the factor loadings of the items.

Most of the teachers (53.8%) were 45 years old, of which 41.9% held bachelor degrees, while 54.8% reported that they had undergone professional development in the teaching of 21st-century skills. Table 2 shows a clear analysis of the demographic features of the participants.

### Data Collection

A paper questionnaire was administered to the teachers in the high schools involved. The teachers' responses were uploaded to a Google Form and later downloaded as an Excel spreadsheet for further analysis using the Statistical Package for the Social Sciences (SPSS) and Analysis of Moment Structures (AMOS).

### Results

Exploratory and confirmatory factor analyses were used to validate the questionnaire using SPSS and Amos version 26. Parametric tests were used to test for the effect of moderators on the constructs.

### Descriptive Statistics

Collaboration and communication means were the highest, indicating a high perception of collaboration and communication among the teachers. The means for critical thinking, creativity, and innovation were low, indicating that the teachers had a low perception of these two elements. Table 3 shows the mean, standard deviation and ranking of the 4C elements.

**Table 4** Factor loadings of the 4C constructs

Item	CT	COL	COM	CI
1	0.600			0.711
2	0.735	0.730	0.577	0.687
3	0.468	0.750	0.615	0.791
4		0.819	0.896	0.602
5		0.789		0.757
6				0.779

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy

All the KMO values exceeded the threshold of 0.6, indicating that factor analysis was plausible (Field, 2018; Kaiser, 1974). Table 5 shows the KMO values.

**Table 5** The KMO values for the 4C constructs

Construct	KMO
CT	0.625
COL	0.813
COM	0.640
CI	0.792

**Table 6** The intercorrelations of the 4C constructs

	CT	COL	COM	CI
CT	1.000			
COL	0.491	1.000		
COM	0.415	0.751	1.000	
CI	0.542	0.494	0.405	1.000

#### Reliability

Reliability measures the internal consistency of the items in the instrument. All the Cronbach's alpha values, except for CT, were greater than 0.7, indicating good reliability (Brown & Moore, 2012). The Cronbach's alpha value for CT was 0.605, which is a reasonable reliability (Cortina, 1993). Construct validity tests should be done since reliability is a prerequisite for validity (Venkatesh, Brown & Bala, 2013). Table 7 shows Cronbach's alpha values for the 4C elements.

**Table 7** Cronbach's alpha for the 4C constructs

Construct	Cronbach's alpha
CT	0.605
COL	0.846
COM	0.717
CI	0.862

Cronbach's alpha may underestimate or overestimate scale reliability (Trizano-Hermosilla & Alvarado, 2016). Hence, there is a need to undertake a more reliable measurement using construct validity (Raykov & Shrout, 2002).

**Table 8** Convergent and discriminant validity measures

	CR	AVE	CT	COL	COM	CI
CT	0.633	0.373	<b>0.611</b>			
COL	0.855	0.598	0.491	<b>0.773</b>		
COM	0.746	0.505	0.415	0.751	<b>0.711</b>	
CI	0.868	0.524	0.542	0.494	0.405	<b>0.723</b>

Note. The values on the diagonal (in bold) are the square root of average variance extracted (AVE) estimates.

#### Confirmatory factor analysis (CFA)

The fit of the measurement model was confirmed using CFA. The measurement model with

