Antecedents and consequences of effective implementation of cooperative learning in universities in Zimbabwe

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Abstract

Purpose – Creating suitable learning conditions in university classrooms continues to be a topical issue in higher education. The above means that a continued search for innovative teaching and learning strategies in universities remains a priority issue. The study therefore investigated conditions that facilitate the effective implementation of cooperative learning (CL) as well as how CL influences the academic performance of students in universities in Zimbabwe.

Design/methodology/approach – The research adopted a quantitative research approach located in the descriptive research design. A sample of 341 undergraduate students selected using a simple random sampling strategy from a sample frame of 701 undergraduate students participated in the study. The study first used a pre-test and later, a post-test to determine the initial and end of semester (EOS) academic performance levels of students, respectively, on a Calculus 1 course. A self-constructed structured questionnaire was also used for data collection on the views of students towards the use of CL with particular reference to the 5 dimensions of positive interdependence (PDI), promotive interaction (PI), individual and group accountability (IGA), social and interpersonal skills (SS) and group processing (GP). The questionnaire was validated using confirmatory factor analysis. Structural equation modelling was used to test proposed relationships. A total of 341 questionnaires were administered through an email survey. Of the total, 149 completed questionnaires were received from the students, giving a return rate of 43.7%.

Findings – The results showed that positive interdependence, promotive interaction, social and interpersonal skills, individual and group accountability as well as group processing were important antecedents to the effective implementation of CL in universities. The results further showed that CL plays a significant role in improving the academic performance of university students; hence, academic performance was viewed as a significant consequence of CL.

Research limitations/implications – This is the first study on the application of CL to enhance the academic performance of university students in the context of Zimbabwe. As a result, caution should be

exercised when generalising the results as more studies to either confirm or disconfirm these results in the context of Zimbabwe may still be required.

Practical implications – These results have implications on policy and practice with regards to active teaching strategies in universities. With regards to practice, the results demonstrated that the use of group activities that allow students to share knowledge and support each other while the teacher plays a facilitating role is important for enhancing students' academic performance. With regards to policy, the results showed that universities can enhance the academic performance of students if policies that promote student-centered teaching and learning approaches to ensure that teaching in universities is more student-led than lecturer-led are developed.

Originality/value – While many studies have been conducted in other contexts, to establish the influence of CL on the academic performance of university students, there is no known study on the influence of CL that has been conducted in the context of Zimbabwean universities. The results of this study therefore are an eye opener on the role of CL in enhancing the academic performance of students in Zimbabwean universities.

Keywords Academic performance, Antecedents and consequences, Cooperative learning, Dimensions of CL, Student-directed learning theory, Teaching strategies

Paper type Research paper

1. Introduction

Cooperative learning (CL) is viewed as one of the modern and effective teaching strategies that can be applied effectively across education levels from primary school to university (Gillies, 2016). According to Algani and Alhaija (2021), the importance of CL as a modern and effective teaching and learning approach has been widely acknowledged. The importance of CL in universities is even more critical based on the fact that most of the teaching is done using the lecturer-centered lecture method approach that takes students as passive participants in the teaching and learning process (Khansa and Khaled, 2017). According to Johnson *et al.* (2013), CL is an old idea premised on the belief that students would benefit better if they teach each other, that is, if they own the teaching and learning process. Such a situation requires a change of the pedagogical structure from a competitive-individualistic model to a high-performance team-based model of teaching and learning. CL has been defined variously by different authorities with some calling it a strategy while others call it an approach. One of the mostly used definition of CL is that it is a teaching and learning approach or strategy in which students work together in small groups of two to six to assist each other to learn and succeed (Abraham, 2021; Yang *et al.*, 2021). Khansa and Khaled (2017, p. 2) also define CL as "an instructional strategy that involves small groups of students and that employs a variety of techniques to promote active learning by ensuring that students are responsible for their own learning".

The above definitions of CL highlight a number of critical issues on CL. First the definitions show that for effective group learning, CL has to be structured. This means that lecturers in universities should provide students with clear tasks for them to be able to work productively in their groups. Second, the definitions highlight the fact that for effective learning, students need to acquire certain group knowledge and skills at individual level, based on their cooperation with other students. Also, the above definitions demonstrate that learning is a social construct and that the need to promote socialisation of students during the teaching and learning process is critical for effective learning and for academic achievement. This is also in line with the views of Mukuka *et al.* (2019) who aver that the need for students to interact and get engaged with knowledge construction is critical for enhanced academic performance.

