# GENDER, TEXT STRUCTURES AND SENIOR SECONDARY SCHOOL STUDENTS ACHIEVEMENT IN GENETICS

**HAFSAT IMAM ALABI & ISAAC OLAKANMI ABIMBOLA**
Department of Science Education, University of Ilorin, Ilorin, Nigeria
**E-mail:** alabi.hi@unilorin.edu.ng

**Abstract**
*The poor achievement of students in genetics knowledge could be ascribed to inappropriate manner of structuring genetics instruction given to students. This study investigated gender, text structure and senior school students' achievement in genetics. A quasi- experimental design involving pretest, posttest, non-randomized control and non-equivalent group design was adopted. A purposive sampling technique was used to select 239 students that participated in the study. The t-test and Analysis of ANCOVA statistics were used for the analysis. Findings indicated that there was: (i) a significant difference in the achievement of students taught genetics using different text structures at* $p < 0.05$, $F_{(2, 238)} = 15.11$, *(ii) no significant difference in the achievement of male and female students taught genetics using concept map at* $p > 0.05$; $t = 0.62$ *among others. The study recommends that biology teachers should consider logical prose and concept map in structuring secondary senior school biology contents.*

**Keywords:** Gender, Text Structures, Genetics, Students

## Introduction

A proper understanding of text structure requires a critical examination of what "structure" is. Structure has been variously defined by the researchers; Kliebard (1965) describes structure as the dissection of certainly recognized disciplines with a view to exposing their components or elemental framework. Structuring instruction, which is the focus of this study, is all about how concepts, facts, laws, generalizations, etc. are organized to ensure perfect understanding. One of which is text structure.

Text structure is the arrangement of the instructional contents presented to learners. Text structures involve exposing students to the detailed instruction of a given concepts. It is concerned with educating students on all fundamental elements that constitute a given concept; the detailed exposition of fundamental elements found within a concept. Teachers' Content Literacy (2009) defined text structure as the semantic and syntactic organizational arrangement used to present written information. Akhondi, Malayeri and Samad (2011) defined it as the structural element that guides students to locate and organize information. Examples of text structure include the semantic and syntactic features of the text used to describe, compare and contrast, find solutions to problems and to explain cause and effect relationship.

Proper understanding of text structures, according to Williams (2005), supports reading comprehension and helps students to transfer what they have learned to novel texts. It serves as graphic organizer and text pattern signal writing frame (Hess, 2008). Awareness and utilization of text structure is paramount to students' understanding. This assertion is supported by Akhondi, Malayeri and Samad (2011) who submitted that the recognition and use of text organization are fundamental processes to understanding and remembering. Barber, Pearson and Cervetti (2012) also reported that knowing text structures help learners to focus on main concepts and relationships; have an idea of what is next and monitor their comprehension as they read. The submissions of these researchers show the significance of

a well-structured text in recall of learnt contents; provision of rich facts as well as better understanding of the contents involved than any other type of arrangement.

Text structures, in this context, were examined at three levels; these are the logical prose, the concept map (a schematic representation of concepts from known to unknown) and the control group involving methods that are commonly used by the teacher classroom to structure instructions for students. The logical prose and concept map structures are forms of description, chronological and deductive structures. Logical prose can be described as a kind of descriptive text structure because it gives an explanation of concepts, ideas or events in an ordinary style of expression common to students. It is about fluidity of the expression of the common type.

Logical prose is largely descriptive and contains simplified terminology in exactitude. It is a method of structuring that takes into cognizance the order of presentation of the explanations, ideas or concepts. For this reason, it is described as logical. This activity comes between translating and paraphrasing. Alabi (2016) conducted a research on comparative effects of text structures on the achievement in genetics of senior school students in Ilorin, the study found a significant difference in the achievement of students taught genetics using logical prose. Amer (2013) concluded that students felt more comfortable and confident about writing when they are explicitly taught the organizational structure of expository text

A concept map is another type of text structure considered in this study. It is concerned with hierarchical representation of concepts in a schema. Bamidele, Adetunji, Awodele and Irinoye (2013) described concept map as two or three-dimensional graphic representation of relationships between pairs of concepts using labeled nodes and internodes. Studies have affirmed the effectiveness of concepts map on students' achievement. For instance, Singh and Moomo (2015) explored the effect of concept mapping on students' academic achievement in chemistry at tertiary level and established a significant difference in the achievement of students exposed to concept map. Similar results were obtained by Ogonnaya, Okafor, Abonyi and Ugama, (2016), Filgona, Filgona, Sababa and Ndatunwong (2016) whose studies were in basic science and social studies respectively.