#### Multicollinearity

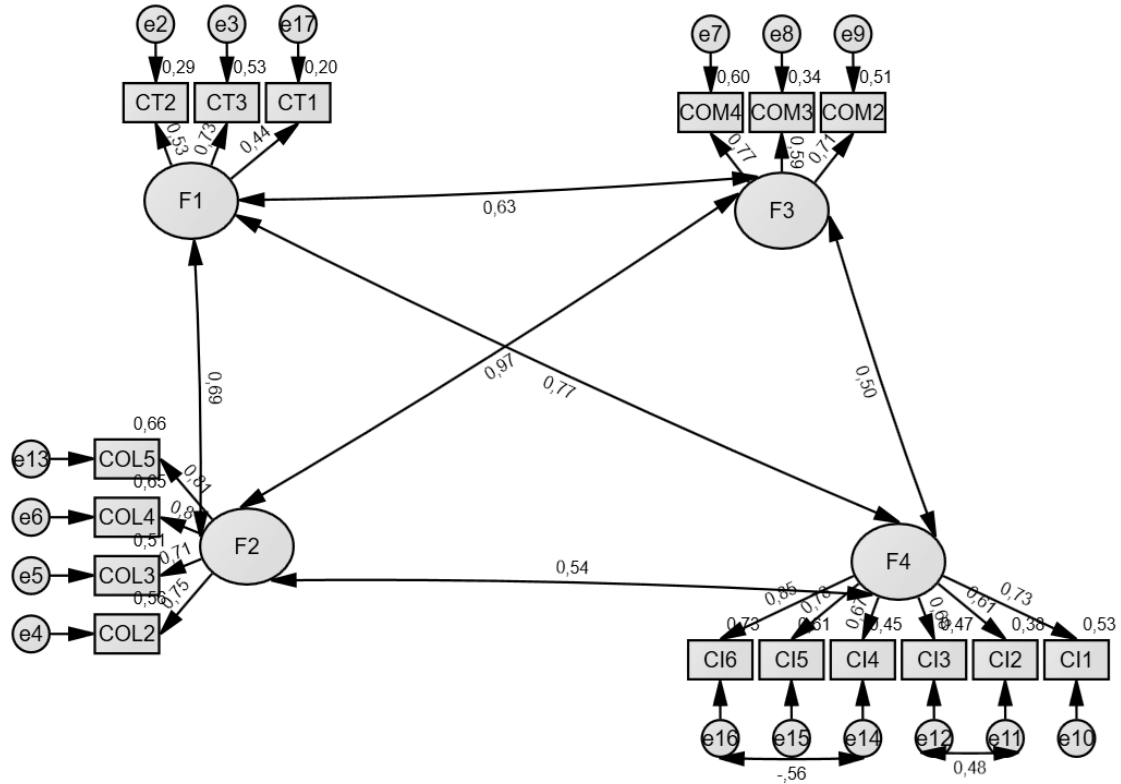
The inter-correlations were less than 0.8, indicating no multicollinearity in the data (Shrestha, 2020). The highest correlation between COL and COM was 0.751. This is unsurprising since the four elements of the 4Cs are closely related, especially COL and COM (Joynes et al., 2019; Pardede, 2020). Also, the correlation between CT and CI was 0.542, indicating that the two were moderately related. Table 6 shows the intercorrelations of the constructs.

#### Construct validity

Construct validity is how accurately a construct measures what it is intended to measure (Strauss & Smith, 2009). Convergent (related items) and discriminant (distinct items) validity are components of construct validity. These two components are measured using composite reliability and the average variance extracted (AVE). Composite reliability (CR) measures the overall reliability of the underlying variable, and AVE measures the amount of variance a variable has compared to its measurement error (Fornell & Larcker, 1981; Hair, Black, Babin, Anderson & Tatham, 2006).

In this study, all the constructs had CR values exceeding 0.6 and AVEs greater than or less than 0.5 for COL, COM, CI and CT, indicating convergent validity (Fornell & Larcker, 1981). Discriminant validity was met since the correlations among the variables were less than the square roots of the AVEs (in bold) in the corresponding rows and columns (Fornell & Larcker, 1981). Table 8 shows the convergent and discriminant validity measures.

modifications (co-varying error terms of error terms) is shown in Figure 2.



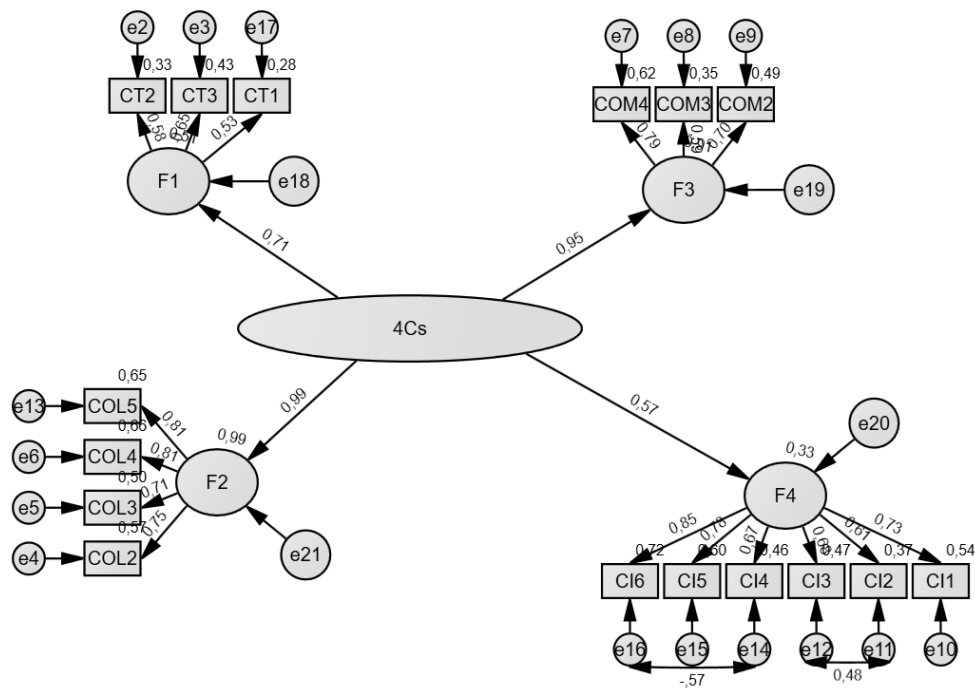
**Figure 2** The measurement model with modifications

Note. F1 = critical thinking; F2 = collaboration; F3 = communication; F4 = creativity and innovation.

