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Enhancing Secondary School Chemistry Students Achievement Using K.W.L. Instructional Strategy.

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ABSTRACT

This study was designed to find out whether K.W.L instructional strategy can enhance chemistry students' academic achievement in some concepts in chemistry. It was a pre-test post- test control group design. Three research questions and three null hypotheses guided the study. The sample consisted of 240 SSII chemistry students selected by simple random sampling technique. Treatment lasted for a period of six weeks. The instrument use for data collection was Electrochemistry Achievement Test (EAT) developed by the researcher and validated by test experts and chemistry teachers. The data collected from EAT was analyzed using ANCOVA. The results showed that there is significant difference in the academic performance between students taught using K.W.L chart instructional strategy and those taught without use of the chart. Also, male and female students taught Electrolysis with the use of K.W.L chart showed no significant difference in their mean academic performance scores. Based on these, conclusion and some recommendations were made for the adoption of this strategy in the teaching – learning of secondary school chemistry concepts in Nigeria.

Keywords: Know-Want-Learn, Instructional Strategy, Achievement, Brain- Based Learning.

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1. INTRODUCTION

In recent decades, many research studies (Bojovic, 2010; Saleh, 2011; Alshatti & Watter's, 2012; Aina & Adedo, 2013; Riswanto & LisMayanti, 2014; Nja, kalu & Neji, 2015; Agummuoh, 2015; Shabatat & Al-Tarawneh, 2016; Zouhor, Bogdanovic & Segedinac, 2016) have remained focused mainly on the problem of students poor level of grasping or understanding clearly what they have been taught in class with much ease. This indeed is very needful in the field of sciences which is practical oriented and requires hands – on and minds – on activities for students to grasp and internalize/retain the concepts. It is very expedient that students engage their brains maximally and efficiently too in order for them to be able to grasp, understand and apply what they have learnt when the need arises. Chemistry is one of the science subjects that is volatile in the brain and students often complain that it is too abstract by nature and as such, do not make necessary effort to engage their brains effectively.

Essentially, it is their unwillingness to engage the brain most effectively for deeper understanding of chemistry concepts taught without much stress in understanding that formed the crux of these problems. It is for effective understanding of concepts without much stress that K.W.L which is a type of Brain – based Learning (BBL) was introduced. The Brain – based Learning (BBL) refers to teaching approaches, lesson designs, and school programs that are based on the latest scientific research about how the brain learns, including such factors as cognitive development. It shows how students learn differently as they age, grow, and nature socially, emotionally and cognitively. Its objective is to move from memorization of information to meaningful learning. The BBL principles originated from the brain – based learning theory which explained vividly how the brain grows through the vital experiences which leads to neural links and secretions. The physical structure of the Brain does not grow only by its protection and nutrition, but also through life experiences which leads to a new link (Shabatat & Al-Tarawneh, 2016).

The BBL theory according to Shabatat & Al-Tarawneh (2016) classified general learning tasks into three (3) categories namely;

(i) Brain –Harmonized Learning (BHL)
(ii) Anti-Brain Learning (ABL) and
(iii) Achievement Learning (AL).

The Brain-Harmonized Learning (BHL) is that type of learning that is very fascinating and joyful, with mere absence of threat. Besides, it has the potentials for free movement of students' sitting arrangements, increase relaxation and eliminates the fear and anxiety often encountered by strong challenges within the study environment. It encourages collaborative learning and experimentation. The Anti-Brain Learning (ABL) appear threatening to both the teachers and students. It is often exhibited when punishment is meted to students and usually followed by negative remarks or statement of expressions by teachers. These statements raise tension and increased anxiety particularly during class test and examinations. Teachers are prone to this type of learning when large class size is involved and scope of content is vast. Students as well are susceptible to this type of learning when grasping becomes difficult.