Implementation of CL has many benefits to university students. Among some of the benefits of CL in university classrooms is that it leads to the development in the students, of a sense of purpose and positive interpersonal relationships (Davis, 2021), promotes self-confidence and positive attitudes towards learning (Yang *et al.*, 2021). Other benefits of CL to students include the development of increased motivation to learn (Drakeford, 2012), social skills such as sharing, cooperation, leadership, conflict management and decision-

making (Alhabeedi, 2015). These benefits are all critical to promoting enhanced academic achievement (Alhabeedi, 2015; Ding *et al.*, 2020). While these and any other benefits of CL are acknowledged, Frykedal *et al.* (2022) and Long-Crowell (2021) argue that creating an environment for well-functioning groups to implement CL is not an easy task as certain conditions have to be met. The aim of this study therefore is to establish conditions that facilitate the effective implementation of CL as well as determine the influence of CL on the academic performance of students in universities in Zimbabwe. To achieve the above aim, the following research questions will be answered:

(1) What are the dimensions of effective implementation of CL in universities?

(2) How significantly does each of the dimensions influence effective implementation of CL in universities?

(3) How significantly does CL influence the academic performance of students in universities?

2. Literature review

CL is more than just students learning together in small groups as it requires lecturers to structure cooperative interdependence among students through the use of the five dimensions of CL. To ensure that there is cooperative interdependence, the study employed the jigsaw strategy of CL. This section discusses the jigsaw CL strategy and the five dimensions of CL in terms of their role in the implementation of CL in university classrooms.

2.1 Jigsaw strategy of cooperative learning

The jigsaw strategy is one of the CL strategies that allows students to play the dual roles of learner and teacher at the same time, hence is considered an efficient way to learn course material in a CL style. The Jigsaw strategy leads a group of students to become "experts" on a specific text or body of knowledge and then share that material with another group of students (Johnson and Johnson, 2019). More specifically, when using a jigsaw strategy of CL for teaching, (1) students are divided into small groups of five or six students each, (2) each member of the group is assigned a portion of an assignment or research project, (3) each member must then research the material pertaining to their section of the project, become an "expert" and be prepared to teach (discuss it with their classmates) (Indriwati *et al.*, 2019). This strategy therefore offers a way to help students understand and retain information while they develop their collaboration skills.

2.2 Dimensions of cooperative learning

Creating conditions for well-functioning groups in universities is not an easy task when implementing CL, there is a need to take into consideration the different principles or dimensions of CL. This is confirmed by long-Crowell (2021) who argues that just grouping students to work on a given task in groups does not guarantee that all students will actively participate during the implementation of CL. This is especially due to the fact that most students in universities are used to be taught using the lecture method which relegates all the students to being passive participants in their lecturers. Five conditions are critical for the successful implementation of CL and these are positive interdependence (PDI), promotive interaction (PI) also called face-to-face interaction, individual and group accountability (IGA), social and interpersonal skills (SS) and group processing (GP) (Fernandez-Rio *et al.*, 2021; Algani and Alhaija, 2021; Volkova *et al.*, 2020).

2.2.1 Positive interdependence. Positive interdependence relates to a group situation in which students are willing to seek as well as offer assistance to support each other's learning (HARAPPA, 2021). A realisation by students in a group that academic success is connected to their colleagues' success is critical for their active participation in group activities and for the success of the implementation of CL (Algani and Alhaija, 2021; Slavin, 2014). Studies by Alhabeedi (2015) and Mukuka *et al.* (2019) found that the successful implementation of CL depends on maximising the participation of all group members. This was also confirmed in studies by Volkova *et al.* (2020) and Estebanez (2017) which found that the awareness and acceptance by all students in a group that the efforts of each group member is necessary and indispensable for the learning success of all group members was critical for the successful implementation of CL. For the above awareness to occur, lecturers need to provide students with opportunities to feel and believe that their efforts and that of their group members are together linked to group success (Johnson and Johnson, 2017; HARAPPA, 2021). The above means that the unique contributions of each group member goes a long way in ensuring that the given tasks are successfully done. This further means that all members in a group are responsible for their and the group's effort and success in given tasks.

H1. Positive interdependence has a significant and positive influence on effective implementation of CL in universities.

2.2.2 Promotive interaction. Promotive interaction, also called face-to-face interaction, is when students directly engage in discussion and dialogue with each other either face-to-face literally, over the phone, by Zoom, WhatsApp, Google Classroom, Skype and other social media platforms (Long-Crowell, 2021). A study by Fernandez-Rio *et al.* (2021) found that the success of CL depends on opportunities that allow students to directly share ideas and learn from each other. In their study, Algani and Alhaija (2021) found that face-to-face opportunities that allow students to engage each other in dialogue and discussion is critical for knowledge sharing and the effective implementation of CL. A study by Volkova *et al.* (2020) also found that direct personal interaction significantly influenced effective implementation of CL by stimulating effective learning by group members through direct support and encouragement of each other. The above was also highlighted in an earlier study by Alhabeedi (2015) and the Public School Review (2019) which found that the implementation of CL was positively influenced by the fact that through face-to-face interaction, group members share knowledge, check on each other's learning progress, support and motivate each other to perform better in given tasks. A study by Johnson and Johnson (2017) also found that promotive interaction significantly influences the implementation of CL as it is an opportunity for students to orally explain to each other how to solve given problems, as well as to teach each other and share knowledge and above all, to motivate each other to perform better.