The model fit was assessed based on the relative chi-square minimum discrepancy (CMIN/*df*) = 1.461), comparative fit index (CFI = 0.935), Tucker-Lewis index (TLI = 0.919), incremental fit index (IFI = 0.937) and the root-mean-square error of approximation (RMSEA = 0.071). The fit values were within threshold ranges, presenting a good measurement model fit (see Hu & Bentler, 1999).

**Second-order confirmatory factor analysis**

The constructs in Table 7 have convergent validity since their CR and AVE meet the Fornell and Larcker (1981) criteria. In addition, they are moderately correlated, suggesting a second or higher-order factor that could account for the four factors (Brown, 2006). The second high-order factor was named the conception of the 4Cs. Figure 3 shows the second-order confirmatory factor model.



**Figure 3** The second-order confirmatory factor model

*Note.* F1 = critical thinking; F2 = collaboration; F3 = communication; F4 = creativity and innovation.

The COL and COM constructs loaded on the conception of the 4Cs with loadings of 0.992 and 0.954 respectively. This was followed by CT and CI with loadings of 0.715 and 0.571 (see Table 8). In addition, the CR and the AVE were greater than 0.7

and 0.5 respectively and were statistically significant, indicating that all the sub-constructs (F1, F2, F3 and F4) belonged together or had convergent validity (see Fornell & Larcker, 1981). Table 9 shows the conception of the 4Cs.

**Table 9** The conception of the 4Cs

		Std. estimate	SE	C.R.	<i>p</i>	Result	CR	AVE
F1 <---	4Cs	0.715	0.194	4.422	***	Significant	0.89	0.68
F3 <---	4Cs	0.954				Reference point		
F4 <---	4Cs	0.571	0.136	4.519	***	Significant		
F2 <---	4Cs	0.992	0.243	6.209	***	Significant		

*Note:* Std = Standardised.

#### Explained variance

The values of the loadings squared measure the explained variance. F1 (critical thinking) and F4 (creativity and innovation) contributed the least variance, 51.1% and 32.6% respectively, while F2 (collaboration) and F3 (communication) accounted for the most explained variance, 98.5% and 91% respectively.

#### Moderators

The moderators used in this study were gender, age, population group, qualification, experience and subject taught. The one-way multivariate analysis of covariance (MANCOVA) indicated that the means of COM and COL among Black teachers were greater and statistically significant than those of

non-Black teachers. In addition, practical subjects such as art influenced CI. However, age, qualification, teaching experience and gender had no statistically significant influence on CT, COL, CI and COM.

#### Discussion

We investigated Zimbabwean high school teachers' perception of the 4Cs. The participating teachers highly endorsed COL and COM, followed by CT, CI with decreasing magnitude, which we discuss in the following sections.

#### Teachers' Perception of Collaboration

In this study COL was endorsed first, dovetailing with previous findings in Finland, Malaysia and

Indonesia (Niu et al., 2021; Rusdin & Ali, 2019). Notwithstanding, this result is not in agreement with findings from Mishra and Mehta (2017), which show that international teachers endorsed COL as second to CT as the most important of the 4Cs. In addition, the high ranking of COL does not align with findings by Mpasu (2018) and Niu et al. (2021), who posit that Malawian and Finnish teachers struggled to teach COL to large classes. While COL is widely recognised as a key 21st-century competency, its implementation varies across educational contexts. For instance, in countries with advanced technology and well-resourced education systems, such as Finland, COL often takes place in student-centred environments (Niu et al., 2021). In contrast, in developing countries like Zimbabwe, COL tends to occur within teacher-centred settings, with limited resources and overcrowded classrooms (Matarise, 2024; Moyo & Hadebe, 2018; Wekwete, 2020). Such disparities call for context-sensitive approaches to embedding the COL element of 4Cs within curricula. The Black teachers had higher and statistically significant means for COL than non-Black teachers, probably indicating different cultural approaches to the teaching of the 4Cs.

