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Implementing continuous assessment learning activities in Zimbabwean education system 5.0: An assessment of driving factors

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ABSTRACT

The paper explores the factors, observable and non-observable, influential in implementation of continuous assessment learning activities strategy in Zimbabwean education system 5.0. This is an activity-based assessment of learners and was reviewed since its inception. Most qualitative researched found the barriers to implementation of continuous assessment learning activities like resources, preparedness of schools and skill but not the relationship and intensity of the influence. A stratified random sampling method was applied in Zimbabwean education institutions that involved educators, parents and learners from primary, secondary and tertiary institutions. Structural equation modelling was conducted to assess the relationship between continuous assessment learning activities implementation and other latent variables. Prior to structural equation modelling, exploratory factor analysis was done. The results obtained from this statistical evaluation indicated that teacher motivation, parental support and child performance were positively related to continuous assessment learning activities implementation. Child performance had a mediation effect in that the relationship of teacher motivation and parental support increased when child performance was included. Respective influence of teacher motivation and parental support were 0.152 and 0.220. Inclusion of child performance increase influence to 0.493, a more than 100% increase in each case. The study therefore recommends a holistic approach to continuous assessment learning activities implementation but with more emphasis on improving child performance.

Keywords: Zimbabwean education system, CALA, education 5.0, factors, latent

INTRODUCTION

In order to attain vision 2030, the Zimbabwean education system has experienced several changes. This resulted in an assessment model that was proposed by the Ministry of Primary and Secondary Education (MoPSE) that advocated for summative and continuous assessment to both contribute to the final mark of a

learner. The summative assessment contributing 70% and continuous assessment contributing 30% to the final mark as recorded according to grading scales used by the Zimbabwe School Examination Council (MoPSE, 2015).

The introduction of Science Technology Engineering and Mathematics (STEM) and Continuous Assessment Learning Activities (CALA) are huge changes that have been introduced to the curriculum. The state of education in Zimbabwe was highly dependent on the theoretical aspect and this motivated the start of the commonly known Nziramasanga Commission of Inquiry in education in 1999. Despite the recommendations of the Nziramasanga Commission, interactive activities that were suggested were never implemented. The Ministry of Primary and Secondary Education (MoPSE) introduced CALA to address the gaps identified in the Zimbabwean education system (Nziramasanga, 1999).

Dambudzo (2015) concurs that education without practical work is insufficient and hence CALA is vital in checking whether students have grasped a concept or not. Learning has to be assessed in order to finally conclude that learners are effectively learning. Continuous assessment therefore involves continued checks on whether learners are understanding the concepts. Assessment is not only through examinations and tests but it is an integrated approach which incorporates termly tests, assignments and practical work. Learners are monitored throughout the year on a variety of activities and these contribute to their final mark (Wallace et al., 2022).

In the past before introduction of CALA, the focus was solely on passing examinations. Once learners do well in examinations, they are deemed to have understood the concepts and learning has taken place. Even if the learner cannot practice whatever was learnt was not crucial. On a review of results before and after implementation of CALA, significant changes have not yet realised. Masiiwa and Last (2024) agree that performance of learners has not yet changed significantly even after implementation of CALA. Poor performance continues to deride Zimbabwean education system. Application of concepts into real life was considered to be done when a learner is employed later in life. The new system is somehow a holistic approach in that practice or application of concepts and academic excellence are assessed at the same time. The advantage is the preparation of a learner who can employ but not a learner who will be looking for employment after schooling (Playfoot et al. 2022).

Even though there are advantages envisaged to be associated with CALA, these advantages have not yet been realised in the Zimbabwean education. This is an indication of failure to solving a problem within the Zimbabwean education system. This research proposes another approach to solving the problem. The approach is specifically on assessing the relationships between the non-observable variables that are also influential in successful implementation of CALA. It is not only observable barriers that contribute to efficacious implementation of CALA but also non-observable factors are crucial.