H2. Promotive interaction has a significant and positive influence on effective implementation of CL in universities.

2.2.3 Individual and group accountability. Individual and group accountability, also referred to as equal participation, relates to holding each other accountable for mastering relevant learning concepts that contribute to group success (Alhabeedi, 2015; Volova *et al.*, 2020). The purpose of assessing each individual's contribution within a group is to enable both group members and the lecturer to establish which student(s) require more support as well as which student (s) could be used to play a leading role in assisting others (Johnson and Johnson, 2017). A study by TeacherVision Staff (2019) found that ensuring that each student in a group plays their share portion of group activities is critical for effective implementation of CL. A study by the Public School Review (2019) also found that by ensuring that each group member is

accountable for the success of the group by being actively involved in group tasks, individual and group accountability significantly contributes to the effective implementation of CL. A study by Fernandez-Rio *et al.* (2021) also found that ensuring that each group member is responsible for the completion of at least one element of a group's tasks significantly contributes to the success of CL. The effect of individual and group accountability on effective implementation of CL is also confirmed in studies by Long-Crowell (2021) and Yang *et al.* (2021).

H3. Individual and group accountability has a significant and positive influence on effective implementation of CL in universities.

2.2.4 Social and interpersonal skills. For students to be able to work successfully in a team during the implementation of CL, they need to have certain social and interpersonal skills (Johnson *et al.*, 2013). A study by Alhabeedi (2015) found that for effective implementation of CL, students should possess the following social and interpersonal skills: communication, trusting, sharing, decision-making and conflict management. Possession of the above skills helps students to collaborate successfully with group members. In their study also, Johnson and Johnson (2017) found that social and interpersonal skills were critical for group cohesion, team building and teamwork, hence they significantly influenced the implementation of CL. In his study, Long-Crowell (2021) found that social and interpersonal skills, which he also referred to as collaborative skills, were critical for the successful implementation of CL. A study by Jakavonyte-Staskuviene *et al.* (2021) also found that the possession of social and interpersonal skills enabled students to effectively communicate and collaborate with other students in the group, and this was important for the effective implementation of CL.

H4. Social and interpersonal skills have a significant and positive influence on effective implementation of CL in universities.

2.2.5 Group processing. Group processing relate to opportunities for students to reflect on their activities as a group to establish whether there are any challenges of concern or successes (Jakavonyte-Staskuviene *et al.*, 2021). The effective implementation of CL requires that students in groups continuously assess each other and the group's performance to identify areas of weakness needing improvement as well as of strength needing to be leveraged on for future success (Yang *et al.*, 2021). In their study, Jakavonyte-Staskuviene *et al.* (2021) found that a reflection by students on how well group members work together and how to maintain anything good in the working relationships contributes significantly to the effective implementation of CL. Studies by SERC (2020), Buchs (2017) and Johnson and Johnson (2019) also alluded to the same results. Long-Crowell (2021) in his study on the relationship between group processing and effective implementation of CL found that by monitoring itself to ensure that the group as a whole is achieving its goals, group processing significantly contributes to effective implementation of CL.

H5. Group processing has a significant and positive influence on effective implementation of CL in universities.

2.2.6 Cooperative learning and academic performance. The critical role of CL as a productive teaching strategy not only in personal and social environments but also in academic environments has been widely acknowledged. In studies by Butera and Buchs (2019), Davidson and Major (2014) and Mukuka *et al.* (2019), it was found that by providing students with opportunities to interact and engage with knowledge construction in their different groups, CL significantly contributes to enhanced academic performance. A study by Slavin (2015) also showed that by making learning a highly active process, CL contributed to improved academic performance by students. A study by Estébanez (2017)

found that the interactive nature of CL enables students to better acquire concepts taught leading to better academic performance by students. In another study by Public School Review (2019), it was found that CL provided opportunities for students to question and challenge each other on taught concepts, share ideas, engage in thoughtful discourse, explore different perspective around the content they will be learning and internalise their learning, leading to improved academic performance.

H6. CL has a significant and positive influence on the academic performance of students in universities.