#### Teachers' Perception of Communication

In this study, COM was endorsed second, and this is consistent with findings by several authors (Mishra & Mehta, 2017; Wattanavorakijkul, 2019) where COM was ranked either first or second since COL and COM are highly correlated (Joynes et al., 2019; Pardede, 2020). However, this finding is inconsistent with findings by Rusdin and Ali (2019), where COM was ranked last (fourth). The findings in our study confirm that the correlation between COM and COL was high (0.751), aligning with findings from Joynes et al. (2019) and Pardede (2020). The Black teachers had a higher and statistically significant mean for COM than non-Black teachers, probably indicating different cultural approaches to teaching the 4Cs.

#### Teachers' Perception of Critical Thinking

In this study, CT was ranked third among the 4Cs, aligning with research from several developing countries (Rusdin & Ali, 2019; Wattanavorakijkul, 2019). This lower ranking may be attributed to factors such as large class sizes (Elfatih, 2017; Nyamayedenga & De Jager, 2021) and limited educational resources (Madondo, 2020; Wekwete, 2020), which restrict opportunities for PBL (Haniah et al., 2021; Kembara et al., 2019) which foster CT. Additionally, the pressure to complete the syllabus often reinforces traditional, teacher-centred approaches (Nyamayedenga & De Jager, 2021; Wekwete, 2020), further limiting the development of CT. In contrast, studies conducted in developed countries (Mishra & Mehta, 2017; Niu et al., 2021)

ranked CT first or second, reflecting student-centred learning pedagogical strategies that thrive in the abundance of and availability of resources – unlike in developing countries where resources are limited or non-existent. Gender did not influence CT, aligning with several authors' findings (Bezanilla et al., 2023; Hussain & Mrinalini, 2021; Liu, 2023; Niu et al., 2021).

#### Teachers' Perception of Creativity and Innovation

In this study, creativity and innovation were ranked fourth (last). This result compares favourably with the findings from Mishra and Mehta (2017) and Wattanavorakijkul (2019) where CI were ranked fourth. Nevertheless, this contradicts findings by Rusdin and Ali (2019) in which CI were ranked second. Notwithstanding, Mishra and Mehta (2017) report that CI were the least difficult skills to teach among the 4Cs. However, this was in the USA where resources are more readily available compared to developing countries such as Zimbabwe.

Practical subjects (arts) influenced CI, supporting the view that practical subjects foster CI in line with findings from Harris and Carter (2021). Science subjects did not influence CI, which does not align with the findings of McLure et al. (2024), who associate problem-solving (innovation) with science.

#### Conclusion

The teachers endorsed COL the highest, followed by COM, CT and CI in decreasing magnitude. Teachers who taught practical subjects had CI skills compared to other subjects.

The limitations of the results are as follows. The sample of the study was limited. Including more schools in the study could have increased its reliability and generalisability. A mixed methods design would have captured rich data, where the qualitative part of the study complemented the quantitative method.

Based on our study, we make a few recommendations. Professional development courses can be implemented to improve the integration of the 4Cs and create favourable perceptions of the 4Cs, especially for CT and creativity, which contributed less to the perceptions of the 4Cs. Schools may allocate more funds (resources) to the sciences to support enquiry and PBL in laboratories and arts subjects for buying supplies to develop and foster CT, creativity, and innovation skills. Schools must provide technological infrastructure that teachers can use for collaborative and COM purposes and for attaining resources for the integration of the 4Cs.

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### Authors' Contributions

OG conceptualised the study, collected the data and edited the article. JG analysed the data and compiled the literature review.

