

**Effects of Concept Mapping Strategy and Cooperative Learning Strategy on Federal Colleges of Education Students Academic Achievement in Cell Biology in Southwest, Nigeria**

**Allwell Iye AGADA-ADELEYE  
LCU/PG/000546**

**Being a PhD Submitted to the Department of Science Education, Faculty of Education,  
Lead City University, Ibadan, Nigeria**

**In Partial Fulfilment of the Requirements for the Award of Doctor of Philosophy  
Degree (PhD) in Biology Education**

**2025**

### **Certification**

This is to certify that Allwell Iye AGADA-ADELEYE, with Matriculation Number LCU/PG/000546 conducted this research work titled "Effect of Concept Mapping Strategy and Cooperative Learning Strategies on Federal Colleges of Education Students Academic Achievement in Cell Biology in Southwest Nigeria in the Department of Science Education, Faculty of Education, Lead City University, Ibadan, Nigeria, for the award of Doctor of Philosophy (PhD) in Biology Education and that this has not been previously submitted to any institution for the award of Degree or Certificate.

---

**Dr. C. O. Sam-Kayode**  
(Supervisor)

---

**Date**

---

**Prof. P. O. Yara**  
(Head of Department)

---

**Date**

## **Dedication**

This thesis is dedicated to my entire family members, for their love and encouragement towards the success of this work.

Lead City University Ibadan DO NOT COPY

## Acknowledgement

The researcher acknowledges the citadel of learning, Lead City University Ibadan, Oyo State for providing me with an enriching learning environment and the resources necessary for this programme. The researcher also appreciates all the principals, teachers and students of all the schools where I carried out my research work. Thank you very much.

The researcher is very appreciative of the Supervisor, Dr. Sam-Kayode C. O., for her direction, experience, and assistance during the entire project. The researcher express her sincere gratitude to Prof. D. A. Odeleye, Dean of the Faculty of Education; Prof. P. O. Yara, Head of the Department of Science Education; Prof. A. O. Oredein, Provost of the Postgraduate College; Prof. B. Adebo, Internal-External Examiner; and Dr. O. S. Pitan, Head of the Department of Art Social Science Education. The researcher greatly appreciates the contributions of the following lecturers: Prof. Senimetu Ileuma, Dr. Toyin Oyedeji, Dr. U. E. Akuche, Dr. M. D. Oyetade, Dr. Sabina Obi, Dr. Mojirade M. Ayantunji, Dr. Olabisi Killian, Dr. Seyi David, Dr. Deborah Ayeni, Miss Adedolapo Awoniyi, and Miss O. G. Oduali.

The researcher expresses her thanks to her husband, Mr. Adeolu Akintunde Adeleye, also to the researcher parents, Mr and Mrs. A. O. Agada and the siblings, Agada Russell and Agada Joseph, for their unwavering encouragement, understanding, and faith in all capabilities. The researcher expresses her gratitude to her course mate and friends, Dr. Ajobiewe Damilola, Mr. Adebimpe Abayomi, Dr. Ogundiran Gideon, Mr. Irawoola Shadrack, and Mrs. Ezekiel Oluwafunnike for their companionship, collaborative ethos, and invaluable perspectives. This initiative would not have been feasible without your collaborative support and encouragement. The researcher is fortunate to possess an exceptional network of folks in her life, and the researcher appreciates their contributions and steadfast support.

Even though the individuals and aforementioned universities helped with my study project, the researcher solely accountable for any mistakes that may have been made.