Biology is a one of the sciences that has a direct relationship with human lives. It could be defined as the life processes or characteristics phenomenon of group or category of living organisms (Hellweg, 2009). Biological knowledge has been of tremendous use to our day to day activities, and knowledge acquired from it provides us with the required information for the protection and welfare of living species. Biology is crucial because it helps in the discovery and production of medicine; it plays a major role in the study of the functions of the living beings, their inheritance among others (Nalhe, 1999).

Joshi and Green (2013) identified embryology, physiology, genetics, molecular biology, biochemistry, ecology paleontology, space biology, as sub disciplines of biology. This is to say that genetics is one of the sub-disciplines in biology. Genetics as a sub discipline in biology studies the behaviour of genes as they move from generation to generation (Ambuno, Egunyomi & Osakwe, 2008). Michael (2012) defined genetics as the scientific study of heredity and variation; or the transmission of biological traits from parents to offspring via genes.

Genetics is one of the disciplines in biology whose principle has been found useful in the counseling of married couples on the risk of having children with disorders. Examples of such disorders are Down syndrome and sickle cell. Genetics knowledge has been extensively utilized in the production of various materials in medical and petrochemical industries. Its knowledge has also been used to provide and improve the genes with regards to having plants resistance

to diseases and pests. Despite the significance of genetics to human lives, studies such as Abimbola (1998); Topcu and Sahin-pekmez (2009); and Awang-Kanak, Masnoddin, Matawali, Daud and Jumat (2016) have established that both students and teachers have difficulties with genetics. The WAEC Chief Examiners' reports of Nigeria (2010 -2012) have also established that most students avoided genetics related topics and that those that attempted it could not provide a detailed response to the questions attempted.

In an attempt to alleviate the problems of genetics difficulty, several strategies had been utilized by researchers like Tanimowo (2005), Araz and Sungur (2007), and Tsui and Treagust (2007). Tanimowo (2005) examined the effect of concept mapping on cognitive preference model of undergraduate level learners in genetics at Ahmadu Bello University Zaria. The finding revealed that concept mapping strategy increases learner cognitive preference. Araz and Sungur (2007) revealed that students taught with Problem-Based Learning had higher academic achievement and performance skill than those taught using the traditional method. Similarly, Tsui and Treagust (2007) concluded that multiple representations facilitated understanding of genetics concepts in some students.

Gender was considered because of the need to know the extent of the usefulness of text structure to the male and female students' learning. Aremu and Ajanaku (2011) submitted that gender does not influence students' achievement in qualitative analysis. On the contrary, Otor (2013) found that, gender greatly influenced how well, or poorly students perform in difficult chemistry concepts in favour of female. Unlike Otor (2013) finding, the outcome of the study by Majere, Role and Makewa (2012) concluded that boys reflected better academic achievement compared to the girls in both chemistry and physics.

Based on the reviewed literature, it could be concluded that, those studies that utilized concept map use it as strategies but not as text structure. This is to say that earlier researchers did not examine concept map from the perspective of contents structuring as was done here, hence, the need for this study. It is also pertinent to mention that, there are studies on text structure, one of which is Idowu (2008) study. This study is at variance with Idowu's in that, it considered logical prose and concepts map as forms of structuring genetic concepts against the mathematical, diagrammatic and expository structure of physiological aspects of Nigeria Certificate in Education by Idowu.

**Purpose of the Study**

The study determined comparative effects of text structures on the achievement in genetics of senior school students in Ilorin. Specifically, the study explored differences in the achievement of (i) students taught genetics using different text structures were utilized (ii) male and female students taught genetics using concept map; and logical prose.

**Research Questions**

The following research questions guided the study:

(i) Do students achieve differently when taught genetics using different text structures?
(ii) Is there a difference in the achievement of male and female students taught genetics using concept map?
(iii) Do male and female students achieve differently when taught genetics using logical Prose?

**Research Hypotheses**

The under listed null hypotheses were analyzed in this study:

**$Ho_1$:** There is no significant difference in the achievement of students taught genetics using different text structure.

**$Ho_2$:** A statistically significant difference does not exist in the achievement of male and female students' taught genetics using concept map.