The research therefore focuses on the establishment of associations between unobservable factors influential in implementing CALA Nexus Industrial Development in the context of Zimbabwean Education System 5.0. CALA Nexus Industrial Development aims at integrating practical, industry-related activities into the curriculum, promoting active learning and preparing students for the demands of the workforce (Smith et al., 2019). The theoretical framework of this research is summarised by **Figure 1**. Many factors are perceived to influence implementation of CALA. The null hypothesis (H_0) postulates that there is no influence between one construct and the other in each case while the alternative presumes that there is influence. This research concentrates of the influence of teacher motivation, parental support and child performance on CALA implementation.

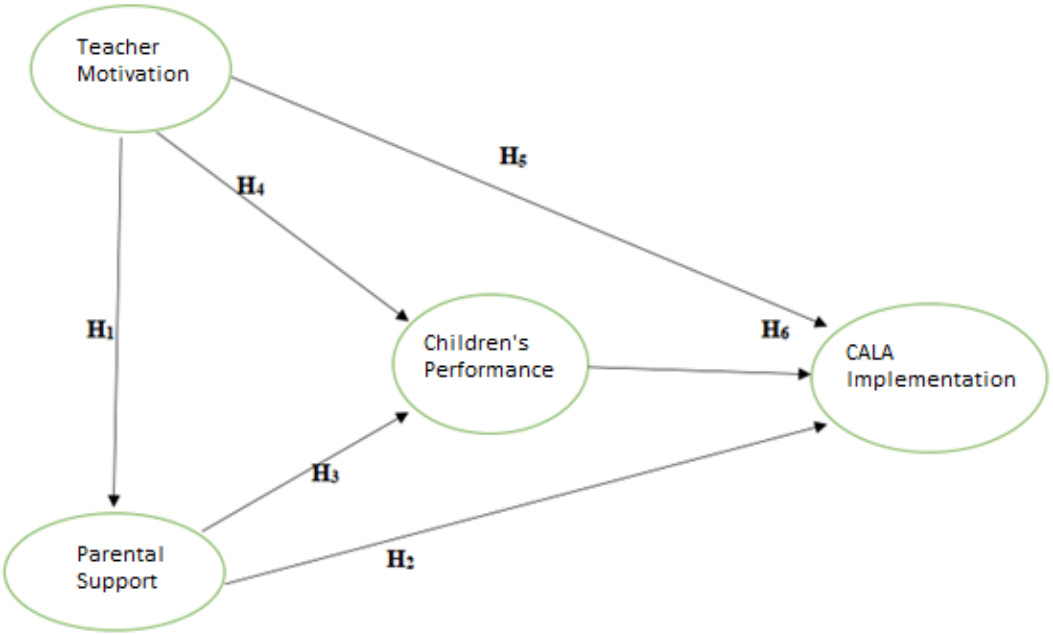

Figure 1. Structural model to assess CALA implementation in Zimbabwean schools (Source: Authors)

However, the successful implementation of CALA Nexus Industrial Development in Zimbabwean schools is hindered by various factors such as limited resources, inadequate training, cultural barriers, and student engagement issues (Mwembe et al, 2022, Mwembe and Chari, 2023). Additionally, inadequate teacher training on the implementation of CALA activities and the need for pedagogical support have been highlighted (Chimbi, 2024). Understanding these challenges and exploring potential solutions ensures more effective and inclusive implementation of CALA Nexus Industrial Development in Zimbabwean schools. This will ultimately benefit educators, learners and parents or guardians.

Studies focusing on rural education have shed light on the unique challenges faced by educators in these areas. Inadequate infrastructure, insufficient funding, and limited access to technology have been identified as barriers to effective implementation of CALA Nexus Industrial Development (Mwasiaji et al, 2022).

Research has shown that the challenges faced by educators in implementing CALA Nexus Industrial Development can have a detrimental impact on student learning outcomes (Yan et al, 2021; Risilo, 2022). This is due to more tasks learners solve with limited resources and educators unskilled in CALA implementation (Masiiwa and Last, 2024). For example, the lack of resources and training may result in limited student engagement and lower academic achievement (Nyamudzodza et al, 2021; Gama, 2022).