## Abstract

The results of pre-service teachers in Cell Biology over the years as observed by the researcher and literature have not been encouraging. This may be due to unfavourable teaching environments, ineffective teaching strategies, overcrowded classroom, and low-quality practical sessions in the laboratory. This study determined the effects of concept mapping strategy and cooperative learning strategy on academic achievement in Cell Biology in Southwest, Nigeria in order to address the problem low academic in Cell Biology among first-year Biology pre-service teachers. A quasi-experimental design was used. The sample consisted of 355 first-year Biology students from three Federal Colleges of Education in Southwest, Nigeria: Oyo, Osiele Abeokuta, and Iwo in Osun. Data were collected using Biology Achievement Test (BAT) (KR-20=0.75), the Instructional Guides for Cooperative and Concept Mapping Strategy. Data were analysed using Analysis of Covariance (ANCOVA) with seven hypotheses tested at 0.05 significance level. The results revealed: a significant main effect of Concept Mapping Strategy on the academic achievement of students in Cell Biology ( $F_{1, 237}=29.485$ ,  $p<0.05$ ); a significant main effect of cooperative learning on the academic achievement of students in Cell Biology ( $F_{1,235}=11.011$ ,  $p<0.05$ ); a significant main effect of gender on the academic achievement of students in Cell Biology ( $F_{1,352}=6.936$ ,  $p<0.05$ ); a significant interaction effect of gender and Concept Mapping Strategy on the academic achievement of students in Cell Biology ( $F_{(1,235)}=10.744$ ,  $p<0.05$ ); a significant interaction effect of gender and cooperative learning on the academic achievement of students in Cell Biology ( $F_{(1,235)}=6.206$ ,  $p<0.05$ ); The study concluded that concept mapping strategy and cooperative learning strategies were effective strategies that significantly enhance Pre-service teachers' academic achievement in Cell Biology in Southwest, Nigeria. This indicate that educational institutions ought to incorporate these strategies into their curricula to enhance comprehension of complex topics, while also taking into account gender dynamics in instructional design. These strategies could significantly improve educational practices in enhancing academic outcomes in Cell Biology. The interactive effects of these strategies with gender further emphasize the need for gender-responsive instructional planning. It was recommended that educators should adopt concept mapping strategy and cooperative learning as complementary strategies to enhance academic achievement in Cell Biology. Curriculum planners and teacher trainers in Colleges of Education should integrate these methods into their instructional design.

**Keyword:** Concept mapping strategy, Cooperative learning strategy, Academic achievement in Cell Biology

**Word count:** 439

## Table of Contents

<b>Content</b>	<b>Page</b>
Title Page	i
Certification	ii
Dedication	iii
Acknowledgement	iv
Abstract	v
Table of Contents	vi
List of Tables	ix
List of Figures	xi
List of Appendices	xii
List of Acronyms	xiii
<b>Chapter One: Introduction</b>	
1.1 Background to the Study	1
1.2 Statement of the Problem	11
1.3 Aim and Objectives of the Study	11
1.4 Hypotheses	12
1.5 Scope of the Study	13
1.6 Significance of the Study	13
1.7 Limitation of the Study	15
1.8 Operational Definition of Terms	15
<b>Endnotes</b>	17

## **Chapter Two: Literature Review**

<b>2.1</b>	<b>Conceptual Review</b>	<b>20</b>
2.1.1	Academic Achievement	20
2.1.2	Concept Mapping	21
2.1.3	Cooperative Learning	47
2.1.4	Gender	71
2.1.5	Cell Biology	74
<b>2.2</b>	<b>Theoretical Framework</b>	<b>77</b>
2.2.1	Ausubel's Meaningful Learning Theory	77
2.2.2	Constructivism Learning Theory	84
2.2.3	Vygotsky's Social Development Theory	91
2.2.4	Social Interdependence Theory	97
<b>2.3</b>	<b>Review of Empirical Studies</b>	<b>102</b>
2.3.1	Concept Mapping Strategy and Pre-service Biology Academic Achievement	102
2.3.2	Cooperative Learning and Pre-service Biology Academic Achievement	113
2.3.3	Concept Mapping Strategy and Students Gender	120
2.3.4	Cooperative Learning and Students Gender	126
<b>2.4</b>	<b>Conceptual Model</b>	<b>133</b>
<b>2.5</b>	<b>Summary of Gap in Literature Reviewed</b>	<b>133</b>
	<b>Endnotes</b>	<b>136</b>
	<b>Chapter Three: Methodology</b>	<b>145</b>

