COGNITIVE DISTORTIONS AS A PREDICTOR OF STUDENTS' ACHIEVEMENT IN BIOLOGY IN COLLEGES OF EDUCATION IN ANAMBRA STATE

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Abstract

The study investigated cognitive distortions as a predictor of biology students' academic achievement in College of Education in Anambra State. Two research questions guided the study and two null hypotheses were tested at 0.05 level of significance. The predictive correlation design was adopted for the study. The population of the study comprised 283 year three (300 level) Biology students in the two public Colleges of Education in Anambra State, Nigeria and which constituted the sample for the study. The instrument for data collection was the Inventory of Cognitive Distortion – Youth Version (ICD-YV), validated by three experts. The reliability the instrument was established using Cronbach Alpha with coefficient of internal consistency of 0.82. The students' CGPA in Biology were obtained from Course adviser folder whereas for ICD-YD was administered to the students with the help of the research assistants. The data obtained was analyzed using simple and multiple linear regressions. The findings of the study revealed among others that 31.5 percent of the variance in Biology achievement was predicted by students' cognitive distortions. Furthermore, achievement in biology were significantly predicted by College of Education students' cognitive distortions. The conclusion drawn from the findings of the study was that cognitive distortions is a significant predictors of academic achievement in Biology. It was recommended among others that, educators and school counselors should implement cognitive behavioural interventions to help students recognize and challenge irrational beliefs about their academic abilities.

Keywords: Cognitive Distortions, Biology, Achievement, College

Introduction

The academic achievement of a student is a critical outcome of the educational process, reflecting students' understanding, competence, and mastery of academic subjects. Academic achievement refers to the successful completion of educational goals and objectives as defined by educational institutions. Academic achievement is therefore a multifaceted concept that reflects a student's academic success and proficiency across different dimensions of their educational journey often measured as grades in examinations and academic degrees. Academic achievement especially in science subjects like in Biology is critical for students in Colleges of Education in Anambra state, Nigeria, as it forms the foundation for future educators who will teach the subject at various educational levels. This is because the importance of Biology in understanding life processes and addressing health and environmental challenges makes it a cornerstone of scientific education.

Biology is the scientific study of life and living organisms (Adebayo and Ajayi, 2023). It encompasses a wide range of subfields that explore the structure, function, growth, evolution, distribution, and taxonomy of all forms of life. The fundamental principles of Biology provide insights into how living systems operate, from the smallest cellular components to the complex ecosystems on Earth. Biology therefore is, a diverse and dynamic field of study that continues to evolve with technological advancements, offering profound insights into the natural world and providing solutions to many of humanity's challenges.

The problems related to the teaching and learning of Biology in Colleges of Education in Anambra State, Nigeria, significantly affect students' academic achievement and often fall short of teachers' expectations. One major challenge is the inadequate provision of laboratory facilities, which limits students' opportunities for practical learning and reduces their understanding of

biological concepts (Emmanuel, and Peters, 2023). Compounding this issue is the shortage of qualified Biology lecturers, resulting in a diminished quality of instruction and a lack of mentorship for students. Additionally, traditional teaching methods, such as the over-reliance on lectures without integrating modern, interactive, and inquiry-based approaches, fail to engage students effectively and hinder their ability to develop necessary academic skills to improve achievement in Biology.

The problem is according Johnson and Clark (2023) further worsened by large class sizes, which prevent effective teacher-student interaction and reduce opportunities for individualized attention and feedback. Moreover, inconsistent assessment methods, particularly poorly structured continuous assessments, do not adequately measure students' understanding or practical skills. The limited integration of digital tools and information and communication technology (ICT) in teaching further impedes students from accessing virtual labs, simulations, and online resources that could enhance their learning experiences. Students' poor study habits and low motivation also contribute to underachievement, often stemming from a lack of effective learning strategies and limited academic support. Additionally, the Biology curriculum in many colleges may be outdated and does not align with modern scientific trends or practical applications, resulting in a disconnect between classroom learning and real-world practices.