**$Ho_3$:** There is no significant difference in the achievement of male and female students taught genetics using logical prose

## Methodology

The study adopted quasi-experimental design comprising a pre-test, post-test, non-randomized, control and non-equivalent intact groups. Hence, a 3 X 2 factorial design was incorporated. All senior secondary schools students in Ilorin constituted the population. Purposive random sampling was used to sample 239 senior secondary school students III that were involved. These students were drawn and involved in their intact classes. The selected schools were equivalent in term of standard with respect to year of establishment and school proprietorship. Two experimental classes were involved, the logical prose group had 83 students (51 males, 32 females); concept map group had 82 students (37 males, 45 females) while the controlled group comprised 74 students (34 males, 40 female). Students in each group were classified into high, medium and low-scoring level based on the highest score obtained by the in their Achievement Test on Genetics, (ATG).

Three instruments were involved; they are Achievement Test on Genetics, (ATG), which comprised of 68 multiple choice item adapted from past West African Senior School Certificate Examination (WASSCE), Logical Structure of Concepts Involved in Genetics, (LSCIG), and Concept Map Structure of Genetics Contents (CSGC). The instruments were validated by two biology education experts from a university and two secondary school biology teachers. Pearson product moment correlation statistic was used to determine the reliability of the ATG at three weeks' interval. A coefficient value of 0.89 was obtained

Consent of the school authority and the parent of the students for the involvement of their children in the research was sought in order to meet the ethics requirement in research. The experimental and the control groups were pre-tested to determine their equivalent prior the commencement of the research. The pretest consisted 68 multiple choice questions which was shuffled to form posttest. The experimental groups were exposed to the treatment for four weeks. The control group was also exposed to the teacher's usual manner of structuring the same four weeks. The posttest was re-administered to the students after the treatment to determine the effect of the treatment.

One lesson period was used for the administration of the pretest to the experimental groups. The pretest consisted of 68 questions that students are expected to answer within 1 hour. The two experimental groups were exposed to four lessons each of transmission and expression of characters in organisms. The logical prose group was exposed to logically structured contents of genetics haven determined their present status in each of the classes. This logically structured content was transcribed to concept maps and was presented to the concept map group after determining their prior knowledge. These lessons take cognizance of order of occurrence of important terminologies as lesson progresses. Each lesson period spans through 40 minutes. At the end of the sixth week, the pretest was shuffled and administered as a posttest. This was to determine if there exist differences, after the administration of the treatment.

**Research Question 1:** Do students achieve differently when taught using different text structures?

The description of the differences in the achievement of students' in genetics when exposed to different text structures is presented in Table 1. Table 1 reveals that students achieved

differently when taught genetics using different text structures. This is reflected from the table mean gain score. The table shows the mean gain score of the logical prose, concept map and control group to be (17.24), (16.29) and (12.69) in the given order. It could be inferred from the table mean gain score that, logical prose group achieved best. Next was the concept map group, while the control group had the least achievement indicated by the lowest mean gain score. This suggests that students had varying achievement when taught genetics using different text structures.

**Table 1: Description of the Achievement of Students in Genetics when Exposed to Different Text Structures**

| Treatment | N | Pre-test ($\bar{x}$) | SD | Post-test ($\bar{x}$) | SD | ($\bar{x}$) Gain Score |
|---|---|---|---|---|---|---|
| Logical prose | 82 | 48.02 | 16.10 | 65.26 | 15.19 | 17.24 |
| Concept map | 83 | 47.84 | 14.37 | 64.13 | 15.29 | 16.29 |
| Control | 74 | 46.08 | 13.25 | 58.77 | 13.42 | 12.69 |

**Hypothesis 1:** There is no statistically significant difference in the achievement of students taught genetics using different text structures.

To test for the statistically significant difference in the achievement of students exposed to different text structures, i.e., logical prose, concept map and the control, students' scores were subjected to Analysis of Covariance and the result is presented in Table 2.An examination of Table 2 reveals that $F$= 15.11, at 2, 238 degrees of freedom was significant (i.e. < 0.05). Since the p < 0.05, there is a statistically significant difference in the achievement in genetics of students taught genetics using different text structures. The null hypothesis which states that there is no statistically significant difference in the achievement of students in genetics when taught using different text structures is rejected. Therefore, this suggests that there is a statistically significant difference in the achievement of students in genetics when exposed to different text structures.