The Achievement Learning (AL) is the judgment of accomplishing a learning task or goals of the teaching – learning process in the most suitable means to avoid obstacles. It is a self-assessment strategic type of learning which is focused on students' record of successes or failures in a cumulative file. It is an enhancement control tool for teaching-learning process. However, it is the perfect blend of these three types of learning that enhances learning task in school. Apparently, the Brain-based Learning Theory thus promotes the application of different teaching approaches that activates prior knowledge of the students and enhances achievement (Zhang, 2010; Duman, 2010; Saheh, 2011; Altiti, 2014 and Shabatat & Al-Tarawneh, 2016). However, the assessment and activation of prior knowledge of the students would help in creating effective learning environment as well as achievement (Lin, Lin & Huang, 2011). These views seemingly agree with the earlier submissions of Szabo (2007) and Zhang (2010) who both suggested the use of K-W-L Instructional Strategy to enhance performance.

Accordingly, Zouhor, Bogdanovic & Segedinac (2016) opined the use of K-W-L instructional strategy would enhance active learning and offers a paradigm shift for students learning that differs from the usual conventional teaching approaches. The K-W-L instructional approach to learning prompts students to get actively involved in assessing, monitoring and evaluating their learning experiences from prior knowledge. In other words, students are actively involved in writing down what they think they know (K) about the topic from prior knowledge, what they want (W) to know with respect to the addressed topic of the lesson, and what they have learned (L) from the lesson after being taught. It is by understanding the fact that there are conditions and environment in which the brain learns fast and effectively that led to the suggestion of K.W.L instructional strategy by Ogle in 1986. Apparently, educators who become aware of these different learning knowledge and conditions on how the brain learns will gain exciting ideas about the conditions and the environment that can optimize learning. Indeed, good teaching approaches or techniques build understanding and skills over time because the brain recognizes that learning is cumulative and developmental.

By providing stimulating classroom environment, teachers can help satisfy the brains enormous hunger for discovery and challenge (Caine and Caine, 1990; Ogle, 1986 & 2009; Szabo, 2007; Al-Ataie, 2010; Yuksel, 2012). Indeed this strategy is viewed to a large extent as an index of active learning exercise that conforms with Edgar-Dale's (1969) cone of learning experience (cited in Nja, Kalu & Neji, 2015). This cone of learning experience revealed that learners do only remember 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they hear and see, 70% of what they say and 90% of what they say and do. Perhaps, these views explain why Ogle (2009) submitted that the knowledge which truly becomes ours is the knowledge that we do construct. Knowledge construction can only be enhanced through active learning exercises. Teacher need to employ as many classroom instructional strategies as possible, to facilitate students' construction of their own meaning. In constructing meaning, a good learner must link his/her prior knowledge to the new information received, reorganize it and create his/her own meaning. The K.W.L strategy thus provide this framework for learning that can be used across contents areas to help students become active constructors of meaning (Szabo,2007; Ogle, 2009; Zhang, 2010; Bojovic, 2010; Alshatti & Watters, 2012;Ibrahim,2012; Yuksel,2012; Riswanto & LisMayanti,2014; Zouhor, Bogdanovic & Segedinac, 2016). Consequently, this study is intended to determine whether K.W.L instructional can enhance chemistry students` academic achievement.

1.1 Statement of the Problems

Students nowadays rely too much on their teachers for constant support with less effort in engaging themselves in critical thinking process, monitoring and control of their thought. In other words, they are hardly aware of their own learning. Unfortunately, Science teaching especially chemistry, in most Nigerian secondary schools is predominantly content-based rather than application (Nja, Kalu & Neji, 2015). Information is provided directly to the students from their textbooks or their teachers by the didactic modes of teaching. Therefore, the students do hardly think constructively on their own in order for them to make more meaning of the concepts taught. This is because their brains are not sufficiently activated enough to hold (store) and retrieve information required of them when the need arise. These problems have persisted and as well reflected in the attendant poor chemistry performance in WASSCE, NABTEB and NECO examinations over the years in Nigeria. This study seeks to address the problems of how to engage the brain most effectively for optimal academic performance of in chemistry teaching process and learning through the use of K.W.L instructional strategy.