The aim of this research is to identify factors and interrelationships among the influential factors in implementing CALA Nexus Industrial Development 5.0 in Zimbabwean schools.

PROBLEM STATEMENT AND RATIONALE

As noted in earlier researches, Zimbabwean schools are over burden by new activities introduced in the educational system (Reniko et al., 2019). Earlier on, there was introduction of science, technology, engineering and mathematics (STEM) in the curriculum. This came with its own challenges that were hard to solve. Later, introduction of the CALA at all levels starting from primary level to high school, worsened the situation in under-resourced schools. While educators were busy trying to copy with STEM challenges, a new approach that

requires more resources and training of the facilitators was introduced. This came with its own challenges and its implementation is undoubtedly difficult, especially in rural schools which are already struggling with implementing STEM subjects. The relationships and strength of these associations of factors influencing implementation of CALA remains a grey area that requires more insights.

Existing literature on CALA implementation in rural school settings, particularly within the Zimbabwean context, is limited. Available literature is largely descriptive and more qualitative in nature. Qualitative methods have been used just identify the factors but contribution of these factors to failure or successful implementation of CALA has not be assessed. This study will therefore bridge this research gap by providing in-depth insights into the factors' associations and influence in successful implementation of CALA. Research findings will contribute to the existing body of knowledge on CALA implementation and inform educational policymakers and practitioners on how best to implement CALA in poorly resourced schools.

METHODOLOGY

Target Population

The target population were teachers and leaners in primary schools, secondary schools and tertiary institutions. Researchers designed two sets of questionnaires which were for learners and the other set for facilitators. Multi-stage simple random sampling was applied. Initially, schools were randomly selected in each location and after identifying the schools, teachers and learners were randomly selected to answer the questions on the questionnaire.

Data Collection Instrument

A self-administered questionnaire was designed for data collection. The questionnaire was made short comprising of relevant questions only. Research questionnaire was developed by researchers through literature search and expert opinion (Huo et al, 2019; Luthra et al, 2017). The questionnaire was structured into 3 sections. Section A outlined the personal information of the respondents that included age, gender, level of education, institution they were in and how they were involved in education. Section B dealt with most likely factors influential in CALA implementation such as questions on motivation of teachers, questions on conduciveness of learning of environment and many more.

The last section of the questionnaire, Section C, covered the feasibility of CALA implementation and this comprised questions on preparedness of schools, skills available in schools and other necessary conditions to ease implementation of CALA. A 5-point Likert scale was adopted for easy and comprehensive data collection process. The ratings, 1 = strongly disagree; 2 = disagree; 3 = undecided; 4 = agree and 5 = strongly agree were used as the response code of the questionnaire questions. Section B and C had on average 15 questions each to be rated. A pilot study was conducted to assess and improve the quality of the questionnaire.

Reliability and Validity of the Data Collection Instrument

To assess the reliability of the questionnaire, Cronbach's alpha was used. This was conducted under the assumption of multiple items measuring same underlying constructs. The Cronbach's alpha was used to measure internal consistency and scale reliability of the questionnaire. It was calculated as follows:

$$\propto = \frac{n\bar{r}}{1 + (n-1)\bar{r}}$$

where n is the number of items and $\bar{r}$ is the mean correlations between the items. In the event where $\alpha > 0.7$, it was termed acceptable and items were regarded as highly correlated.

Further, average variance extracted (AVE) and composite reliability (CR) were calculated. AVE was used as a measure of the amount of variance taken by a construct in relation to amount of variance due to measurement error. This was in line with testing convergent validity. AVE was found as follows:

$$AVE = \frac{\sum_{i=1}^{n} \theta_i^2}{n}$$

where θ_i are loadings.