The lack of adequate funding further compounds these challenges, as insufficient resources prevent the organization of practical activities, field trips, and the procurement of modern teaching aids. More so, poor teacher-student relationships, often marked by a lack of communication and academic support, negatively impact students' learning experiences and performance (Johnson and Clark, 2023). These challenges collectively contribute to students’ underachievement in Biology, highlighting the urgent need for comprehensive reforms to improve teaching methods, upgrade

facilities, integrate technology, and foster supportive learning environments that could improve academic achievement.

The academic achievement of students in Biology, particularly in Colleges of Education, is also influenced by various psychological and social factors. Among these factors, motivation, cognitive style, test anxiety, self-efficacy among others have been shown sufficiently in literature to influence academic achievement. Other factors such as cognitive distortion, cognitive interference, and social intelligence have also emerged as significant predictors but they have not been satisfactorily explored in empirical studies, neither is the understanding into their predictive association with academic achievement replete in literature. Understanding these predictors is crucial for developing effective educational strategies and interventions that can improve students' academic achievement in the Subject in Colleges of Education in Anambra state, Nigeria. There is need therefore, to find out how these psychological variables of cognitive distortion, cognitive interference and social intelligence predict students' academic achievement in Biology in Colleges of Education in Anambra state, Nigeria.

Cognitive distortions refer to the biased or irrational thought patterns that individuals use to perceive reality inaccurately (Yüksel and Bahadir-Yilmaz, 2019). According Kelsey (2023), cognitive distortions are the irrational thoughts that influence how students perceive the world, how they feel, and how they behave. Cognitive distortions are recurring negative thoughts that often become habitual and are influenced by an individual's opinions or emotions (Buğa and Kaya, 2022). Cognitive distortions therefore, are internal mental filters or biases that amplify a student's misery, fuel anxiety, and lower self-esteem. These distortions, such as overgeneralization, catastrophizing, and personalization, can lead to maladaptive emotional responses and behaviours.

In the academic context, cognitive distortions may cause students to misinterpret their abilities, leading to diminished self-esteem, increased anxiety, and poor academic performance (Beck, 2022). For instance, a student who consistently thinks, "I'm not good at Biology," may experience heightened anxiety during Biology examinations, and negatively affect their academic achievement. A study by Smith and Jones (2021) found that students with high levels of cognitive distortion exhibited lower academic achievement due to increased academic stress and reduced self-efficacy. In the context of Biology education, cognitive distortions can hinder a student's ability to understand complex concepts like genetics and taxonomy, solve problems effectively, and perform well in examinations. A student for example, who overgeneralizes may believe that failing one test in Biology means they will fail all future tests, leading to a decline in effort and academic achievement.

There are various instruments for measuring cognitive distortions and only four of them have been developed, that attempt to directly assess cognitive distortions. However, most of them are lacking in psychometric development. Thus, there is need for more a refined multi-dimensional measure with good psychometric properties. Hence, the Inventory of Cognitive Distortion – Youth Version (ICD-YV) by Kelsey (2023) as a more recent measure than all other measure of cognitive distortion will be used in this study. ICD-YV distortion dimensions or subscales covered within the measure include: externalization of self-worth, fortune-telling, magnification, labeling, perfectionism, comparison to others, emotional reasoning, arbitrary inference/jumping to conclusions, discounting the positive, personalization, dichotomous thinking, should statements.

The externalization of self-worth according to Kelsey (2023) attempts to assess how a youth’s self-esteem may depend on others' opinions. Fortune telling evaluates how youth predict and believe negative outcomes to be inevitable. Magnification measures the tendency to

exaggerate the significance of certain circumstances, either positively or negatively. The labelling examines how a child might label themselves with derogatory terms. Perfectionism measures the relentless pursuit of perfection based on internal or external standards without considering their feasibility. Comparison to others subscale determines how youth compare themselves to others, often resulting in feelings of inferiority. Emotional reasoning assesses how youth might use their emotional state to make decisions. Arbitrary inference or jumping to conclusions evaluates the tendency to draw conclusions without evidence. The discounting the positive measures the tendency to dismiss positive experiences or personal attributes.