3.1	Research Design	145
3.2	Population of the Study	147
3.3	Sample and Sampling Techniques	148
3.4	Research Instruments	148
3.4.1	Description of Research Instruments	148
3.5	Validity of the Cell Biology Achievement Test (CBAT)	151
3.6	Reliability of the Cell Biology Achievement Test (CBAT)	151
3.7	Method of Data Collection	151
3.7.1	Work Schedule Table for Data Collection	152
3.8	Method of Data Analysis	154
3.9	Ethical Approval	154
	<b>Chapter Four: Results and Discussion of Findings</b>	<b>155</b>
4.1	Demographic Data Analyses	155
4.2	Test of Hypotheses	156
4.3	Discussion of Findings	163
	<b>Endnotes</b>	<b>169</b>
	<b>Chapter Five: Conclusion</b>	<b>171</b>
5.1	Summary of Findings	171
5.2	Conclusion	172
5.3	Recommendations	173
5.4	Contributions to Knowledge	174
5.5	Suggestion for Further Studies	174
	<b>Bibliography</b>	<b>175</b>
	Appendices of Instruments	183
	Bio-data	208
	The University Compliance Certification	211

## List of Tables

<b>Table</b>	<b>Title</b>	<b>Page</b>
2.2.1	Ausubel's Model of Meaningful Learning	81
3.1	Research Design Layout	145
3.2	Population of the Study	147
3.4.1	Table of Specification	149
3.7.1	Work Schedule Table for Data Collection	153
4.1.2	Distribution of the Participants by Gender	155
4.1.3	Distribution of the Participants by Groups	155
4.2.1a	Analysis of Covariance of Main Effect of Concept Mapping Strategy on Biology Students' Academic Achievement when taught Cell Biology at Federal College of Education in Southwest, Nigeria	156
4.2.1b	Estimated Marginal Means of Concept Mapping Strategy on Biology Students' Academic Achievement when taught Cell Biology	157
4.2.2a	Analysis of Covariance of Main Effect of Cooperative Learning Strategy on Biology Students' Academic Achievement when taught Cell Biology at Federal College of Education in Southwest, Nigeria	157
4.2.2b	Estimated Marginal Means of Cooperative Learning on Biology Students' Academic Achievement when taught Cell Biology	158
4.2.3a	Analysis of Covariance of Main Effect of Gender on Biology Students' Academic Achievement when taught Cell Biology at Federal College of Education in Southwest, Nigeria	159
4.2.3b	Estimated Marginal Means of Gender on Biology students' Academic Achievement when taught Cell Biology	159
4.2.4a	Analysis of Covariance of Interactive Effect of Concept Mapping Strategy and Gender on Biology Students' Academic Achievement when taught Cell Biology at the Federal College of Education in Southwest, Nigeria	160

4.2.4b: Estimated Marginal Means of Concept Mapping Strategy and Gender on Biology students' Academic Achievement when taught Cell Biology

161

Lead City University Ibadan DO NOT COPY

4.2.5a	Analysis of Covariance of Interactive Effect of Cooperative Learning and Gender on Biology Students' Teachers' Academic Achievement when taught Cell Biology at the Federal College of Education in Southwest, Nigeria	162
4.2.5b	Estimated Marginal Means of Cooperative Learning and Gender on Biology Students' Academic Achievement when taught Cell Biology	163

Lead City University Ibadan DO NOT COPY

## List of Figure

<b>Figure</b>	<b>Title</b>	<b>Page</b>
2.1	Adopted Conceptual Model	133

Lead City University Ibadan DO NOT COPY

## List of Appendices

<b>Appendix</b>	<b>Title</b>	<b>Page</b>
I	Lesson Plan	183
II	Assessment sheet	201
III	Bio-data	208
IV	The University Compliance Certification	211

Lead City University Ibadan DO NOT COPY

## **List of Acronyms**

### **Abbreviation**

### **Meaning**

BAT

Biology Achievement Test

ANCOVA

Analysis of Variance

Lead City University Ibadan DO NOT COPY