### Notes

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### References

- Almulla MA 2015. An investigation of teachers' perceptions of the effects of class size on teaching. *International Education Studies*, 8(12):33–42 <https://doi.org/10.5539/ies.v8n12p33>
- Ametordzi S 2017. Instructor-learner ratio and its implications on creative design skills acquisition in higher education. *Journal of Education and Practice*, 8(27):239–248.
- Bakhshandeh B 2021. Perception of 21st century 4Cs (critical thinking, communication, creativity & collaboration) skills gap in private-sector employers in Lackawanna County, Nepa. PhD dissertation. University Park, PA: The Pennsylvania State University. Available at <https://www.proquest.com/docview/2577123614?pq-origsite=gscholar&fromopenview=true&source=type=Dissertations%20&%20Theses>. Accessed 28 February 2026.
- Bedir H 2019. Preservice ELT teachers' beliefs and perceptions on 21st century learning and innovation skills (4Cs). *Journal of Language and Linguistic Studies*, 15(1):231–246. <https://doi.org/10.17263/jlls.547718>
- Bezanilla MJ, Galindo-Domínguez H, Campo L, Fernández-Nogueira D & Ruiz MP 2023. Understanding critical thinking: A comparative analysis between university students' and teachers' conception. *Tuning Journal for Higher Education*, 10(2):223–244. <https://doi.org/10.18543/tjhe.2515>
- Bhat IH & Gupta S 2024. A study of the 21st century 4Cs skill gap in the Indian private sector. In AM Thake, K Sood, E Özen & S Grima (eds). *Contemporary challenges in social science management: Skills gaps and shortages in the labour market* (Vol 112B). Leeds, England: Emerald Publishing. <https://doi.org/10.1108/S1569-37592024000112A014>
- Brown T 2006. *Confirmatory factor analysis for applied research*. New York, NY: The Guilford Press.
- Brown TA & Moore MT 2012. Confirmatory factor analysis. In RH Hoyle (ed). *Handbook of structural equation modelling*. New York, NY: Guilford Press.
- Brubaker A 2023. *How online education builds career-readiness with the 4Cs*.
- Care E, Kim H, Vista A & Anderson K 2018. *Education system alignment for 21st century skills: Focus on assessment*. Washington, DC: Center for Universal Education at The Brookings Institution. Available at <https://www.brookings.edu/wp-content/uploads/2018/11/Education-system-alignment-for-21st-century-skills-012819.pdf>. Accessed 28 February 2026.
- Chimbi GT & Jita LC 2021a. Policy failures with learner-centered pedagogy: Case studies from the Zimbabwean experiment on project-based learning. *Interdisciplinary Journal of Problem-Based Learning*, 15(1). <https://doi.org/10.14434/ijpbl.v15i1.29268>
- Chimbi GT & Jita LC 2021b. Searching for learners' voices: Teachers' struggle to align pedagogical-reform policy with instructional practice. *Journal of Pedagogy*, 12(2):61–83. <https://doi.org/10.2478/jped-2021-0010>
- Coetzer N 2018. *The 4 C's needed for your future employment success*. Available at <https://www.linkedin.com/pulse/4-cs-needed-your-future-employment-success-nitha-coetzer>. Accessed 28 February 2026.
- Cortina JM 1993. What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, 78(1):98–104. <https://doi.org/10.1037//0021-9010.78.1.98>
- De Villiers R & Weda Z 2017. Zimbabwean teachers in South Africa: A transient greener pasture. *South African Journal of Education*, 37(3):Art. # 1410, 9 pages. <https://doi.org/10.15700/saje.v37n3a1410>
- Elfatih M 2017. Teaching critical thinking skills in large classes. *Higher Education of Social Science*, 12(1):12–16. <https://doi.org/10.3968/8993>
- Field A 2018. *Discovering statistics using IBM SPSS statistics* (5th ed). Newbury Park, CA: Sage.
- Fornell C & Larcker DF 1981. Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1):39–50. <https://doi.org/10.1177/002224378101800104>
- Goto O & Goto J 2024. Secondary school students' perceptions of the 21st-century 4Cs in Zimbabwe. *Perspectives in Education*, 42(2):145–161. <https://doi.org/10.38140/pie.v42i2.7489>
- Hair JF, Jr, Black WC, Babin BJ, Anderson RE & Tatham RL 2006. *Multivariate data analysis* (6th ed). Upper Saddle River, NJ: Pearson Prentice Hall.
- Haniah AU, Ngadiso N & Setyaningsih E 2021. Students' perception on the implementation of Online Project-based Learning in teaching 4Cs. *Indonesian Journal of English Language Teaching and Applied Linguistics*, 6(1):123–140 <https://doi.org/10.21093/ijeltal.v6i1.895>
- Harris A & Carter MR 2021. Applied creativity and the arts. *Curriculum Perspectives*, 41(1):107–112. <https://doi.org/10.1007/s41297-020-00127-z>
- Hartono, Sofendi, Mirizon S, Salim AA, Abdelgani EM & Elsyed YB 2020. Preparing pre-service teachers for the 21st century education: A comparative study of two teacher education programs. In R Perdana, HD Barke, JB Bacasmot, H Ramadhan, TY Septiawan & B Saputra (eds). *International Conference on Progressive Education (ICOPE 2019)* (Vol. 422). Amsterdam, The Netherlands: Atlantis Press. <https://doi.org/10.2991/assehr.k.200323.141>
- Haryani E, Cobern WW, Pleasants BAS & Fetters MK 2021. Analysis of teachers' resources for integrating the skills of creativity and innovation, critical thinking and problem solving, collaboration, and communication in science classroom. *Jurnal Pendidikan IPA Indonesia*,