The dimension of personalization evaluates the tendency to blame oneself without sufficient evidence whereas the dimension of should statements determines the internal demands a youth places on themselves, their abilities, and their behaviour (Kelsey, 2023). The need for a multi-dimensional measures of cognitive distortions arose according to Kuzucu, Sariot Ertürk, ¸Sim and Gökda¸ (2020), because these different forms of distortion impact thinking and cognition in diverse ways, which in turn affect behaviour differently. Specifically, the stress resulting from these distortions can lower academic achievement. Cognitive distortions lead to decreased self-efficacy, heightened anxiety, and overall poor academic performance due to the high expectations placed on academic success and the competitive nature of the educational system which sometimes lead to cognitive interference. Despite the recognized importance of these factors, there is a paucity of research specifically examining the relative contributions of the dimensions of cognitive distortion and the variable as a construct in predicting academic achievement in Biology among Colleges of Education students in Anambra state. Addressing this gap is crucial for developing targeted interventions that can mitigate the negative impacts of cognitive distortions and interference while enhancing social intelligence.

Purpose of the Study

The purpose of the study is to investigate cognitive distortions as a predictor of students' academic achievement in Biology in Colleges of Education in Anambra state. The study specifically seeks to investigate the;

1. Prediction of Colleges of Education students' academic achievement in Biology by cognitive distortions.
2. Relative contribution of the dimensions of cognitive distortions (externalization of self-worth, fortune-telling, magnification, labeling, perfectionism, comparison to others, emotional reasoning, arbitrary inference/jumping to conclusions, discounting the positive, personalization, dichotomous thinking, should statements) to prediction of Colleges of Education students' academic achievement in Biology.

Research Questions

The following research questions guided the study:

1. What is the predictive value of cognitive distortions on Colleges of Education students' academic achievement in Biology?
2. What are the relative contributions of the dimensions of cognitive distortions (externalization of self-worth, fortune-telling, magnification, labeling, perfectionism, comparison to others, emotional reasoning, arbitrary inference/jumping to conclusions, discounting the positive, personalization, dichotomous thinking, should statements) to prediction of Colleges of Education students' academic achievement in Biology?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. Cognitive distortions is not a significant predictor of Colleges of Education students' academic achievement in Biology.
2. The relative contributions of the dimensions of cognitive distortions (externalization of self-worth, fortune-telling, magnification, labeling, perfectionism, comparison to others, emotional reasoning,

arbitrary inference/jumping to conclusions, discounting the positive, personalization, dichotomous thinking, should statements) to prediction of Colleges of Education students' academic achievement in Biology is not significant.

Method

The design adopted for the study was predictive correlation design. The study was carried out in Colleges of Education in Anambra state, Nigeria. There are four colleges of education in Anambra state, namely; one Federal College which is Federal College of Education (Technical), Umunze, one state College, Nwafor Orizu College of Education, Nsugbe, and two private colleges which are Uli College of Education, Uli and Onit College of Education, Abagana. The population of the study comprised 283 year three (300 level) Biology students in the two public Colleges of Education in Anambra State, Nigeria. The number of students was gotten from the school registry (School Registry, FCE(T), Umunze, NOCE, Nsugbe, 2025).

The instrument for data collection are the; Inventory of Cognitive Distortion – Youth Version (ICD-YV). Inventory of Cognitive Distortion – Youth Version (ICD-YV) was adapted from Kelsey (2023). ICD-YV was developed and revalidated by Kelsey (2023) from all other known measures as a 58-item measure of distorted thinking in youths. The distortion categories covered within this measure include: externalization of self-worth, fortune-telling, magnification, labelling, perfectionism, comparison to others, emotional reasoning, arbitrary inference/jumping to conclusions, discounting the positive, personalization, dichotomous thinking, should statements. Each item is rated on a 5-point Likert scale (1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Often; 5 = Always). The major adaptations made were that the language of the statements was changed to formal language without any more abbreviations. ICD-YV was validated by one three experts.