CR was used to measure the internal consistency of the data collection tool or internal consistency in the scale items. CR was calculated as follows:

$$CR = \frac{\sum_{i=1}^{n} \theta_i^2}{\sum_{i=1}^{n} \theta_i^2 + \sum_{i=1}^{n} var(e_i)}.$$

Factor Analysis

Exploratory factor analysis (EFA) was used in the analysis of the collected dataset. As according to Jani et al (2023) and Bakar et al (2023), the principal component analysis (PCA) can be used to establish strong trends, patterns in the dataset. To identify trends and interrelationships, EFA was used and three steps involved in the application of EFA were observed. These were:

(i) Suitability assessment of the dataset,
(ii) Factor extraction, and
(iii) Factor rotation and interpretation of results.

Suitability Assessment of the Dataset

Even though large samples are recommended, smaller samples can suffice if solutions have several high loading marker variables, normally of less than 0.80. In order to assess strength of relationship, correlation coefficients greater than 0.3 among the variables in the correlation matrix must be evident. One thorny issue of multicollinearity among the independent variables had to be assessed. It is a well-known fact that presence of multicollinearity among independent variables might make some of the significant variables insignificant in a research. This then gives unreliable results. To resolve that, determinant score was used.

To assess the data for factorability, two methods were used and these are namely Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of Sphericity. KMO is given by:

$$KMO = \frac{\sum_{i \neq j} R_{ij}^2}{\sum_{i \neq j} R_{ij}^2 + \sum_{i \neq j} U_{ij}^2}$$

where R_{ij} is the correlation matrix and U_{ij} is the partial covariance matrix. Values close to one indicate that the sample is adequate.

Bartlett's test of sphericity tests the null hypothesis (H_0) that the items are orthogonal against the alternative that they are not orthogonal. That is to say they are correlated and the correlation matrix departs from the identity matrix significantly. This is calculated as follows:

$$X^2 = -\left(n - 1 - \frac{2p + 5}{6}\right) x \ln |R|$$

where p is number of variables, n is total sample size and R is correlation matrix.

Factor Extraction, Rotation and Interpretation of Results

Factor extraction and rotation basically is concerned with determining minimum number of factors that can be used to describe the interrelationships among the variables. In this research cross loadings and outer loading were used in determining the minimum number of factors to explain the interrelationships.

Structural Equation Modelling (SEM)

The interrelationships between the unobservable variables were then further analysed using structural equation models. The association among the latent variables was assessed. Latent variables are unobservable constructs who use measurable or observable proxies for their measurement. These variables are not observable directly but their proxies could be observed.

DATA ANALYSIS

Data Collection Tools

Data obtained was analysed using SMART PLS version 3 and Statistical Packages for Social Sciences (SPSS) version 26. Information on age, gender, level of education, location of the educational institution as well as the involvement of participants in education in order to understand challenges of CALA implementation from different perspectives was collected from each participant.

The total responses for online questionnaires that were accessible through a Google form link were 69. Physically, 249 questionnaires were distributed and 185 valid responses were obtained while the remaining 64 questionnaires include the spoiled and non-returned questionnaires. This yielded a response rate of 74.3%. Altogether, valid responses from both online and physical respondents summed to 254. Henceforth 27.2% of the data was from the online surveys and 72.8% was from the administration of structured physical questionnaires. Most respondents highlighted challenges in accessing internet facilities. The target population were students, teachers and parents or guardians of students.

Demographic Information of the Respondents

Most of the respondents were males of which 24 were educators and 111 were students. Males were 135, making up 53.1% of the respondents and 46.9% were females. Of the 46.9% of the females, 17.6% were female educators and 82.4% were female students. As expected, most of the respondents were aged below 30 years as these age groups represent most of the students in high schools and tertiary institutions. Very few respondents were aged above 50 years and these constituted 2% of all the respondents.

According to ZIMSTAT (2021), they are more students in secondary schools in Zimbabwe than in tertiary institutions. As a result, secondary institution contributed most of the respondents, followed by tertiary and lastly primary schools. Primary schools contributed least number of respondents as most of the students at this level were not able to answer the questionnaire. There were more students (82%) than educators (18%). The research consisted mostly of institutions in urban (69.3%) areas as compared to institutions in the rural (16.5%) and peri-urban areas (14.2%). This information is summarised in **Table 1**.

