Perceived cognitive load and students' performance in social studies

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Abstract: The aim of this study was to investigate impact perceived cognitive load could have on basic eight students' performance in social studies. A correlational survey research design was used in the study. The population consisted of 3,957 upper basic eight students of secondary schools in Kogi east education. This study employed a sample size of 250 basic eight social studies students. Two instruments: social studies performance test and students' perceived cognitive load were used for data collection. The data collected were analyzed using regression analysis. The findings revealed that there was significant impact of cognitive load on basic eight students' mean performance scores in social studies. There was significant impact of cognitive load on basic eight male and also female students' mean performance scores in social studies. The study recommends among others that School authorities and administrators should make provision for activities that would lead to reduction in cognitive load in social studies among others to enhance performance.

Keywords: Social studies, cognitive load, performance, gender, learners

Beban kognitif yang dirasakan dan kinerja siswa dalam ilmu sosial

Abstrak: Tujuan dari penelitian ini adalah untuk menyelidiki dampak beban kognitif yang dirasakan terhadap kinerja siswa kelas delapan dalam ilmu sosial. Penelitian ini mengadopsi desain penelitian survei korelasional. Populasi dalam penelitian ini adalah 3.957 siswa kelas delapan sekolah menengah atas di pendidikan timur Kogi. Penelitian ini menggunakan sampel sebanyak 250 siswa dasar delapan ilmu sosial. Dua instrumen: Tes Kinerja ilmu sosial dan beban kognitif persepsi siswa digunakan untuk pengumpulan data. Data yang terkumpul dianalisis menggunakan analisis regresi. Temuan menunjukkan bahwa ada dampak yang signifikan dari beban kognitif pada skor kinerja rata-rata siswa kelas delapan dalam ilmu sosial. Ada pengaruh yang signifikan dari beban kognitif pada nilai rata-rata kinerja siswa kelas delapan laki-laki dan perempuan dalam ilmu sosial. Studi ini merekomendasikan antara lain bahwa pihak sekolah dan administrator harus membuat ketentuan untuk kegiatan yang akan mengarah pada pengurangan beban kognitif dalam ilmu sosial antara lain untuk meningkatkan kinerja.

Kata Kunci: Ilmu Sosial, beban kognitif, kinerja, jenis kelamin, peserta didik

INTRODUCTION

The reason for making social studies a core school subject at basic 1 to 9 in Nigeria is not far-fetched. There are essentials of life that the young ones must learn through social studies before becoming adult: good private and public attitude, citizenship education, good human relations, understanding the culture and to resist evil among others. This therefore makes its study and to further improves performance a necessity but has been very challenging over the years due to high cognitive load (Al-Sarry et al., 2022; Hassan Majeed et al., 2021; Šorgo et al., 2008). The theory of cognitive load propounded by Sweller (1988) states that learning happens best under condition that are aligned with human cognitive architecture. Since human working memory is limited, learners, when given too many information and if the complexity of instructional materials is not managed properly, it can lead to cognitive load. Heavy cognitive load can lead to negative effects on task completion. Cognitive theory is important to this study because it helps the teachers to be guided in keeping cognitive load at a minimum during the learning process. As such the teacher is able to ensure that cognitive load in social studies class is minimized by giving relevant examples and involving in activities that will enhance students' performance in the subject.

Social studies is described as the combination of human interactions experience and knowledge for the aim of civic education and changing human behaviour (Bhure et al., 2021; Bozkaya, 2021). Barth and Shermis (2014) describe social studies as the study of integrating knowledge, experience, and the efficient use of resources for the aim of civic education. social studies is an interdisciplinary topic with more potential to meet educational goals than any other discipline of study. It is a topic that is intended to promote a child's awareness, knowledge, and pride in his or her local culture, as well as an understanding of other cultures inside and outside the child's national boundaries (Enwelim, 2016) and social skill (Putro et al., 2019).

An important part of the middle school curriculum, social studies may help students develop the character traits and skills necessary to become contributing members of society (Akubuilo et al., 2019). Because of this, the Nigerian government has ensured that students in the basic education system, from kindergarten through junior high school, have a solid grounding in social studies (Opoh et al., 2014; Ugo et al., 2020). Teaching students that graft and corruption, favoritism, and other such vices are not what Nigerians bargain for when they seek and get their own government is another crucial function of the social sciences (Federal Republic of Nigeria, 2014). Enwelim (2016) argues that social studies classes should encourage students to take a more patriotic stance on issues like social justice, human rights, and local/national progress. Nationalistic sentiments may also be bolstered by study of social studies (Afriani et al., 2022; Afrina et al., 2021).