- 10(1):92–102.  
<https://doi.org/10.15294/jpii.v10i1.27084>
- Herrington J & Herrington A 2006. Authentic conditions for authentic assessment: Aligning task and assessment. In A Bunker & I Vardi (eds). *Critical Visions: Thinking, Learning and Researching in Higher Education: Proceedings of the 2006 Annual International Conference of the Higher Education Research and Development Society of Australasia Inc (HERDSA)*. Milperra, Australia: Higher Education Research and Development Society of Australasia (HERDSA). Available at <https://researchportal.murdoch.edu.au/esploro/outputs/conferencePaper/Authentic-conditions-for-authentic-assessment-Aligning/991005542462607891#file-0>. Accessed 28 February 2026.
- Hu LT & Bentler PM 1999. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1):1–55.  
<https://doi.org/10.1080/10705519909540118>
- Hussain SA & Mrinalini J 2021. Comparative study of critical thinking ability among teacher educators on the basis of gender. *International Journal of Emerging Technologies and Innovative Research*, 8(8):a926–a931.
- Jauhainen JS & Guerra AG 2023. Generative AI and ChatGPT in school children's education: Evidence from a school lesson. *Sustainability*, 15(18):14025.  
<https://doi.org/10.3390/su151814025>
- Jehan R, Shahzada G & Mustafa J 2022. Does gender difference exist on the teaching creativity level of male and female secondary school English teachers in district Bannu? *Sir Syed Journal of Education & Social Research*, 5(3):123–136.  
[https://doi.org/10.36902/sjesr-vol5-iss3-2022\(123-136\)](https://doi.org/10.36902/sjesr-vol5-iss3-2022(123-136))
- Joynes C, Rossignoli S & Fenyiwa Amonoo-Kuofi E 2019. *21st century skills: Evidence of issues in definition, demand and delivery for development contexts* (K4D Helpdesk Report). Brighton, England: Institute of Development Studies. Available at [https://assets.publishing.service.gov.uk/media/5d71187ce5274a097c07b985/21st\\_century.pdf](https://assets.publishing.service.gov.uk/media/5d71187ce5274a097c07b985/21st_century.pdf). Accessed 28 February 2026.
- Kaiser HF 1974. An index of factorial simplicity. *Psychometrika*, 39(1):31–36.  
<https://doi.org/10.1007/BF02291575>
- Kapkır F 2024. Teaching 21st century skills in EFL classrooms: An investigation of teacher, student and institutional perceptions on the instructional practices of the 4C skills. MA thesis. Ankara, Türkiye: Middle East Technical University.
- Kembara MD, Rozak RWA & Hadian VA 2019. Research-based lectures to improve students' 4C (communication, collaboration, critical thinking, and creativity) skills. In AG Abdullah, AA Danuwijaya, N Haristian, R Dallyono, Y Wirza & D Yuliana (eds). *Proceedings of the Second Conference on Language, Literature, Education, and Culture (ICOLLITE 2018)*. Dordrecht, The Netherlands: Atlantis Press.  
<https://doi.org/10.2991/issueh-18.2019.6>
- Levin-Goldberg J 2012. Teaching generation TechX with the 4Cs: Using technology to integrate 21st century skills. *Journal of Instructional Research*, 1:59–66.  
<https://doi.org/10.9743/JIR.2013.8>
- Liu W 2023. Critical thinking skills for Chinese teachers: A study of mathematics teachers' perceptions. *PUPIL: International Journal of Teaching, Education and Learning*, 7(2):01–16.  
<https://doi.org/10.20319/pijtel.2023.72.0116>
- Madondo MM 2018. A requiem too soon or a landing strand too far? Teacher-centred pedagogy versus teaching for critical thinking in the Zimbabwe Curriculum Framework 2015–2022. *Zimbabwe Journal of Educational Research*, 30(1).  
<https://doi.org/10.4314/zjer.v30i1>
- Madondo MM 2020. Curriculum reform and classroom practice: Teaching geography in the Zimbabwean Curriculum Framework 2015 – 2022. PhD thesis. Bloemfontein, South Africa: University of the Free State. Available at <https://scholar.ufs.ac.za/server/api/core/bitstreams/4cef1f92-c26d-4dd1-9f6b-b5524e5a0adf/content>. Accessed 23 February 2026.
- Mapolisa T & Tshabalala T 2013. The impact of the economic meltdown on the education system of Zimbabwe. *International Journal of Asian Social Science*, 3(11):2254–2266.
- Mason M 2008. Complexity theory and the philosophy of education. *Educational Philosophy and Theory*, 40(1):4–18. <https://doi.org/10.1111/j.1469-5812.2007.00412.x>
- Matarise RS 2024. *State of education in Zimbabwe: A comprehensive review*.
- McLure F, Won M & Treagust DF 2024. Science teachers' understanding of creative thinking and how to foster it as mandated by the Australian Curriculum. *Journal of Science Teacher Education*, 35(5):524–543.  
<https://doi.org/10.1080/1046560X.2024.2313882>
- Mishra P & Mehta R 2017. What we educators get wrong about 21st-century learning: Results of a survey. *Journal of Digital Learning in Teacher Education*, 33(1):6–19.  
<https://doi.org/10.1080/21532974.2016.1242392>
- Morrison K 2008. Educational philosophy and the challenge of complexity theory. *Educational Philosophy and Theory*, 40(1):19–34.  
<https://doi.org/10.1111/j.1469-5812.2007.00394.x>
- Moyo L & Hadebe LB 2018. Education challenges affecting research and skilful teaching-learning (pedagogies) in Zimbabwe. *European Journal of Alternative Education Studies*, 3(1):1–14.  
<https://doi.org/10.5281/zenodo.1154967>
- Mpsao J 2018. An investigation of learner-centered education in a large class developing country setting: Evidence from Lilongwe, Malawi. MDS dissertation. Durban, South Africa: University of KwaZulu-Natal. Available at <https://researchspace.ukzn.ac.za/server/api/core/bitstreams/8b95963c-ffbf-4a4b-836e-138d9af3ef6d/content>. Accessed 28 February 2026.
- Nakano TC & Wechsler SM 2018. Creativity and innovation: Skills for the 21st century. *Estudos de Psicologia (Campinas)*, 35(3):237–246.  
<https://doi.org/10.1590/1982-02752018000300002>
- Ng PT 2008. Educational reform in Singapore: From