2. K – W – L INSTRUCTIONAL STRATEGY

K.W.L which is simply an acronym for what I know (K), what I want to know (W), and what I learned (L) was designed and developed by Ogle in 1986 as a teaching-learning strategy for activating students prior knowledge towards active participation in learning and increasing their comprehension. It is one of the most prominent Brain-based learning (BBL) approaches for studies designed to inspire students` inquiry and activates their prior knowledge. It increases students` meta-cognition (i.e. by increasing the knowledge and control of what the student has over his/her own thinking and learning activities). By using the K.W.L chart effectively, the student would know about his/her own cognitive processes for learning.

It would help the student to learn the topic or concept more efficiently, retain the knowledge longer and apply the skills in solving new problems successfully using retrieval method as applied in similar context (Ogle,1986; Zhang,2010; Dhull,2011; Ibrahim,2012; Najeefi,2013; Altiti,2014; Khaira,2015; Shabatat & Al-Tarawneh,2016). It was first suggested, designed and developed by Ogle (1986), as a teaching strategy that enhances active learning. It helps students to activate their prior knowledge and assess what they have learned. Therefore, it is an active learning strategy that is learner-centered (Ogle, 1986). It is a very simple and effective strategy that can be applied in different school subjects (Zouhor, Bogdanovic & Segedinac,2016; Khaira,2015; Alshatti & Watters,2012; Bojovic,2010; Zhang,2010; Ogle,2009; Riswanto & Lismayanti,2014; Yuksel,2012).

The K-W-L approach or strategy can be classified in three (3) stages:
Stage1. – Assessment of previous knowledge.
Stage 2.-Determining what an individual wants to know.
Stage 3.-Recalling what an individual have learnt.

It is organized in form of a chart to inspire students' inquiry and activates their prior knowledge (Ogle, 1986 & 2009). The chart consist of three (3) columns: What I know (K), what I want to know (W) and what I have learned (L). In other words, the first letters in the name, K. W. L, stands for the process of making meaning that begins with what students KNOW, moves on to the articulation of questions of what they WANT TO KNOW, and continues as the students' record what they LEARNED. The strategy is designed to be used by teachers and group of students working together collaboratively. It can then be easily transferred after into a method for students' independent study.

By using this strategy, the teacher first leads the group through an oral discussion of each of the components and then turns the process over to students to individually write down their own ideas and questions on personal worksheet. The intent of this strategy is to involve the students actively in thinking by first making real the connection between their prior knowledge and the information that will be presented in the course of teaching. In doing so, the teacher will elicit their students' prior knowledge (i.e. what they know) about the specific information and the ways that information is likely to be structured after teaching the concept (topic) by the teacher. Then, the teacher guide the students to think of questions they would need and want to have it answered and, finally, the students make notes and then organize the old and new information in chart (graphic) and elaborate them in written form. This strategy is often times christened "the 4C's model" to represent (connect, confirm, correct and collect) simply because its benefits are quite enormous and very systematic. Allen (2004) and Colorado Springs-School District (2010-2011) did caption and summarize the 4C's model based on description and benefit as follows:

(i) It gives the students the opportunity to think about what they know up front and hear what their colleagues know. This brings prior knowledge to the surface and fosters connections between old and new information as would be contained in the K-column of the chart. The process involved here is connection (C) of prior knowledge with new information during its teaching- learning process.
(ii) It also provides the students that chance to ask questions and wonder aloud about other information in order to establish a purpose and build motivation for further inquiry or investigations. Also, some conceptions or misconceptions are clarified through confirmation. Therefore, this process involves confirmation (C) from superior authority. That is confirming the prior information that the student had with respect to wanting-to-know in the W-column.
(iii) The recording of specific information they have learned as a result of the human brain conceptual change or paradigm shift of ideals in the L-column does not only make for the construction of meaning of the concepts taught, but also reinforces the purposes to become even much more inquisitive for further inquiry or investigations about the application of what was learnt and how to apply it successfully in other climes. This process involves taking correction (C). That is the process of correcting ones misconception as he/she learns.
(iv) The categorization process adopted in this strategy helps students to organize the information they have learned properly and sequentially or chronologically for retention in their long-term memory. Indeed, it is a frantic practice for students who are learning how to write more clearly, logically and systematically in the order of points learned. This process involves the proper organization or collection (C) of ideas to make more meaning of the topic learnt.