Table 1. Demographic characteristics of respondents

Characteristic		Frequency (n)	Percentage (%)
Gender	Male	135	53.1
	Female	119	46.9
Age (years)	Below 20	170	66.9
	21–30	53	20.9
	31–40	19	7.5
	41–50	7	2.8
	Above 50	5	2
Educational institutions	Primary	46	18.1
	Secondary	148	58.3
	Tertiary	60	23.6
Involvement	Educator	46	18
	Student	208	82
Location of the school	Rural	42	16.5
	Peri-Urban	36	14.2
	Urban	176	69.3

Exploratory Factor Analysis (EFA)

Four factors were determined and these were teacher motivation (TM), parental support (PS), child performance (CP), and CALA implementation (CI) and had a total variance of 63.6%. EFA was used to reduce the number of items to four factors thus ensuring a parsimonious description of the latent variables (Kuo & Lin, 2020).

The research found a KMO value of 0.893 that indicates adequacy of the sample. Furthermore, the Bartlett's test of sphericity had the p-value less than 0.001, hence it was considered significant, thus the factor analysis was accurate. Henceforth, the sample could be used for further analysis.

Cronbach's Alpha, CR and AVE Results

Cronbach alpha was used in determining the consistent and internal reliability of the latent variables (Maware and Adetunji, 2019a). Values greater than 0.7 indicates high internal reliability (Maware and Adetunji, 2020; Wang and Ozturk, 2023). As shown in **Table 2**, all the Cronbach's alpha values were above 0.7, therefore the sample has high internal consistency and it is highly reliable (Prasad et al., 2016).

Table 2. Cronbach's alpha, CR and AVE results

	Cronbach's Alpha	Composite Reliability	AVE	Evaluation
Parental Support	0.881	0.910	0.629	Reliable
CALA implementation	0.948	0.955	0.659	Reliable
Teacher motivation	0.96	0.966	0.757	Reliable
Child performance	0.95	0.958	0.695	Reliable

Composite reliability is used to measure the internal uniformity of the data (Firmansyah and Maemunah, 2021). Values above 0.7 indicates high internal consistency (Maware and Adetunji, 2019a). The obtained values ranged from 0.91 – 0.966 showing that the data has high internal consistency. AVE is one of the measures that was used to determine convergent validity (Kuo and Lin, 2020; Firmansyah and Maemunah, 2021; Mustafa et al, 2021). According to the rule of thumb, the latent variable should explain at least 50% of each indicator's variance (Hair et al, 2021; Muhammad et al, 2021). In this research, the values obtained were all greater than 0.5, showings the convergent validity has been satisfied.

Discriminant Validity and Cross-loadings

The degree to which a construct is uniquely and truly different from other constructs due to observed empirical standards was assessed using Fornall-Lacker criterion and Heterotrait-Monotrait criterion (HTMT) and cross loadings. **Table 3** shows the Fornell-Lacker and HTMT values obtained.

Table 3. Fornell-Lacker and HTMT criterion values

		Parental support	CALA implementation	Teacher motivation	Child Performance
Fornell-Lacker values	Parental support	0.793			
	CALA Implementation	0.685	0.812		
	Teacher motivation	0.649	0.661	0.870	
	Child performance	0.748	0.768	0.747	0.834
Heterotrait Monotrait ratio (HTMT)	Parental support	0.740			
	CALA Implementation	0.704	0.677		
	Teacher motivation	0.814	0.798	0.779	

Cross loadings were also used to measure discriminant validity where the measure are supposed to have rigorous loadings on their constructs and not on the other constructs which are part of the model (Muhammad et al, 2021). It should be noted that indicators with outer loadings between 0.4 and 0.7 were removed from the model scale so that there is no negative impact on the outer loadings of the latent variable.