A well-implemented social studies education can equip students with the knowledge and motivation to take on the duties of citizenship (Alazmi, 2022; Bozkaya, 2021). This includes helping them get a firm grasp of civics, economics, geography, and history. Due to its integrated nature as a topic taught and learned in schools, social studies may help students fulfill their civic duties. Therefore, it is in a better position to help the kid develop the social skills necessary to become a contributing member of society. The amount of work students are asked to do in a given period of time is an often-overlooked, yet crucial component of quality social studies instruction. In so doing, their cognition is tasked indicating how much (high or less) load they carry per time. The importance of the current

research is represented in the importance of cognitive load which is often represented by the cognitive burden and mental effort in the study of social studies, acquisition and application of social studies knowledge and the lack of recent research conducted in this field at the local level. The research provides opportunity for determining influence of cognitive load on performance in social studies.

In contrast to the abundance of studies on the effect of cognitive load on students' success in fields like physics and mathematics, little has been done in the social sciences. The majority of research show a significant correlation between students' cognitive workload and their academic outcomes (Al-Sarry et al., 2022; Chew & Cerbin, 2021; Hassan Majeed et al., 2021). The phrase "cognitive load" describes the strain placed on students' working memory when they are being taught. The educational community also makes use of the term "cognitive load" to refer to the strain placed on students' working memories (Chaudhry & Irshad, 2013). Consequently, the "brain power" needed to comprehend anything is the cognitive load. This might include everything from gaining insight to addressing problems to making snap judgments about past events. According to studies, our short-term or working memory is capped at a certain number of items, whereas our long-term memory can store an infinite number of items. Cognitive strain has been linked to worse academic performance, according to research (Sweller, 2010). There has been no research on the influence of cognitive load on the academic performance of social studies students in the current study area, namely the Ankpa Area of the Kogi State Regional Government. Given the importance of the subject is for the cultivation of national awareness and nationalism, as well as the cultivation of the right types of values and attitudes for the survival of the Nigerian individual and society.

Students' levels of achievement may be correlated with how well they succeed in social studies classes (Ejimonye, 2015). Academic performance could be seen as an index for determining academic success of students (Okonkwo, 2014). It explains the educational efforts of students (Ugwuoke, 2014). According to Uroko (2010), the academic performance of a person is the individual's learning result. This encompasses information, abilities, and concepts gained over the course of education inside and outside of the classroom. Academic performance could also be referred to as successes recorded by students in an academic endeavour. Students' academic performance in social studies may improve due to how they regulate their cognitive load. Tukura, (2015) found that the overall performance of students in social studies in Nigeria State has been abysmally low and not encouraging. This poor academic performance could be linked to students' perceived cognitive load in the subject also.

Personal factors such as gender may influence students' academic performance (Nunaki et al., 2019), especially in social studies. To the genders, As defined by the World Health Organization (2013), gender norms are the set of expectations that a society has about the kind of jobs, hobbies, physical appearance, and relationships that men and women should have. The gendered expectations of men and women in society may be implied. Gender issues remain unresolved as findings from some studies on gender have shown contradicting evidence in academic performance of students. Thus, while some researchers found that male students have a higher academic performance than females, others opined that the reverse is the case, and yet, another group found no significant difference. For instance, Offorma, (2004) found that there is no agreement on which gender does better in

language learning. Achor and Musa (2021) found that sex is not a significant factor in students' cognitive load when simulation strategy is used in teaching Basic Science to students. These controversies on gender studies justify its inclusion as a possible intervening variable in this study. The main purpose of this study was to investigate the impact of perceived cognitive load on basic eight students' performance in social studies.

METHOD

A correlational survey was employed as the basis for this study's research strategy. Correlational survey research designs are those that seek to establish a connection between two or more study variables or phenomena (Nworgu, 2015). The purpose of a correlational survey is to determine whether or not there is a connection between two or more variables, and the results of these surveys usually reveal the strength and direction of any established connections. According to Agogo and Achor (2019), a correlational survey is a sort of survey that aims to establish a connection between three or more factors. Choosing this specific design was influenced by the study's overarching goal, which is to establish a causal model of relationships between varying degrees of cognitive load and the academic achievement of male and female students majoring in social studies.