2.3 Theoretical framework

A number of classroom management theories allude to the importance of social settings in the cognitive development and learning of students. Among such theories are the social learning theory by John Dewey, the theory of cognitive development (TCD) by Jean Piaget (1936), and the sociocultural theory by Vygotsky (1978) and the student-directed learning theory (SDLT) by Kohn (1996). In his theory of social learning theory, Dewey argued that for effective learning, schools and classrooms should be representative of natural social where students learn cooperatively in groups (Kalkbrenner and Horton-Parker, 2016). Dewey's (1938) social learning theory further propounded that experiential learning through cooperative activities was important for developing reflexive thinking skills that enable students to solve learning problems from multiple perspectives (Janse, 2019; Kalkbrenner and Horton-Parker, 2016). On the other hand, the cognitive development theory of Piaget (1936) argues that learning is a natural occurring process as a result of the maturation of innate structures of children in the brain (Mcleod, 2021). Overall, Piaget's (1936) theory which was mostly focused on children is based on the beliefs that (1) children build their knowledge based on their experience, (2) children learn things on their own without the influence of (interaction with) older children or adults and (3) children are motivated to learn by nature (learning is a natural occurring process) as children go through the stages of cognitive development (Karen, 2018). The sociocultural theory of Vygotsky (1978) also argues that learning and cognitive development are tied to social interactions between students, their peers and knowledgeable adults (Karen, 2018; Kendra, 2020; Mcleod, 2021). Using his zone of proximal development, Vygotsky (1978) argued that the social interaction between students and either their peers, family members or knowledgeable others, assist in scaffolding students to close the distance between where they are in terms of knowledge to where they can potentially be through if supported. To Dewey and Vygotsky (1978), therefore, learning is a social process in which interaction plays a critical role, while to Piaget (1936), learning is a natural occurring process as students go through the stages of cognitive development (Hargraves, 2021; Kendra, 2022; Kurt, 2020a, b).

In the context of the current study, Kohn's (1996) SDLT is used to demonstrate the influence of the five dimensions on effective implementation of CL in universities. Kohn (1996) argues that student-directed learning stimulates motivation to learn among students and teaches them to share responsibility and roles among themselves. The SDLT taps on students' curiosity and natural desire to be competent, to be able to engage students in CL behaviour as well as to promote a deeper understanding of the concepts the students would be learning (Lynch, 2018). According to Kohn's (1996) SDLT, for students to be fully engaged during CL, a variety of structured learning activities should be used by the lecturers. Such learning activities should provide students with opportunities to actively question and challenge each other in their groups, share and discuss their ideas, and adopt their chosen group learning styles' (p. 2). Using this theory, therefore, for lecturers to be able to motivate students to learn, they need to set group learning activities that are

intellectually challenging, creative, open-ended, and that involve higher order thinking skills (Kohn, 2021). Based on literature review and the theoretical framework, a model (Figure 1) was developed.

3. Methodology
3.1 Research design and instrument development
The research adopted a quantitative research approach located in the descriptive research design. The purpose of the descriptive research design was to enable the researchers to establish possible characteristics and trends of the phenomenon under study (McCombs, 2017).
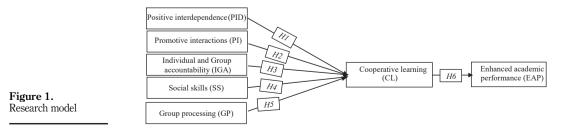
3.2 Instrument design and measures
The study employed a self-constructed structured questionnaire with two sections, for data collection, namely Section A – demographic data, and Section B – research constructs. The research constructs of the self-constructed questionnaire had 40 items as follows: Positive interdependence (PID) – 4 items, promotive interaction (PI) – 7 items, individual and group accountability (IGA) –7 items, social and interpersonal skills (SS) – 8 items, group processing (GP) – 6 items, CL – 5 items and academic performance (AP) – 3 items. The questionnaire used a five-point Likert scale from strongly disagree (SDA) – 1 to strongly agree (SA) – 5.

3.3 Sample frame and sampling strategies
The study used a sample of 341 students which was selected using stratified random sampling strategy from a sample frame of 701 undergraduate students in the Faculties of Education from three universities. The three universities were selected using purposive sampling strategy based on the criterion that they offered degrees in education. The sample size was determined using the Research Advisors (2006) sample size table at 99% confidence level and at 5% margin of error. Based on the stratified random sampling strategy, the overall distribution of students from the three universities is as follows: $U1$ = 127 students, $U2$ = 108 students and $U3$ = 106 students.

3.4 Data collection procedures
The data collection process was done in line with coronavirus disease 2019 (COVID-19) protocols that called for social distancing and masking. As a result, a total of 341 questionnaires were administered through an email survey. To be able to administer the questionnaires to the students, the researchers first obtained permission from Deputy Registrars Academic of the three universities to carry out their study. After the permission was granted, the researchers then approached Senior Assistant Registrars in the Faculties of Education to randomly obtain emails of 341 undergraduate students according to the

Figure 1.
Research model

distributions per university. The researchers then distributed the 341 questionnaire to the students using SurveyMonkey. The students were given 14 days to complete and return the questionnaires in line with the minimum benchmark of 12.21 days to complete and return email surveys (Ilieva *et al.*, 2002). A further week was allowed for follow ups. After three weeks, a total of 149 completed questionnaires were received from the students, giving a return rate of 43.7% which was within the allowable return rate of 33.3% for online surveys (QuestionPro, 2020; Sinclair *et al.*, 2012). The return rate was therefore considered adequate to provide valid and reliable results in this study. Demographic factors of respondents are as shown in Table 1. Furthermore, a pre-test was conducted before the jigsaw strategy of CL (treatment) on Calculus 1 course was used and results collected. The final results on the same course were collected from the end of semester (EOS) examination results. With the permission of the Academic Registrars of the 3 universities, the 341 students wrote the same pre-test and later, the same post-test. The post-test was in the form of an EOS examination.