**Table 2: The Analysis of Covariance of Mean Score of Students Exposed to Different Text Structure**

| Source | Type III Sum of Square | df | Mean Square | *F* | Sig |
|---|---|---|---|---|---|
| Corrected Model | 46231.77[a] | 3 | 15410.59 | 497.91 | 00.00 |
| Intercept | 7355.78 | 1 | 7355.78 | 237.66 | 00.00 |
| Pre-test | 44388.86 | 1 | 44388.86 | 1434.18 | 0.00 |
| Treatments | 935.30 | 2 | 467.65 | 15.11 | 0.00 |
| Error | 7273.40 | 235 | 30.95 | | |
| Total | 997817.00 | 239 | | | |
| Corrected Total | 53505.16 | 238 | | | |

a = R-square

Table 3 illustrates the location of the significant difference in the post-test mean scores of students exposed to different texts structure. The data shows a significant difference in the post-test mean score of students taught with concept map structure and the control in favour of those taught concept map structure. The result also revealed a significant difference in the post-test mean score of students subjected to logical prose and control, in support of the logical prose group. This implies that text structure had effects on achievement of students in

genetics. However, the differences in the post-test mean score of students exposed to concept map and logical prose are not significant.

**Table 3: Multiple Comparisons of the Mean Score of Students Exposed to Different Text Structures**

| Treatment (I) | Treatment (J) | Mean Difference (I-J) | SD | Sig[b] | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower bound | Upper bound |
| Concept map | Logical prose | 0.96 | 0.87 | 0.61 | -3.04 | 1.13 |
| | Control | 3.72* | 0.89 | 0.00 | 1.58 | 5.87 |
| Logical prose | Concept map | 0.96 | 0.87 | 0.61 | -1.13 | 3.04 |
| | Control | 4.68* | 0.89 | 0.00 | 2.53 | 6.83 |
| Control | Concept map | -3.72* | 0.89 | 0.00 | -5.82 | -1.28 |
| | Logical prose | -4.68* | 0.89 | 0.00 | -6.83 | -2.53 |

* = The mean difference is significant at the 0.05 level

**Research Question 2:** Do male and female students achieve differently when taught genetics, using concept map?

Male students achieve slightly higher in genetics than females when exposed to the concept map. Table 4 reveals that male students had (Mean=64.92, Std. Dev. =14.02), while their female counterparts had (Mean =63.19, Std. Dev. =17.02). This implies that the score of every male and female differs from the mean by 14.02 and 17.02, respectively.

**Hypothesis 2:** A statistically significant difference does not exist in the achievement of male and female students' taught genetics using concept map.

Table 7 reveals a non-statistically significant difference at ($p > 0.05$; $t = 0.62$). Hence, the null hypothesis is therefore not rejected.

**Table 4: The t-test Analysis of the Differences in the Achievement of Male and Female Students Exposed to Concept Map Structure**

| Treatment | N | $(\bar{x})$ | SD | df | $t$ | Sig. |
|---|---|---|---|---|---|---|
| Male | 51 | 64.92 | 14.02 | 81 | 0.62 | 0.51 |
| Female | 32 | 63.19 | 17.02 | | | |

**Research Question 3:** Do male and female students achieve differently when taught genetics, using logical prose?

There existed a variation in the attainment of male and female students taught genetics using logical prose, in favour of female, with a higher mean score of 74.98. This is evident from the mean scores obtained in Table 5. The 37 male students had (Mean = 53.43, SD =12.93), which is lower than that of the 45 female (Mean = 74.98, SD = 8.89). The table also reveals that each male differs from the mean score with a value of 12.93, while the female differs by 8.89.

**Hypothesis 3:** There is no statistically significant difference in the achievement of male and female students taught genetics using logical prose structure.

Table 5 shows that there existed a statistically significant difference at ($p$ = 0.00; $t$ = 8.91) alpha level of significance, in the achievement of males and females exposed to logical prose structure. The hypothesis, which states that there is no statistically significant difference in the achievement of male and female students' taught genetics using logical prose structure, is therefore rejected. Hence, there is a statistically significant difference in the achievement of males and females taught genetics using logical prose structure.

**Table 5: The t-test Analysis of the Differences in the Achievement of Male and Female Students Exposed to Logical Prose Structure**

| Treatment | N | ($\bar{x}$) | SD | df | $t$ | Sig. |
|---|---|---|---|---|---|---|
| Male | 37 | 53.43 | 12.93 | 80 | 8.91 | 0.00 |
| Female | 45 | 74.98 | 8.89 | | | |

**Summary of Major Findings**

(i) Senior secondary school students exposed to logical prose structure achieved significantly better than those exposed to concept map structure as well as those not exposed to any structure.