Structural Equation Modelling Results

SEM was used to validate the proposed hypotheses using the data collected from various respondents in the education sector. The coefficient of determination (R^2) values ranged from 0.422–0.678. According to Maware and Adetunji (2019a), R^2 values greater than 0.26 are substantial and have a large effect. Parental support, child performance and CALA implementation had R^2 values of 42.2%, 67.8%, and 62.8% respectively. This indicated that teacher motivation, parental support and child performance are influential on CALA implementation.

Teacher motivation has a positive influence on child performance, parental support and CALA implementation with path coefficients of 0.451, 0.649, and 0.152, respectively. Thus, the relationship between TM and PS is stronger compared to CP. There exists a stronger relationship between PS and CP compared to PS and CALA implementation as shown by the path coefficient of 0.455 and 0.220, respectively. The relationship between CP and CALA implementation had a path coefficient of 0.493 showing that it is strong and significant. To further validate these relationships, bootstrapping was performed and all the t-values were above 1.96 with the p-values lower than 0.05.

It can be noted from **Figure 2**, adapted from **Figure A1** in **Appendix** that TM and PS have lower influence on CI on their own. TM to CI has a path coefficient of 0.152 and PS to CI has a path coefficient of 0.220. This shows an influence less than 40% in both cases. However, when CP performance is introduced, the effect of TM and PS through CP increases to 0.493. This shows the moderation effect of child performance. In other words, performance of a child plays a pivotal role in CALA implementation.

TM and PS influence CI at a lesser extent compared to when there is CP. If CI will have a negative effect on the academic performance of children, its implementation will be very difficult even if the resources will be availed. If CI will have a positive effect on CP, then its implementation will be enhanced and supported by all stakeholders. In conclusion, all the proposed hypotheses were valid and acceptable.

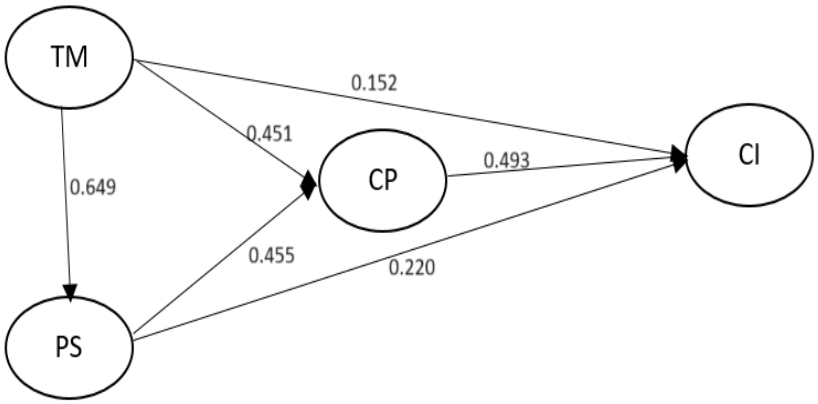

Figure 2. Moderation effect of CP

DISCUSSION

The research's aim was to establish influential factors and establish the interrelationship between these factors in CALA implementation. Several observable variables on CALA implementation were seen to be influential but these were grouped into four categories which are parental support (PS), teacher motivation (TM), child performance (CP) and CALA implementation (CI). It was established that these factors are interrelated and influence CALA implementation differently.

It was found that there is an association between the factors that influence CALA implementation. Parental support and teacher motivation had 0.22 and 0.15 coefficients, respectively in influencing CALA implementation. Child performance as moderation factor increased the effect to 0.49. This indicates that CALA implementation will be highly acceptable if performance of learners is boosted by introduction of CALA.

Many researches have been conducted in Zimbabwe. Using phenomenological qualitative research Firomumwe (2022) found that CALA implementation improves creative skills in learners but teachers had a negative attitude towards its implementation due to poor remuneration and lack of resources. These results are also echoed by Sithole et al (2021). If teachers are not motivated, there will be poor results in schools and hence adding another burden on the education system which is not supported will worsen the situation in schools. Teachers and parents will take a longer time to understand the advantages of implementing CALA in schools. This shows that teacher motivation influences CALA implementation as found by this research.