Thus, Ogle's (1986) K.W.L chart is as shown in the table below:

<table>
<tr><td colspan="3">THE K.W.L CHART. DATE:</td></tr>
<tr><td colspan="3">TOPIC: .... CLASS: ………………
STUDENT/GROUP NAME: ………………… SEX: …………………
INSTRUCTION: Before you begin your learning task, list down details in the first two columns; after the completion, fill in the last column.</td></tr>
<tr><td>WHAT I KNOW (K)</td><td>WHAT I WANT TO KNOW (W)</td><td>WHAT I LEARNED (L)</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

The benefits of using K.W.L strategy in chemistry instructions cannot be over emphasized, since teaching in the classroom should bridge gap between the content to be learned with the background knowledge and experiences of the students. The KWL strategy is then primarily concerned with the teachers' ability to plan instructions effectively in such way that it draws from the students' backgrounds, interests and developmental learning needs. It shows therefore that by adopting this strategy, the students would learn not simply by memorizing facts, but by reconfiguring and re-organizing what they already know. The background and experiences herein refers to the students' prior knowledge, their skills, interests, motivation to learn, and their developmental needs to achieve an educational objective.

The K.W.L chart in recent times, have been adapted and modified in certain specific classroom situations to accommodate the different students activities and their motivations on how to learn. These adaptations allow for full encouragement of the students to think critically better than before about the possible ways of expanding their knowledge on the subject matter (Shabatat and Al-Tarawneh, 2016). Therefore, the new K.W.L chart was adapted to accommodate additional H-column, which stands for 'How can I learn more'. This implies that the H column encourages future learning and the ability to think more critically and mentally active during the teaching learning process.

2.2 Theoretical Framework

The K.W.L instructional strategy is borne out of interest from constructivism as one of the approaches of Brain-based Learning Theory. Constructivism is a learning theory and epistemology that has influenced much of science education lately. It states that students construct their knowledge of the world through their past experiences. Students do not learn much just by sitting in class listening to the teacher, memorizing repackaged assignments and spitting out answers (Nja, Kalu & Neji, 2015). Therefore, they must talk what they are learning, write about it, relate it to past experiences, and apply it to their daily lives. They must make what they learn part and parcel of themselves .In constructivism, learning is simply the process of adjusting our mental models to accommodate new experiences while searching or negotiating for meaning based on prior knowledge. Meaning requires understanding.

Much significant learning is acquired by doing as learning is often facilitated when the student is an active participant. Vygotsky's social constructivist theory (cited in Nja, Kalu & Neji, 2015) states that learning takes place in a social context and interactions with others. Therefore, students are encouraged to say and do by way of putting down in writing, all their learning experiences in the KWL chart that is designed to help them become more actively involved in classroom learning activities. In doing so, the purpose of learning becomes the dexterity in perception and construction of individuals` own meaning, not just to memorize the answers and regurgitate someone else`s meaning.

Carr & Ogle (1987 & 1988) observed that if students are not familiar with categorizing and structuring information, teachers can help to model this kind of higher order thinking from the initial brainstorming that students do by asking "How do you think one is more likely to organize information on any given topic". If no ideas are brought forth, the teacher can direct student's attention to the list of information they generated earlier for identification. The teacher then redirects these ideas to be chunked into a single category. These categories form the basis for each column in the K.W.L chart. Ultimately, these constitute the pillars of K.W.L-instructional strategy.