(ii) There was no significant difference in the achievement of male and female students taught genetics using concept map structure.

(iii) Female students taught with logical prose achieved significantly better than their male counterparts taught using the text structure.

**Discussion**

The result of the *ANCOVA* for hypothesis one illustrated that students taught with different text structure achieved significantly different in the order logical prose > concept map > control. This implies that students benefitted most from logical prose structure, which is a form of expository structure, followed by the concept map while the control group recorded the least achievement. The study sensitizes us to the significance of detailed text structure to meaningful learning. The finding is in contrast with Idowu (2008) findings in which the diagrammatic group had the highest achievement, followed by expository next to the mathematical and the control.

Gender influence on text structures was also considered in this analysis. Hypothesis two and three examined the differences in the achievement of male and female-taught genetics using concept map and logical prose respectively. The finding from hypothesis two, however, reveals that both sexes benefitted equally from the text structure. Hence, there is no significant difference in the achievement of male and female students in genetics. The implication is that male and female students find the strategy useful in learning genetics. The findings corroborate the results of Akomolafe (2010) who found that gender was not a determining factor in concept mapping ability in evolution. Also, the findings of Aremu and Ajanaku (2011) and Oludipe (2012) indicated a non-significant difference in the achievement of male and female students in the logical prose group, female students achieved differently from their male counterparts in favour of the female. The interpretation of this is that female students found the logical structure contents of genetics more useful than male students. The difference in their achievement might be as a result of the fact that most females like detailed or extensive verbal expression than males. This result agrees with the submission of Hale (2002); Majere, Role and Makewa (2012) and Otor (2013) whose findings revealed that females performed better than males. The study was, however, at variance with the results

of Ogunwale (2008) whose findings revealed that boys performed significantly better than their females' counterparts.

**Recommendations**

Based on the findings, the following recommendations were made:

(i) Logical prose and concept map might be employed by future researchers in teaching other difficult concepts in other school subjects. This will expose the students to the needed details as far as instruction is concerned and as a result, assist them in meaningful learning.

(ii) Concept map should be used in presenting instructions to students irrespective of their gender because it is gender friendly.

(iii) Biology teachers should find a way of getting male to be more interested in logical prose so as to be at the same level with their female counterparts. This could be achieved by creating a good teacher-students relationship as well as a good rapport among students in a classroom, irrespective of the students' gender.

**References**

Abimbola, I. O. (1998). Teachers' perception of important and difficult biology contents. *Journal of Functional Education, 1*(1), 10-21.

Akhondi, M., Malayeri, F. A., & Samad, A. A. (2011). How to teach text structure to facilitate reading comprehension. *The Reading Teacher*, *64*, 368 – 372. doi 1598/ RT. 645.9.

Akomolafe, M. J. (2010). Measured influence of self-efficiency and gender on secondary school students' academic performance in Ondo State, Nigeria. *Educational Thought, 17*(1), 1-11.

Alabi, H. I. (2016). *Comparative effects of text structures on the achievement in genetics of senior school students in Ilorin, Nigeria* (Unpublished Ph. D. Thesis). University of Ilorin, Ilorin, Nigeria.

Ambuno, S., Egunyomi, A., & Osakwe, U. C. (2008). *Comprehensive certificate biology for senior secondary schools.* Ibadan: University Press Ltd.

Amer, M. (2013). The effect of explicit instruction in expository text structure on the writing performance of Arab EFL University students. *Arab World English Journal (AWEJ), 4*(1), 224-238.

Araz, G., & Sungur, S. (2007). Effectiveness of problem based learning on academic performance in genetics. *International Union of Biochemistry and Molecular Biology Education, 35*, 448-451.

Aremu, K. A., & Ajanaku, J. A. (2011). Influence of gender difference on students' achievement in qualitative analysis practical in Kwara State College of Education Oro. *Nigerian Journal of Educational Studies and Research (NJESR), 7(*1*)*, 46-51.

Awang-Kanak, F., Masnoddin, M., Matawali, A., Daud, M. A., & Jumat, N. R. (2016). Difficulties experienced by science foundation students on basic Mendelian genetics topics: A preliminary study. *Transactions of Science and Technology, 3* (1-2), 283-290.

Bamidele, E. F., Adetunji, A. A., Awodele, B. A., & Irinoye, J. (2013). Attitudes of Nigerian secondary school chemistry students' towards concept mapping strategies in learning the mole concepts. *Academic Journal of Interdisciplinary Studies, 2*(2), 475 – 485. doi: 105901.