The results in Table 1 show that most of the undergraduate students (78%) are below 30 years old which is as expected of undergraduate students as most would have come from high school. Universities in Zimbabwe still recruit more male students (58%) when compared to female students (42%) which show failure to address issues of gender parity in university recruitment. Most of the students (56%) are either in their first or second year of study which is again as expected with regards to student population in universities that they become fewer as they move towards completion of their studies.

3.5 Data validation
Before testing relationship to establish the nature of relationships between variables, the researchers first validated the collected data using the following tests: normality test, convergent validity and discriminant validity.

3.5.1 Normality test. SPSS Version 24 was used to establish the normality of data. *Z*-scores and Q-Q plots were used to establish the normality of data. Results showed that all *Z*-scores ($n = 341$) ranged between -1.96 and $+1.96$ at 5% level of significance. Also, Q-Q plots showed that data were normally distributed.

3.5.2 Convergent validity. To test the data for convergent validity, the researchers used measurement model fit indices, standardised factor loadings, composite reliability, individual items reliabilities, critical ratios and average variance extracted (see Tables 2 and 3). The results showed the presence of convergent validity in the data.

Table 2 shows that model fit assessment was done using the following fit indices: CMIN/ Degrees of freedom (χ^2/df), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), normed fit index (NFI), Tucker–Lewis index (TLI), comparative fit index (CFI) and root mean

Demographic factor	Demographic items	%
Age	<20 years	17
	20–30 years	61
	>30 years	22
Gender	Male	58
	Female	42
Degree type	Bachelor of Education	61
	Bachelor of Science Education	39
Study year	First year	31
	Second year	25
	Third year	22
	Fourth year	22

Table 1.
Demographic factors of participants

	Model fit indices	Initial measurement model	Final measurement model	Recommended values	Sources
Absolute fit measures	χ^2/df	2.495	2.053	<3.000	Hair *et al.* (2010)
	GFI	0.861	0.985	>0.900	Hair *et al.* (2010)
	AGFI	0.807	0.922	>0.900	Hair *et al.* (2010)
Incremental fit measures	NFI	0.769	0.971	>0.900	Hair *et al.* (2010)
	TLI	0.746	0.988	>0.900	Hair *et al.* (2010)
Parsimonious fit measures	CFI	0.801	0.933	>0.900	Hair *et al.* (2010)
	RMSEA	0.063	0.049	<0.008	Hair *et al.* (2010)

Table 2.
Model fit indices assessment

Note(s): χ^2/df = CMIN/Degrees of freedom, GFI = Goodness of fit index, AGFI = Adjusted goodness of fit index, NFI = Normed fit index, TLI = Tucker–Lewis index, CFI = Comparative fit index, RMSEA = Root mean square error of approximation

square error of approximation (RMSEA). The initial assessment of model fit showed that all the fit indices except for RMSEA were below the recommended values. The researchers therefore checked whether there were any outliers in the data by inspecting if there were any factor loadings that were below 0.6 (Hair *et al.*, 2014) and individual items reliabilities values that were below 0.6 (Hair *et al.*, 2014). Items PI5 (0.372), IGA2 (0.508), IGA7 (0.552), GP3 (0.419), SS4 (0.388) and AP3 (0.409) had standardised factor loadings which were less than 0.6, while the following items: PID2 (0.413), PI7 (0.307) and CL5 (0.447) had individual items reliability coefficients of less than 0.6, hence were dropped from the collected data. Thereafter the measurement model was conducted again and the measurement model fit indices had values that satisfied the minimum recommended limits for good measurement model fit.

The results in Table 3 show the standardised factor loadings, individual items reliabilities, critical rations, Cronbach's alpha, composite reliability and average variance extracted for the modified measurement model. The results show that all standardised factor loadings range between 0.733 and 0.926 satisfying the minimum requirement of $\lambda > 0.6$ (Hair *et al.*, 2017). Individual items reliabilities ranged between 0.603 and 0.835 satisfying the minimum requirement of IRR > 0.6 (Hair *et al.*, 2014). Cronbach's alpha values ranged between 0.814 and 0.915 satisfying the minimum requirement of $\alpha > 0.7$ and also demonstrating the presence of internal consistency reliability in the data. For all items, the composite reliability values ranged between 0.825 and 0.921 satisfying the minimum cut-off point of CRel > 0.7 also confirming the presence of internal consistency reliability (Hair *et al.*, 2017). For all items, critical rations were large satisfying the cut-off point of CR > 2 and significant at $p < 0.001$ (Segars, 1997). The AVE values ranged between 0.583 and 0.651 satisfying the minimum requirement of AVE > 0.6 (Fornell and Larcker, 1981).