Alharbi (2023) compared developed and underdeveloped countries on the implementation of CALA and it was found that implementation of CALA was difficult in developing countries and these findings are in line with what this research established. Lack of support from disgruntled teachers and other factors make implementation difficult. Moreover, other stakeholders need to be incorporated for successfully implementing CALA. Latent constructs like parental support and teacher motivation need to be understood to successfully implement CALA in most under developed countries. Latent constructs that were assessed included teacher motivation, parent support and child performance. The results show that all have an influence on implementation of CALA hence they need to be observed when implementing CALA.

Continuous assessment empowers facilitators in making objective decisions on the performance of learners. The challenge, however, still remains with staff development of educators so that these decisions could be done or made with confidence. This affects motivation of teachers who make decisions in areas they lack expertise. Boosting educators' motivation will increase acceptance of CALA implementation. These findings are in line with what Makuvire et al (2023) found in Goromonzi, Zimbabwe. There is need for knowledgeable

professionals in the area so that CALA implementation will be expedited and without such professionals, the process will delay till a time when such professionals will be in the education system.

Implementation of CALA need not to be solely left to schools and school administrators. There are many stakeholders involved for the successful implementation of CALA. Parents and the learners themselves play a pivotal role in CALA implementation. Complaints have been raised by parents that most CALA activities are done by parents or teachers who charge money for these extra duties. This has neutralised the practical part or intended effectiveness of CALA. This shows that without involvement these other stakeholders, CALA implementation might be a nightmarish. This is in line with what Vurayai (2024) found. These findings show that other stakeholders are vital in making CALA implementation a success. These findings echo what Masiiwa and Last (2024) and Dhliwayo and Jita (2023) found. Successful implementation of CALA is an interplay of many factors and hence caution needs to be observed when introducing this system in the Zimbabwean education.

Studies have been done to assess the successful implementation of CALA at subject level. The results still indicate that CALA implementation is not subject related. It needs a holistic approach where more factors are assessed and included for a successful implementation of CALA. Risilo (2022) and Shonhiwa (2023) assessed competency based continuous assessment learning activities (CBCALA) in Geography but still many factors hindered the implementation of CBCALA in Geography. Makamure and Jojo (2023) assessed implementation of CALA in Mathematics. The findings in both cases are in line with what this research has established. Motivation, parental support and performance of children is all vital for successful implementation of CBCALA.

In summary, efficacious CALA implementation is dependent on an interplay of many factors that observable and that which are not observable. This therefore suggests an all-inclusive approach to successfully implement CALA in schools. Teachers need to be motivated, parents need to be educated on the essence of CALA and children need to perform well, both academically and practically, for parents to appreciate its introduction and henceforth support it. Otherwise, if these are not realised, CALA implementation will not be implemented rewardingly. It is therefore recommended that factors influencing CALA implementation should be treated collectively with child performance enhanced at all levels.

CONCLUSION AND RECOMMENDATION

Findings from this research indicated that there is an association among variables that influence CALA implementation in schools. It was found that teacher motivation was highly associated with parental support, child performance and parental support were modestly associated with CALA implementation. The association of teacher motivation and parental support to CALA implementation was amplified by the moderating effect of child performance. Child performance was found to be important in making CALA implementation acceptable in schools. The research has established that CALA implementation hinges more on child performance as compared to teacher motivation as is generally perceived. The better students perform the easier it will be to implement CALA and the poorer the performance of learners, the tougher it will be to implement CALA. It is recommended that government through Ministry of Primary and Secondary Education strive to motivate teachers, give all the support in terms of resources for easy CALA implementation and improve results so that parents do not attribute failure of students to CALA. As these factors are not stand-alone factors since they are associated, other stakeholders need to be educated on the benefits of CALA implementation in schools.

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Data availability: Data collected and used in this study are available from the authors on request.