- quantity to quality. *Educational Research for Policy and Practice*, 7:5–15.  
<https://doi.org/10.1007/s10671-007-9042-x>
- Niu SJ, Niemi H, Harju V & Pehkonen L 2021. Finnish student teachers' perceptions of their development of 21st-century competencies. *Journal of Education for Teaching*, 47(5):638–653.  
<https://doi.org/10.1080/02607476.2021.1951602>
- Nyamayedenga MS & De Jager L 2021. Enhancing knowledge-building through communicative language teaching. *Journal of Education*, 83:146–161. <https://doi.org/10.17159/2520-9868/i83a08>
- Ojo G 2019. Acquiring the 4Cs (communication, collaboration, critical thinking and creativity) through integrating the four language skills in secondary ELS classrooms in Nigeria. *LWATI: A Journal of Contemporary Research*, 16(1):42–54. <https://doi.org/10.4314/lwati.v6i1>
- Oktaviani HI, Slamet TI, Setyosari P, Ulfa S, Nofaizzi MU, Putra WP & Kass RDD 2019. The most important soft skill for students 21st century learning: Contribution technology-enhanced in classroom. In *2019 5th International Conference on Education and Technology (ICET)* (Vol. 382). IEEE.  
<https://doi.org/10.1109/ICET48172.2019.8987200>
- Ongesa CM 2020. Critical thinking skill gap in the Kenyan education curriculum: The 21st century skills for the global citizen. *Journal of Interdisciplinary Studies in Education*, 9(S1):178–191. <https://doi.org/10.32674/jise.v9iS1.1860>
- Pardede P 2020. Integrating the 4Cs into EFL integrated skills learning. *Journal of English Teaching*, 6(1):71–85. <https://doi.org/10.33541/jet.v6i1.190>
- Partnership for 21st Century Learning 2011. *Framework for 21st century learning*.
- Ravitz J 2014. *A survey for measuring 21st century teaching and learning: West Virginia 21st Century Teaching and Learning Survey [WVDE-CIS-28]*. <https://doi.org/10.13140/RG.2.1.2246.6647>
- Raykov T & Shrout PE 2002. Reliability of scales with general structure: Point and interval estimation using a structural equation modeling approach. *Structural Equation Modeling*, 9(2):195–212. [https://doi.org/10.1207/S15328007SEM0902\\_3](https://doi.org/10.1207/S15328007SEM0902_3)
- Reihanian I, Hou Y, Chen Y & Zheng Y 2025. *A review of generative AI in computer science education: Challenges and opportunities in accuracy, authenticity, and assessment* [Preprint]. <https://doi.org/10.48550/arXiv.2507.11543>
- Rusdin NM & Ali SR 2019. Practice of fostering 4Cs skills in teaching and learning. *International Journal of Academic Research in Business & Social Sciences*, 9(6):1021–1035. <https://doi.org/10.6007/IJARBS/v9-i6/6063>
- Selman YF & Jaedun A 2020. Evaluation of the implementation of 4C skills in Indonesian subject at senior high schools. *JPI (Jurnal Pendidikan Indonesia)*, 9(2):244–257. <https://doi.org/10.23887/jpiundiksha.v9i2.23459>
- Shrestha N 2020. Detecting multicollinearity in regression analysis. *American Journal of Applied Mathematics and Statistics*, 8(2):39–42. <https://doi.org/10.12691/ajams-8-2-1>
- Singh S 2023. *What is a cross-sectional study? Definition, advantages, disadvantages, and examples* [Blog]. Available at <https://researcher.life/blog/article/what-is-a-cross-sectional-study-definition-and-examples/>. Accessed 28 February 2026.
- Somphol R, Pimsak A, Payoungkiattikun W & Hemtasin C 2022. Enhancing 4Cs skills of secondary school students using project-based learning. *Journal of Educational Issues*, 8(2):721–731. <https://doi.org/10.5296/jei.v8i2.20367>