Since convergent validity alone is inadequate to confirm construct validity, discriminant validity was also assessed. Table 4 shows the assessment of discriminant validity by comparing the square roots of AVE against squared inter-construct correlations (SICs). The results show that for all items, AVE values were greater than the SICs demonstrating the presence of discriminant validity in the data (Segars, 1997). To further confirm the presence of discriminant validity in the data, the maximum shared value (MSV) metric by Wheaton *et al.* (1977) was used. The results in Table 4 show that for all items, AVE values are greater than

Constructs	Items	λ	IIR	CR	α	CRel	AVE
Positive interdependence	PID1	0.825	0.825	–	0.817	0.825	0.626
	PID3	0.791	0.691	24.083***			
	PID4	0.844	0.736	20.419***			
Promotive interactions	PI1	0.785	0.647	–	0.833	0.841	0.621
	PI2	0.853	0.751	14.628***			
	PI3	0.865	0.764	13.441***			
	PI4	0.871	0.685	11.215***			
	PI6	0.839	0.719	10.619***			
Individual and group accountability	IGA1	0.795	0.603	–	0.915	0.921	0.583
	IGA3	0.917	0.835	27.094***			
	IGA4	0.805	0.813	26.147***			
	IGA5	0.818	0.692	24.701***			
	IGA6	0.861	0.801	23.117***			
Social and interpersonal skills	SS1	0.766	0.662	–	0.847	0.853	0.651
	SS2	0.926	0.711	13.825***			
	SS3	0.751	0.804	12.447***			
	SS5	0.814	0.671	10.511***			
	SS6	0.733	0.685	9.713***			
	SS7	0.837	0.692	8.528***			
	SS8	0.828	0.816	6.901***			
Group processing	GP1	0.821	0.733	–	0.911	0.920	0.644
	GP2	0.855	0.688	25.301***			
	GP4	0.831	0.659	24.633***			
	GP5	0.862	0.725	22.117***			
	GP6	0.920	0.788	20.413***			
Cooperative learning	CL1	0.835	0.638	–	0.818	0.834	0.623
	CL2	0.908	0.644	28.471***			
	CL3	0.810	0.829	27.101***			
	CL4	0.911	0.719	25.318***			
Academic performance	AP1	0.834	0.658	–	0.822	0.827	0.631
	AP2	0.826	0.814	10.602***			

Note(s): CR is fixed. ***p < 0.001, λ = standardised factor loadings, IIR = Individual items reliabilities, CR = Critical ratios, α = Cronbach's alpha, CRel = Composite reliability, AVE = Average variance extracted

Table 3.
Convergent validity
and reliability
assessment

	CRel	AVE	MSV	MaxR (H)	PID	PI	IGA	SS	GP	CL	AP
PID	0.825	0.626	0.407	0.831	1.000						
PI	0.841	0.621	0.371	0.844	0.374	1.000					
IGA	0.921	0.583	0.402	0.927	0.095	0.137	1.000				
SS	0.853	0.651	0.367	0.853	0.528	0.388	0.215	1.000			
GP	0.920	0.644	0.415	0.921	0.203	0.104	0.071	0.259	1.000		
CL	0.834	0.623	0.336	0.836	0.549	0.491	0.210	0.619	0.351	1.000	
AP	0.827	0.631	0.331	0.833	0.417	0.375	0.081	0.309	0.171	0.649	1.000

Note(s): CRel = Composite reliability, AVE = Average variance extracted, MSV = Maximum shared variance, MaxR (H) = Maximum reliability

Table 4.
Assessment of
discriminant validity

MSVs confirming the presence of discriminant validity (Wheaton *et al.*, 1977; Hu and Bentler, 1999).

3.6 Data analysis
Descriptive statistics were used for summarising data. Structural equation modelling using SPSS Version 24 was used for establishing relationships between the dependent variable (CL)

and independent variables (PID, PI, IGA, SS and GP). Paired samples test was used for establishing the relationship between CL and AP.

4. Results

4.1 Hypotheses testing

4.1.1 Hypothesis testing using structural equation modelling. The structural equation modelling approach was used for testing the hypotheses in this study. Before hypothesis testing could be conducted, an assessment of whether the measurement model fit indices were within recommended limits was done. The results showed that $\chi^2/df = 2.017$, GFI = 0.968, AGFI = 0.975, NFI = 0.981, TLI = 0.965, CFI = 0.977 and RMSEA = 0.044 demonstrating that the structural model fitted the data well. Path analysis was thus performed.

The results in Table 5 show that all the five dimensions of CL have a significant influence on the effective implementation of CL in universities. The results show that PID ($\beta = 0.319$, $p < 0.05$), PI ($\beta = 0.342$, $p < 0.001$), SS ($\beta = 0.416$, $p < 0.001$), IGA ($\beta = 0.237$, $p < 0.05$) and GP ($\beta = 0.239$, $p < 0.05$) have a significant influence on the effective implementation of CL in universities.