The population of this study consisted of 3,957 upper basic eight students that offer social studies made up of 2,500 males and 1,457 females from 150 secondary schools in Kogi east education area 2020/2021 Academic Session (Kogi State Ministry of Education, 2021). 250 basic eight social studies students involved the study's sample size. The sample was obtained using a multi-stage sampling approach. For the research, simple random sampling was used to choose three out of nine local government regions. In addition, in each of the examined local government regions, three schools having at least one upper basic eight class were selected by means of a process of purposeful sampling. Purposive sampling was used to guarantee that each component of the population had an equal probability of being included in the sample. One intact class was selected from each school by random sampling. The names of the schools in the Local government areas were written down, reshuffled and put in a container, out of which three were randomly picked.

Two instruments were used for data collection for the study. The instruments are social studies performance test (SOSPT) and students' perceived cognitive load (SPCL). Social studies performance test (SOSPT), would be used to measure students' performance in Social Studies concepts. Students' perceived cognitive load (SPCL) was a 4-point rating scale for the study, which had the response mode of VHME=4, Very High Mental Effort, HME=3, High Mental Effort, LME=2, Low Mental Effort and VLME=1, Very Low Mental Effort. This rating was based on the assumption that social studies students are able to explain their idea on cognitive process.

Social studies performance test (SOSPT): SOSPT was developed by the researchers. It contained sections A and B. Section A solicited information on the respondents. Section B of the social studies performance test (SOSPT) was developed based on a table of specifications (test-blue print) constructed by the researcher. Section B evaluated the learning outcome (performance) of the basic eight social studies contents. The contents are people and their environment, physical environment, mineral resources, weather and climate, seasons in Nigeria, settlement in Nigeria, social group, cooperation, culture, socialization, citizen and citizenship from basic eight social studies curriculum which served

as a guide. The section was made up of initial 44 multiple choice items with A, B, C and D options which later reduced to 35 after validation. According to the test blueprint, the number of multiple-choice questions created from each subject was dictated by the volume or weight of each topic.

Students' perceived cognitive load (SPCL): This instrument students' perceived cognitive load (SPCL) was adapted from Paas and van Paas and Merrienboer (1994) by the researchers to measure students' perceived cognitive load. The subjective rating scale by Paas and van Merrienboer consists of a 9-point rating scale which ranges from 1 (Very Low Mental Effort) to 9 (Very High Mental Effort), but the researcher modified it to a 5 point rating scale for this study. The reliability coefficient of the instrument by Paas and van Merrienboer was 0.82. The present instrument is divided into two sections, A and B. Section A solicited demographic data of students such as gender. Section B consists of concepts in social studies as a questionnaire comprising five semantic differential scales in which a student can indicate his or her experiential level of mental effort (ME)/cognitive load (CL) after completing the study. This rating is based on the assumption that social studies students are able to introspect on the cognitive process and report the amount of mutual effort expended. The students' perceived cognitive load (SPCL) consisted of 11 social studies concepts rated on five-point scale, 5- Very High Mental Efforts, 4- High Mental Effort, 3- Undecided, 2- Low Mental Efforts, and 1- Very Low Mental Efforts. The concepts are people and their environment, physical environment, mineral resources, weather and climate, seasons in Nigeria, settlement in Nigeria, social group, cooperation, culture, socialization, citizen and citizenship.

Three experts performed face validation on the social studies performance test (SOSPT) and the students' perceived cognitive load (SPCL) measures: two from social studies department and the third one from Test and Measurement, all from Benue State University. Content validation was also done for social studies performance test (SOSPT) using the table of specification. The experts were tasked with determining whether or not the instruments had enough item phrasing, clarity, and relevance to the respondents, and whether or not the items covered sufficient ground in terms of substance.

A psychometric analysis was done on the social studies performance test (SOSPT) to determine the test's quality in terms of the difficulty of the questions and the discrimination of the distracting ones. The difficulty, discriminating, and distracter indices of the student-received items were calculated for analysis. So that the findings might be comprehended, this was performed. Before being selected for their high difficulty index, many SOSPT questions were reviewed or adjusted to strengthen their grammatical structure and guarantee that they included all of the relevant information. Due to the deletion of 10, the total number of items was reduced from 45 to 35 at the completion of the procedure.

Items with discrimination levels between 0.30 and 1.0 were allowed, as were alternatives with distracted index values between 0.30 and 1.0. Items whose distracted index values were within the allowed range were also approved. For the purpose of retention, however, the items whose choice scores were below the required level for distracter indices but whose discrimination scores were within the acceptable range were adjusted or modified. There will be a total of 35 things retained, while 10 will be eliminated.