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APPENDIX

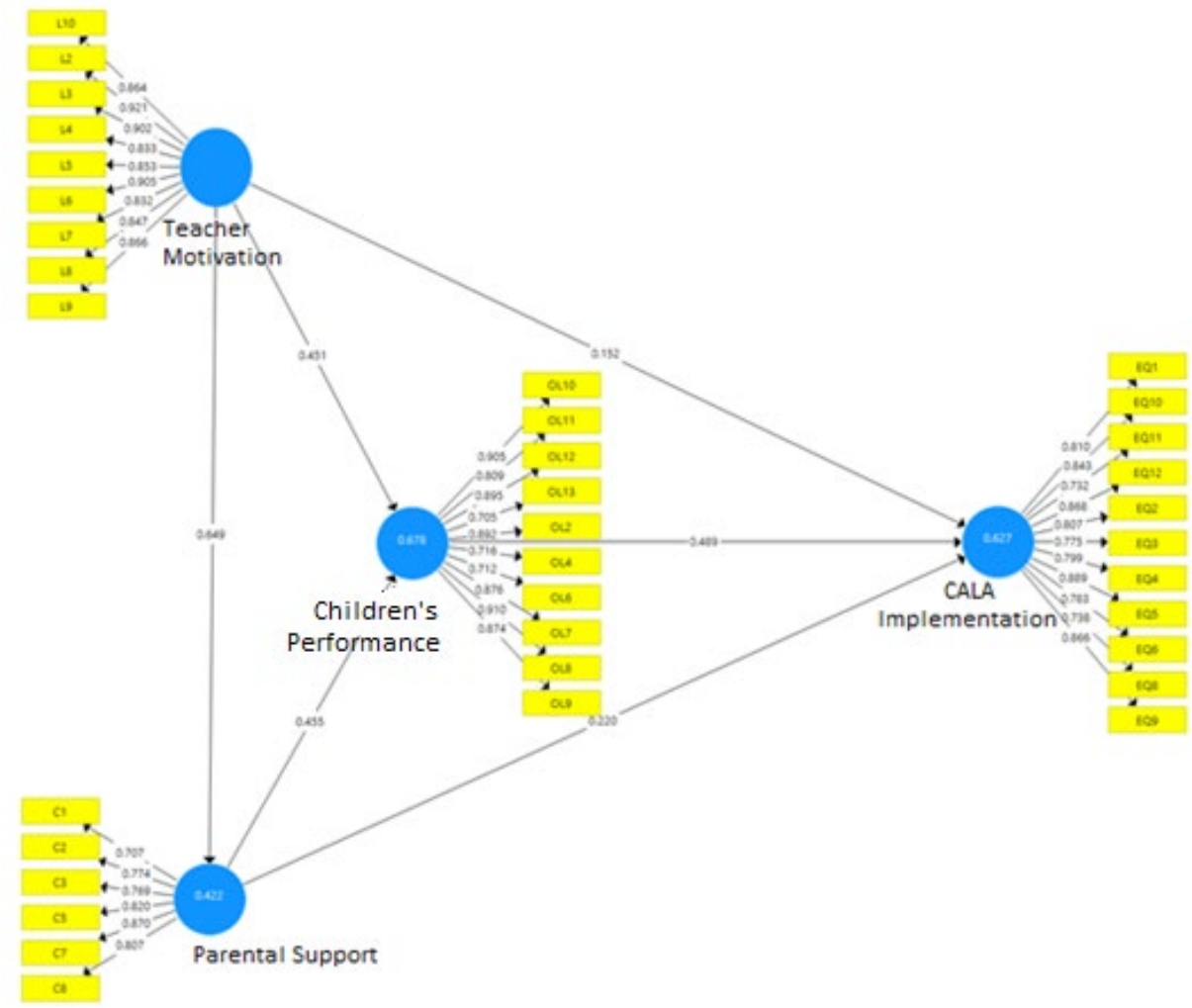

Figure A1. Structured model from Smart PLS