The results in Table 6 show that the mean performance of students after they were taught using the jigsaw strategy of CL was higher than before they were taught using the same strategy ($M_{AP2} > M_{AP1}$). This shows that there is evidence to suggest that the jigsaw strategy improves the performance of students.

The results in Table 7 show that there is a high correlation between the academic performances of students before and after they are taught using the jigsaw strategy.

Hypotheses	Path	SRW[a]	CR[b]	p	Decision
H1	CL ← PID	0.319	5.161*	0.030	Supported
H2	CL ← PI	0.342	4.883**	0.000	Supported
H3	CL ← IGA	0.237	2.093**	0.000	Supported
H4	CL ← SS	0.416	9.019**	0.000	Supported
H5	CL ← GP	0.239	3.285*	0.016	Supported

Note(s): *$p < 0.05$, **$p < 0.001$
[a]SRW = Standard regression weights; [b]CR = Critical ratio

Table 5.
Structural equation modelling test results

		Mean	N	Std deviation	Std error mean
Pair 1	AP1	55.179	341	5.713	0.631
	AP2	65.464	341	6.229	0.652

Note(s): AP1 = Academic performance 1 before treatment using jigsaw CL strategy; AP2 = Academic performance 2 after treatment using jigsaw CL strategy

Table 6.
Paired samples statistics

		N	Correlation	Sig
Pair 1	AP 1 and AP 2	341	0.861	0.000

Note(s): AP1 = Academic performance 1 before treatment using jigsaw CL strategy; AP2 = Academic performance 2 after treatment using jigsaw CL strategy. Sig. $p < 0.05$

Table 7.
Paired samples correlations

These results suggest that a student who performs highly academically before treatment using the jigsaw strategy will also perform highly after the treatment and vice versa.

The results in Table 8 show that CL has a significant and positive influence on the academic performance of students in universities ($t(340) = -9.047, p = 0.003, p < 0.05$). These results suggest that teaching students using CL under the following conditions: positive interdependence (PDI), promotive interaction (PI) also called face-to-face interaction, individual accountability (IA), social and interpersonal skills (SS) and group processing (GP) significantly enhances the academic performance of university students.

5. Discussion

The study sought to establish dimensions of CL, among the five dimensions that have a significant influence on the effective implementation of CL in universities. The five dimensions that were investigated in the study were positive interdependence, promotive interaction, individual and group accountability, social and interpersonal skills, and group processing. The study further sought to determine whether CL has a significant effect on the academic performance of undergraduate students in universities. The study used the SDLT by Kohn (1996) as the theoretical lens guiding the study.

The results of the study showed that positive interdependence has a significant influence on the effective implementation of CL in universities. This means that once students in their various groups believe that they are teams and each members should actively contribute to the group or team effort, the students will achieve their learning goals. Every student in the teams should view him/herself as an important cog in the learning process whose effort is critical to the success of the group. In fact once the group takes itself as a system, it means every group member will be called upon to actively contribute to the team effort for the system to work towards achieving learning goals. In a system, if one component does not contribute, the whole system collapses and it is the same with the issue of interdependence in CL. If one or some students do not actively contribute, the whole group will fail to achieve learning goals. These results are in line with the findings of earlier studies. Studies by Alhabeedi (2015) and Mukuka et al. (2019) found that the successful implementation of CL depends on maximising the participation of all group members. This was also confirmed in studies by Volkova et al. (2020) and Estébanez (2017) which found that the awareness and acceptance by all students in a group and the efforts of each group member is necessary and indispensable for the learning success of all group members was critical for the successful implementation of CL.

It also emerged from the study that promotive interaction also called face-to-face interaction has a significant effect on effective implementation of CL in universities. If students are provided with opportunities to directly interactive either face-to-face and/or online through platforms such as Zoom, WhatsApp, Google Classroom, Skype and others, they will be able to support, assist and motivate each other to perform better academically contributing to effective CL in university classrooms. Direct interaction breaks communication barriers posed by

	Mean	Std deviation	Std error mean	Lower	Upper	df	t	Sig
				Paired differences 95% Confidence interval of the difference				
Pair 1	AP1 – AP2	−10.285	0.513	−12.351	−9.519	340	−9.047	0.003

Note(s): AP1 = Academic performance 1 before treatment using jigsaw CL strategy; AP2 = Academic performance 2 after treatment using jigsaw CL strategy. Sig. $p < 0.05$

Table 8.
Paired samples test

distance and students will feel the closeness necessary to act as a learning family. When students talk to each other directly, a feeling of mutual closeness is developed and with it, the need to support each other to succeed. These results link well with findings of earlier studies. A study by Fernandez-Rio *et al.* (2021) found that the success of CL depends on opportunities that allow students to directly share ideas and learn from each other. In their study, Algani and Alhaija (2021) found that face-to-face opportunities that allow students to engage each other in dialogue and discussion is critical for knowledge sharing and the effective implementation of CL. A study by Volkova *et al.* (2020) also found that direct personal interaction significantly influenced effective implementation of CL by stimulating effective learning by group members through direct support and encouragement of each other. The above studies therefore indicate when students directly communicate with each other, learning in teams becomes more of a team effort and the need to uplift each other through support and encouragement becomes the norm in the groups leading to effective implementation of CL.