The reliability of the instrument was determined using Cronbach Alpha as the instruments are polytomously scored. The coefficient of internal consistency obtained was 0.82. The

instruments were administered with the aid of two research assistants who are the colleagues of the research and who will work closely with the Biology lecturers in the Colleges of education for the study. They obtained the students' Commulative Grade Point Average in Biology for 200 level academic sessions and used it as the students' achievement. Data generated from the study were analysed using simple linear and multiple regressions. All null hypotheses were evaluated at the 0.05 level of significance and were rejected if the P-value is less than or equal to 0.05 ($P \leq 0.05$), and not rejected if it is greater than 0.05 ($P > 0.05$).

Results

Table 1: Prediction of Students' Achievement score in Biology by Cognitive Distortions

Model	R	R^2	Adjusted R^2	Unstandardized coefficients (B)	Std. Error
Constant	.561[a]	.315	.312	1.541	9.064
Cognitive Dist.				.281	

a. Predictors: (Constant), Cognitive Distortion

Table 1 shows that the R-Square value of 0.315 indicates that 31.5 percent of the variance in students' Biology scores is predicted by cognitive distortions. The unstandardized coefficient of 0.281 shows that a unit rise in cognitive distortion increases academic achievement score in Biology by 28.1%.

Table 2: Contributions of the Dimensions of Cognitive Distortions in the Prediction of Achievement scores in Biology

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	60.013	8.706		6.894	.000
	Labelling	.264	.127	.136	2.082	.039
	Externalization of Self-worth	.232	.245	.122	.947	.345
	Should statement	.524	.228	.159	2.292	.023
	Dichotomous Thinking	.031	.225	.009	.137	.892
	Arbitrary Inf./Jumping to Concln.	.407	.236	.122	1.724	.086
	Fortune-Telling	.794	1.423	.114	.558	.578
	Personalization	.104	.210	.033	.494	.622
	Perfectionism	.833	.218	.258	3.828	.000
	Magnification	.126	.119	.071	1.059	.291
	Emotional Reasoning	.038	.113	.023	.332	.740
	Comparison to Others	.202	.230	.114	.878	.381
	Discounting the Positive	.773	1.423	.112	.543	.588

a. Dependent Variable: Achievement

Table 2 shows the standardized beta coefficient which indicates predictive correlation between variables. The unstandardized B coefficient shows the predictive value of each dimension of cognitive distortions which indicates their relative contribution to achievement score in Biology. Table 2 shows that labelling contributes 26.4% to achievement score in Biology whenever a student labelling increases by one unit and with a unit increase in externalization of self-worth, achievement score in Biology by 23.2%. Should statement increases achievement by 52.4%, dichotomous thinking by 3.1%, arbitrary influence by 40.75, fortune telling by 79.4%, personalization by 10.4%, perfectionism by 83.3%, magnification by 12.6%, emotional reasoning by 3.8%, comparison to others by 20.2% and discounting the positive by 77.3% when each of these dimension increased by 1 unit. The order of relative contribution to achievement score in Biology from the highest to lowest by each dimension of cognitive distortion therefore is; perfectionism

(83.3%), fortune telling (79.4%), followed by discounting the positive (77.3%), discounting the positive (77.3%), should statement (52.4%), arbitrary inference (40.7%), labelling (26.4%), externalization of self-worth (23.2%), comparison to others (20.2%), magnification (12.6%), personalization (10.4%), and dichotomous thinking (0.31%).