- Strauss ME & Smith GT 2009. Construct validity: Advances in theory and methodology. *Annual Review of Clinical Psychology*, 5:1–25. <https://doi.org/10.1146/annurev.clinpsy.032408.153639>
- Sumara DJ & Davis BA 2006. Correspondence, coherence, complexity: Theories of learning and their influences on processes of literary composition. *English Teaching: Practice and Critique*, 5(2):34–55. Available at <https://files.eric.ed.gov/fulltext/EJ843825.pdf>. Accessed 16 February 2025.
- Tamela E & Dwi MH 2021. Four C's skills integration in the lesson plans of grade 7 English teacher. *Jo-ELT (Journal of English Language Teaching) Fakultas Pendidikan Bahasa & Seni Prodi Pendidikan Bahasa Inggris IKIP*, 8(2):124–138. <https://doi.org/10.33394/jo-elt.v8i2.4345>
- Tavakol M & Dennick R 2011. Making sense of Cronbach's alpha. *International Journal of Medical Education*, 2:53–55. <https://doi.org/10.5116/ijme.4dfb.8dfd>
- Teng Y, Yin Z, Wang X & Yang H 2024. Investigating relationships between community of inquiry perceptions and attitudes towards reading circles in Chinese blended EFL learning. *International Journal of Educational Technology in Higher Education*, 21(1):6. <https://doi.org/10.1186/s41239-024-00440-x>
- Trim M, Thota N, Liberatore M, Richards T, Anderson G & Verts WT 2017. Innovation with scale: Turning large class sizes into opportunities for pedagogical innovation. *Journal of Computing Sciences in Colleges*, 32(6):183–186.
- Trizano-Hermosilla I & Alvarado JM 2016. Best alternatives to Cronbach's alpha reliability in realistic conditions: Congeneric and asymmetrical measurements. *Frontiers in Psychology*, 7:769. <https://doi.org/10.3389/fpsyg.2016.00769>
- Venkatesh V, Brown SA & Bala H 2013. Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. *MIS Quarterly*, 37(1):21–54. <https://doi.org/10.25300/MISQ/2013/37.1.02>
- Walter Y 2024. Embracing the future of Artificial Intelligence in the classroom: The relevance of AI literacy, prompt engineering, and critical thinking in modern education. *International Journal of Educational Technology in Higher Education*, 21:15. <https://doi.org/10.1186/s41239-024-00448-3>
- Wattanavorakijkul N 2019. Challenges faced by Thai tertiary teachers in designing and delivering English courses in the 21st century. *Thai Tesol Journal*, 32(1):33–54. Available at <https://files.eric.ed.gov/fulltext/EJ1247235.pdf>. Accessed 14 February 2025.
- Wekwete P 2020. The role of critical thinking in the teaching of History at secondary schools in Masvingo, Zimbabwe: A critical investigation.

- PhD thesis. Pretoria, South Africa: University of South Africa. Available at [https://www.academia.edu/117442036/The\\_role\\_of\\_critical\\_thinking\\_in\\_the\\_teaching\\_of\\_History\\_at\\_secondary\\_schools\\_in\\_Masvingo\\_Zimbabwe\\_a\\_critical\\_investigation](https://www.academia.edu/117442036/The_role_of_critical_thinking_in_the_teaching_of_History_at_secondary_schools_in_Masvingo_Zimbabwe_a_critical_investigation). Accessed 28 February 2026.
- Wekwete P & Higgs L 2024. Obstacles to critical thinking: A qualitative study on secondary school learners in Masvingo, Zimbabwe. *South African Journal of Education*, 44(1):Art. #2261, 11 pages. <https://doi.org/10.15700/saje.v44n1a2261>
- Zhai C, Wibowo S & Li LD 2024. The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. *Smart Learning Environments*, 11(1):28. <https://doi.org/10.1186/s40561-024-00316-7>