In order to ensure the validity of the research instruments, the instruments were trial-tested using a total of 30 basic eight social studies students. The instruments were administered to the students by the researcher and collected immediately. The test was administered on students in a co-educational school in Kogi State. The school used was not part of the sample size of the study. The purpose of the trial test was to establish the reliability of the instruments and to determine the time that would be required for their administration. The Kuder-Richardson formula (K-R21) for the social studies performance test (SOSPT) and the Cronbach Alpha formula for the students' perceived cognitive load (SPCL) were used to assess the test results. When comparing SOSPT with SPCL, a reliability coefficient of 0.87 was observed for SOSPT and 0.76 for SPCL. These numbers are all within the generally accepted range for the dependability coefficient, which is between 0.50 and 0.99 (Nworgu, 2015). This means that the instruments themselves may be trusted.

For the purpose of this study, the researcher briefed one Social Studies teacher from each selected school on effective implementation of metacognitive strategies. The social studies performance test (SOSPT) and students perceived cognitive load (SPCL) were administered to the students in sampled schools and results collated.

The data for answering research questions were analysed using simple descriptive data from linear regression analysis while the hypotheses were tested using linear regression analysis to investigate the bivariate impact of social studies students' perceived cognitive load on performance in social studies. Simple linear regression analysis measures the extent and magnitude of relationship between variables; hence it would be used for analysis. More so, since the study is a correlation study with one of the variables predicting another, the use of regression analysis was considered good for the study.

RESULTS

Impact of cognitive load on students' performance

Table 1. ANOVA of impact of cognitive load on students' performance

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	0.270	1	0.270	1.033	0.010
Residual	64.860	248	0.262		
Total	65.130	249			

Table 1 reveals that $F(1, 248) = 1.033$; $p = 0.010 < 0.05$. This implies that there is significant impact of cognitive load on basic eight students' mean performance scores in social studies. Thus, based on evidence from data analysis, cognitive load has statistical significant impact on students' mean performance scores.

Table 2. Contribution of cognitive load on students' performance

R	R Square (R^2)	B	B (Reg. Weight)
0.264	0.069	3.527	0.264

As can be shown in Table 2, cognitive load has a significant effect on students' average social studies test results throughout Grade 8. The results suggest that cognitive load has a regression weight of 0.264 on the mean performance scores in social studies for students in

Grade 8. When controlling for other factors, this suggests that cognitive load affects the mean performance scores in social studies of students in Grade 8. Therefore, 26.4 percent of basic eight students' mean performance scores in social studies can be accounted for by their cognitive load level.

Impact of cognitive load on basic eight male students' performance

Table 3. ANOVA of impact of cognitive load on male students' performance

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	0.487	1	0.487	6.702	0.010
Residual	18.023	120	0.073		
Total	18.510	121			

Table 3 reveals that $F_{(1,120)} = 6.702$; $p = 0.010 < 0.05$. This implies that there is significant impact of cognitive load on basic eight male students' mean performance scores in social studies. Thus, based on evidence from data analysis, cognitive load has statistical significant impact on basic eight male students' mean performance scores in social studies.

Table 4. Contribution of cognitive load on male students' performance

R	R Square (R^2)	B	B (Reg. Weight)
0.162	0.026	3.052	0.162

Table 4 shows the contribution of cognitive load on basic eight male students' mean performance scores in social studies. The analysis shows that the regression weight of cognitive load on basic eight male students' mean performance scores in social studies is 0.162. This implies that cognitive load has impact on basic eight male students' mean performance scores in social studies when the variance explained by all other variables is controlled. Therefore, 16.2 percent of basic eight male students' mean performance scores in social studies can be accounted for by cognitive load

Impact of cognitive load on female students' performance

Table 5. ANOVA of impact of cognitive load on female students' performance

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	0.056	1	0.056	0.340	0.050
Residual	40.539	126	0.163		
Total	40.594	127			

Table 5 reveals that $F_{(1,126)} = 0.340$; $p = 0.050 = 0.05$. This implies that there is significant impact of cognitive load on basic eight female students' mean performance scores in social studies. Thus, based on evidence from data analysis, cognitive load has statistical significant impact on basic eight female students' mean performance scores in social studies.

Table 6. Contribution of cognitive load on female students' performance scores

R	R Square (R²)	B	B (Reg. Weight)
0.337	0.114	2.501	0.337

Table 6 shows the contribution of cognitive load on basic eight female students' mean performance scores in social studies. The analysis shows that the regression weight of cognitive load on basic eight female students' mean performance scores in social studies is 0.337. This implies that cognitive load has impact on basic eight female students' mean performance scores in social studies when the variance explained by all other variables is controlled. Therefore, 33.7 percent of basic eight female students' mean performance scores in social studies can be accounted for by cognitive load

DISCUSSION

In this part, the research's findings are detailed. In Ankpa Local Government Area, Kogi State, Nigeria, the research examined the influence of perceived cognitive load on the performance of basic eight students in social studies. Given that the population of the research consists of both female and male students. The gender factor was considered as a moderator variable.