Barber, J., Pearson, P. D., & Cervetti, G. (2012). Teaching text structure with what happens to the atoms. A publication of University of California.

Chief Examiners' Report. (2010). The West African Senior secondary school Certificate Examinations. Retrieved 10th July, 2014 from www.waecheadquartersgh.org/intex.php.

Chief Examiners' Report. (2011). The West African Senior secondary school Certificate Examinations. Retrieved 10th July, 2014 from www.waecheadquartersgh.org/intex.php.

Chief Examiners' Report. (2012). The West African Senior secondary school Certificate Examinations. Retrieved 10th July, 2014 from www.waecheadquartersgh.org/intex.php.

Filgona, J., Filgona, J., Sababa, L. K., & Ndatunwong, L. G. (2016). Effects of concept mapping and brainstorming instructional strategies on junior secondary school achievement in social studies in Mubi educational zone, Nigeria. *British Journal of Education, Society and Behavioural Science, 18*(2), 1-18. Retrieved from www.sciencedomain.org.

Hale, K. V. (2002). Gender difference in computer technology achievement. *A Middle School Computer Technology Journal, 5*(2), 1-13. Retrieved from http:// www.ncsu.edu/meridian/sum2002/ gender/

Hellweg, P. (2009). *American Heritage Dictionary of English* (4th edition). American University Press

Hess, K. K. (2008). Teaching and assessing understanding of text structure across grades. Denver, Colorado: Author: Retrieved from www.nciea.org/publications/Textstructures_KH08.pdf.

Idowu, C. B. (2008). *Effect of content structure on the performance of college of education biology students' in South Western Nigeria* (Unpublished Doctoral Thesis). University of Ilorin, Ilorin, Nigeria.

Joshi, S. H., & Green, E. R. (2013). Biology interdisciplinary work. *Encyclopedia Britannica* inc Retrieved on 13/12/14.

Kliebard, H. M. (1965). Structure of the discipline as an educational slogan. *Teachers College Record, 6*(7), 598- 603.

Majere, I. S., Role, E., & Makewa, L. N. (2012). Gender disparities in self - concept, attitude and perception in physics and chemistry. *Atlas Journal of Science Education, 2*(1), and 61- 69.doi 10.5147/aise.

Michael, M. C. (2012). *Essential biology for senior secondary schools*. Ilorin: Tonald Publisher Ltd.

Nahle, N. (1999). Biology. Biology cabinet. New Braunfels. Retrieved fromhttp:/biocab.org/ Biology.html.

Ogonnaya, U. P., Okafor, G., Abonyi, O. S., &Ugama, J. O. (2016). Effects of concept map instruction approach on students' achievement in basic science. *Journal of Education and Practice, 7* (8), 79-84. Retrieved from www.iiste.org.

Ogunwale, Y. E. (2008). Effect of gender differences on computer technology achievement. *Nigerian Journal of Educational Studies and Research (NJESR), 51*,162-166.

Oludipe, D. I. (2012). Gender difference in Nigerian junior secondary students' academic achievement in basic science. *Journal of Education and Social Research, 2*(1), 93- 99.

Otor, E. E. (2013) Effect of concept mapping strategy on students' achievement in difficult chemistry concepts. *Educational Research, 4*(2), 182 – 189.

Singh, I. S., & Moomo, K. (2015). Effect of concept map on students' achievement in selected topics in chemistry at tertiary level. *Journal of Education and Practice, 6* (15), 106-114. Retrieved from www.iiste.org.

Tanimowo, E. L. (2005). The effect of concept mapping strategy on cognitive preference model of undergraduate level learners in genetics at Ahmadu Bello University, Zaria. *Journal of Educational Research and Development, 1*(1), 15 – 18.

Teachers Content Literacy. (2009). Text structure introduction. Retrieved from http://www.literacymatters.org/content/text/intro.htm

Topcu, M. S., & Sahin-pekmez, E. (2009). Turkish middle school students' difficulties in learning genetics concepts. *Journal of Turkish Science Education, 6*(2), 55- 62.

Tsui, C., & Treagust, D. F. (2007). Understanding genetics: Analysis of secondary school students' conceptual status. *Journal of Research in Science Teaching*, *44*(2), 205-235.doi. 10.1002/tea. 20116

Williams, J. P. (2005). Instruction in reading comprehension for primary – grade students: A focus on text structure. *The Journal of Special Education, 39*(1), 6 – 18.