Table 3: Significance of Prediction of Achievement score in Biology by Students' Cognitive Distortions

Model		Sum of Squares	Df	Mean Square	F	Pvalue
1	Regression	8496.788	1	8496.788	103.422	.000[b]
	Residual	18485.274	225	82.157		
	Total	26982.062	226			

a. Dependent Variable: Achievement

b. Predictors: (Constant), Cognitive Distortion

Table 3 shows that cognitive distortions is a significant predictor of achievement scores in Biology, $F(1, 225) = 103.422$, $p < .05$. The null hypothesis was therefore rejected meaning that cognitive distortions is a significant predictor of Colleges of Education students' academic achievement in Biology. Since cognitive distortions is a significant predictor of achievement scores in Biology, the regression model ($Y = a + bX$) for the prediction of achievement score in Biology as derived from Table 1, where constant = 1.541 and b value = 0.281 is:

ASB = 1.541 + 0.281(CD)

Where, ASB = Achievement score in Biology and CD = Cognitive Distortions score.

Table 4: Significance of Prediction of Achievement score in Biology by the Individual Dimensions of Cognitive Distortions

Model		Sum of Squares	df	Mean Square	F	Pvalue
1	Regression	3133.964	12	261.164	2.344	.008[b]
	Residual	23848.098	214	111.440		
	Total	26982.062	226			

a. Dependent Variable: Achievement

a. Predictors: (Constant), Discounting the Positive, Personalization, Magnification, Labelling, Emotional Reasoning, Should statement, Externalization of Self-worth, Dichotomous Thinking, Perfectionism,

Arbitrary Inference/Jumping to Conclusions, Comparison to Others, Fortune-Telling

Table 4 shows that all the individual dimension of cognitive distortions jointly predicted the students' achievement scores in Biology significantly, $F(12, 214) = 2.344$, $p < .05$. However, data contained in Table 2 shows the significance of the contributions of the individual dimensions to the prediction of achievement scores in Biology.

Table 2 shows that labelling is a significant predictor of achievement scores in Biology, $t(12, 214) = 2.082$, $p < 0.05$; should statement is not a significant predictor of achievement scores in Biology, $t(12, 214) = 2.292$, $p < 0.05$; and perfectionism is a significant predictor of achievement scores in Biology, $t(12, 214) = 2.292$, $p < 0.05$. Thus, the only significant contributors to the achievement score of students in Biology in order of significance are perfectionism, should statement and labelling. However, since the joint prediction of all the dimensions of cognitive distortions in the prediction of achievement score in Biology is significant, the regression model ($Y= a + bX_1 +cX_2+dX_3+eX_4+fX_5+gX_6+hX_7+iX_8+jX_9+kX_{10}+lX_{11}+mX_{12}+nX_{13}$) for the prediction of achievement score in Biology. The equation is derived from Table 2 as follows:

ASB = 60.013 + 0.264(LBL) + 0.232(EOS) + 0.524(SHS) + 0.031(DTH) + 0.407(AIJC) + 0.794(FOT) + 0.104(PER) + 0.833(PERF) + 0.126(MGN) + 0.038(EMR) + 0.202(CTO) + 0.773(DTP)

Where, ASB = Achievement score in Biology and LBL = Labelling, EOS = Externalization of Self-Worth, SHS = Should Statement, DTH = Dichotomous Thinking, AIJC = Arbitrary Inference/Jumping to Conclusions, FOT = Fortune- Telling, PER = Personalization, PERF = Perfectionism, MGN = Magnification, EMR = Emotional Reasoning, CTO = Comparison to Others, DTP = Discounting the Positive.

Discussion

The study found that cognitive distortion is a significant predictor of College of Education students' academic achievement in Biology. This finding suggests that the way students perceive, interpret, and think about academic tasks and challenges in Biology has a direct impact on their performance. Cognitive distortions, which refer to irrational, negative, or biased thinking patterns, can shape students' academic behaviours, motivation, and overall success in Biology.