The results further showed that social and interpersonal skills have a significant influence on effective implementation of CL in universities. This shows that there are some social and interpersonal skills that are required and are important for students to work as teams for the achievement of learning goals during CL. With skills such as effective communication, sharing, decision-making, conflict-management among others, students will be able to work as teams and work together towards the achievement of group learning goals. Social skills are therefore critical for teamwork and once there is teamwork, students will be able to support and motivate each other in their groups to succeed academically during CL. These results confirm findings of earlier studies. A study by Alhabeedi (2015) found that for effective implementation of CL, students should possess the following social and interpersonal skills: communication, trusting, sharing, decision-making and conflict management. In their studies, Long-Crowell (2021) and Jakavonyte-Staskuviene *et al.* (2021) found that social and interpersonal skills, which he also referred to as collaborative skills, were critical for the successful implementation of CL. Based on the above studies, as was also shown in the current, social and interpersonal skills are therefore very critical for students to work collaboratively and hence, for the effective implementation of CL.

The results further showed that individual and group accountability has no significant effect on the effective implementation of CL in universities. This shows that students are also concerned with issues of accountability in terms of how much effort each and every group member brings to the group for the achievement of group learning goals. These results confirm findings of earlier studies that found that when students take time to assess each individual's contributions to group effort, both group members and the lecturer will be able to establish which student(s) require more support to ensure that every student succeeds in their learning. A study by TeacherVision Staff (2019) found that ensuring that each student in a group plays their share portion of group activities is critical for effective implementation of CL. A study by Fernandez-Rio *et al.* (2021) also found that ensuring that each group member is responsible for the completion of at least one element of a group's tasks significantly contributes to the success of CL. The issue of individual and group accountability is therefore important in ensuring that each group member is accountable for the success of the group by being actively involved in group tasks, and this, according to the Public School Review (2019), significantly contributes to the effective implementation of CL.

It further emerged in the study that group processing has a significant and positive influence on the effective implementation of CL in universities. These results therefore indicate that by continuously evaluating group performance in terms of areas where the group is performing well as a team and where the group is having challenges in achieving group learning goals, students are going to devise strategies for either maintaining good group performance of dealing with the challenges. Being able to maintain group performance from group cohesion to achievement of group learning goals as well as being able to solve

problems affecting group performance are critical elements for the effective implementation of CL in universities. The importance of continuous evaluation of group or team effort during the implementation of CL is also alluded to in findings of past studies. In their study, Jakavonyte-Staskuviene *et al.* (2021) found that a reflection by students on how well group members work together and how to maintain anything good in the working relationships contributes significantly to the effective implementation of CL. Studies by SERC (2020), Buchs (2017) and Johnson and Johnson (2019) also alluded to the same results.

Finally, the study showed that CL has a significant influence on the academic performance of university students. When students work in groups, they become a team and with teamwork, they are able to support, assist and motivate each other to perform better academically. When students work as a team during CL, they also develop positive social skills such as trust, respect, conflict-resolution and effective communication necessary for working together and solving learning challenges and eventually improve their academic performance. The influence of CL in the academic performance of university students is also confirmed in previous studies. Studies by Butera and Buchs (2019), Davidson and Major (2014) and Mukuka *et al.* (2019) found that by providing students with opportunities to interact and engage with knowledge construction in their different groups, CL significantly contributes to enhanced academic performance. This, as also highlighted in the SDLT, highlights the importance of social settings in the cognitive development and academic performance of students. The main attribute of CL is the use of social settings to facilitate learning through the use of collaborating teams. CL, according to Mukuka *et al.* (2019), is premised on the belief that if teams work together on structured tasks, they can enhance their academic performance. This shows that if university lecturers manage group activities well by playing a facilitating role and allowing students to interact among themselves as much as possible during the implementation of CL, students will perform better academically.

6. Conclusions
The purpose of the study was to establish antecedents and consequences of CL in the teaching of undergraduate students in universities. Based on the findings of the study, two major conclusions were made. First, positive interdependence, promotive interaction, individual and group accountability, social and interpersonal skills as well as group processing significantly and positively influence the effective implementation of CL in universities. As a result, the five elements of dimensions of CL were all considered critical antecedents to effective implementation of CL in universities which demonstrated the important role of social settings in the learning process at university level. The five dimensions also highlighted the important role of dialogue or direct interaction, accountability and performance evaluation as important for the effective implementation of CL and ultimately for enhanced academic performance of university students. Second, it was concluded that CL plays a significant and positive role on the academic performance of students. This is because when students work in teams during CL, they support, assist and motivate each other to perform better leading to improved academic performance.

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Further reading

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