Impact of cognitive load on students' performance

The first findings revealed that there is significant impact of cognitive load on basic eight students' mean performance scores in social studies. This implies that cognitive load has statistical significant impact on basic eight students' mean performance scores in social studies. Zimmerer and Matthiesen (2021) confirmed that there was a correlation between increasing cognitive load and a decrease in performance in their study. Other researchers also confirmed the same thing regarding cognitive load on student performance (Gillmor et al., 2015; Su, 2016; Takırr, 2011).

The finding is equally consisted with that of Minkley et al. (2021) that mental or cognitive load are predictors of task performance. The finding further agrees with that of Agbidye et al. (2019) that students in the experimental group expended lower cognitive load in all the concepts in Basic Science implying that lower cognitive load corresponds with high academic performance. The finding also agrees with that of Gazorkhani et al. (2014) that cognitive strategies training led to the better performance in learning educational media course.

Learning and social studies performance are influenced by cognitive load. Cognitive load refers to the complexity of content in social studies, and material with a high number of interactive components is seen as more challenging than material with fewer interactive elements and fewer members. Low interactivity content consists of single, simple elements that can be taught in isolation, and high inactivity material comprises of elements that can only be comprehended in connection to other elements. Therefore, there is nothing or very little we can do to reduce cognitive load; certain items to be studied are just more difficult than others. This is shown by the considerable effect cognitive load has on the mean social studies performance of students in the eighth grade. In order to manage cognitive load, Social Studies students should organize the content to be learnt in a simple-to-complex order.

Impact of cognitive load on male students' performance

The second finding indicated that there is significant impact of cognitive load on basic eight male students' mean performance scores in social studies. This implies that cognitive load has statistical significant impact on basic eight male students' mean performance scores in social studies. The finding confirms work of Ellah et al. (2018) that there was correlation between male as well as female students of high cognitive styles and their study process. Strombach et al. (2016) found that the cognitive-load impact on social discounting was gender-specific: although social discounting was substantially reliant on cognitive load in males, cognitive load interventions little affected women. Cognitive load evolved in the instructional material and contributes directly to the learning processes of male students in social studies class. This is generated by manner in which information is presented to the learners. The social studies teacher may describe the agents of socialization using a diagram because the learner may not have dealt with extraneous unnecessary information. This is due to the fact that intrinsic and extraneous cognitive loads can be added to form the load of task. A social studies problem presented to the male students devoid of extraneous cognitive loads may be responsible for the significant impact of cognitive load on basic eight male students' mean performance scores in social studies.

Impact of cognitive load on female students' performance

The third finding indicated that there is significant impact of cognitive load on basic eight female students' mean performance scores in social studies. This implies that cognitive load has significant impact on basic eight female students' mean performance scores in social studies. This findings contrasts Strombach et al. (2016), who verified the gender-specificity of the cognitive-load impact on social discounting: although social discounting was highly reliant on cognitive load in males, cognitive load interventions had almost no effect on women. The finding agrees with that of Rao et al. (2020) who found that predicting cognitive load and operational performance in a Simulated Marksmanship Task was possible. This means that female students with high cognitive load performed poorly and vice versa.

For the female students, the primary purpose of social studies is to build schemas and then program them. Constructing a schema requires cognitive operations such as interpretation, illustrative example, classification, inference, differentiation, and organization. Germane cognitive load predominates among the demands made by such procedures. It's been shown that the cognitive strain caused by poorly executed relevant procedures is greater than that caused by their smoothly executed counterparts. This implies effective learning approach, which encourages female students to invest free smooth processes to schema construction and automation is used in social studies instructions make students not overloaded. This is responsible for the significant impact of cognitive load on basic eight female students' mean performance scores in social studies.

CONCLUSION

The study has established that cognitive load has significant impact on basic eight students' mean performance scores in social studies. It was also established that cognitive

load had significant impacts on both basic eight male and female students' mean performance scores in social studies.

Two recommendations are provided in light of the results of the study:

1. School authorities and administrators should make provision for activities that stimulate learning and expose learners to less cognitive load so as to enhance their performance.
2. Curriculum planners should include strategies will help to reduce students' cognitive load in social studies irrespective of gender.

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