Cognitive distortion includes maladaptive thought processes such as catastrophizing (expecting the worst outcomes), overgeneralization (applying a single negative experience to all situations), and self-blame (attributing failures to personal inadequacy). These distorted thought patterns can lead to academic anxiety, low self-efficacy, and poor learning engagement, ultimately affecting students' academic achievement. Students who experience high levels of cognitive distortion may struggle to process Biology concepts effectively, as negative thoughts about their abilities can hinder concentration, problem-solving skills, and persistence in studying. For instance, a student who believes that they are inherently bad at Biology due to a single poor test score may disengage from learning, leading to consistent poor performance. Conversely, students with fewer cognitive distortions are more likely to maintain a growth mindset, adopt positive learning strategies, and persevere through academic challenges.

This finding aligns with previous research that has highlighted the relationship between cognitive distortions and academic performance. For example, a study by Usman and Adeyemi (2020) found that students with high cognitive distortions exhibited lower academic motivation and higher academic stress, negatively impacting their performance in science subjects, including Biology. Similarly, Okafor and Nwosu (2021) emphasized that negative self-perceptions and maladaptive thinking patterns significantly reduce students' ability to comprehend and retain

scientific concepts. Furthermore, Bandura's (1986) Social Cognitive Theory supports this finding, as it explains that students' thoughts, emotions, and beliefs about their academic abilities play a crucial role in shaping their learning behaviours and outcomes. The theory suggests that cognitive distortions can weaken self-efficacy, reducing the likelihood of sustained academic effort in complex subjects like Biology.

The study also found that perfectionism, "should" statements, and labeling are the only dimensions of cognitive distortions that significantly contribute to students' achievement in Biology. This suggests that while cognitive distortions generally affect students' academic performance, only these three specific thought patterns play a substantial role in determining how well students perform in Biology. These cognitive distortions influence students' motivation, self-efficacy, and approach to learning, ultimately shaping their academic outcomes. In Biology, a subject that requires both conceptual understanding and practical application, perfectionist tendencies can result in anxiety, procrastination, and decreased learning engagement. Students with perfectionist traits may focus too much on avoiding mistakes rather than on mastering concepts, which can hinder their overall academic progress. However, for some students, perfectionism can also serve as a motivator, driving them to work harder and achieve higher academic performance.

Similarly, "should" statements, can create unnecessary academic pressure. When students fail to meet these self-imposed standards, they may experience frustration, low self-esteem, and academic disengagement. In contrast, students who adopt more flexible thinking patterns are better able to cope with setbacks and persist in their learning efforts. Labeling, another significant cognitive distortion in this study and such self-defeating thoughts can undermine motivation, leading to avoidance behaviours, lack of effort, and poor academic achievement. When students

internalize negative labels, they may develop a fixed mindset, believing that their abilities in Biology are unchangeable rather than seeing challenges as opportunities for growth.

This finding aligns with previous research by Adeyemo and Okechukwu (2020), who found that perfectionism and unrealistic academic expectations were significant predictors of academic stress and lower achievement in science subjects. Similarly, Obi and Nwafor (2021) reported that students who frequently used "should" statements in their self-talk were more likely to experience test anxiety, leading to poor performance in STEM courses. Additionally, Bandura's (1986) Social Cognitive Theory suggests that self-perceptions and thought patterns significantly influence students' academic behaviours, reinforcing the role of labeling in shaping achievement outcomes.

Conclusion

The study concludes that cognitive distortion significantly influences College of Education students' academic achievement in Biology, as negative thinking patterns such as overgeneralization, catastrophizing, and self-doubt hinder learning, motivation, and performance. This finding highlights the crucial role of psychological and emotional factors in academic success, emphasizing that achievement in Biology is not solely dependent on intellectual ability but also on students' thought processes and self-perceptions.

Recommendations

The following recommendations are made based on the findings of the study:

1. Educators and school counselors should implement cognitive behavioural interventions to help students recognize and challenge irrational beliefs about their academic abilities.
2. School counsellors should teach students self-reflection, self-regulation, and adaptive thinking strategies as these can improve their approach to learning and problem-solving in Biology.
3. Lecturers should foster a positive learning environment that promotes effort, resilience, and mastery-oriented thinking, rather than reinforcing fixed beliefs about intelligence and ability in Biology

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