3. METHODOLOGY

The research adopted a quasi-experimental design. It was a pre-test-post-test non-equivalent control group design. A simple random sampling technique was use to select 240 SSII chemistry students used for the study. Kuder-Richardson's formula – 20 was used to obtain a reliability coefficient of 0.79 after validation of instrument by two research experts in test and measurement and chemistry education teachers.

3.1 Procedure:

(i) **(i).** Engage the students to brain-storm on what they already know about the topic of class lesson and write their views or opinions/responses in the K-column of the chart. That is, by fully engaging the students in a discussion of what they already know about the topic in question.
(ii) (ii). Instruct them to write out all their doubts, disagreements, and questions that they would want to have it answered in the W-column of the chart. Where necessary, ask the students what they want to know about the topic and record their responses as questions in the W-column.
(iii) (iii). Then, instruct them to now pay attention to all what the teacher would say and do/perform during the delivery of lesson. This marks the beginning of proper teaching-learning engagements using any appropriate teaching methods. During this process key points are noted down by the students.
(iv) (iv). Thereafter, engage them again in a summary discussion of what they have learned from the teaching or explanations of the teacher on the topic taught.
(v) (v). Summarize the discussion in the L-column of the chart.

3.2 Research Questions

1. What is the effect of K.W.L instructional strategy on the academic achievement of chemistry students taught with and those taught without it?
2. What is the effect of K.W.L instructional strategy on the mean performance scores of male and female students in chemistry?
3. 3 .What is the interaction effect of treatment and gender on the mean achievement of students in chemistry?

Hypothesis one (Ho1): There is no significant difference between the mean achievement scores of students taught Chemistry using K.W.L instructional strategy and those taught without the strategy.

Hypothesis two (Ho2): Male and female students do not significantly differ in their mean achievement scores when taught chemistry using K.W.L instructional strategy.

Hypothesis three (Ho3): There is no significant interaction effect of treatment and gender on the mean achievement scores of students when taught chemistry using K.W.L instructional strategy.

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4. TABLE OF FINDINGS

Mean, Standard Deviation and Summary of ANCOVA of Effect of Treatment and Gender on SSII Chemistry Students' Academic Achievement in Electrolysis.

Treatment	Gender	Pre-test Mean	Post-test Mean	Mean	Standard Deviation	Number of Sample (N)
Experimental	Male	1236.36	1284.48	48.12	8.88	69
	Female	1307.06	1354.12	47.06	9.64	51
	TOTAL	2590.93	2638.60	47.67	9.19	120
Control	Male	1176.07	1194.20	18.13	5.26	55
	Female	1228.06	1243.80	15.74	7.07	65
	TOTAL	2421.17	2438.00	16.83	6.40	120
TOTAL	Male	2443.86	2478.68	34.82	16.72	124
	Female	2568.41	2597.92	29.51	17.66	116
	TOTAL	5044.35	5076.6	32.25	17.35	240

Sources of Variation	Sum of Squares	Df	Mean Squares		Sig. Level	Partial Eta square
Corrected Model	59459.98	4	14864.995	279.663	000*	.826
Intercept	29246.912	1	29246.912	550.237	000*	.701
Pretest	2215.541	1	2215.541	41.682	000*	.151
Treatment	54472.013	1	54472.013	1024.810	000*	813
Gender	119.987	1	119.987	2.257	.134	.010
Treatment X Gender	14.043	1	14.043	.264	.608	.001
Error	12491.018	235	531.153			
Total	321566.000	240				
Corrected Total	71951.000	239				

R. Squared = 826 (adjusted R squared = .823) F-critical = 3.86 *P>.05

5. FINDINGS AND DISCUSSIONS:

The table above showed that, the experimental group had higher mean achievement scores of 47.67 than the control group with 16.83 respectively. Males in the experimental group achieved higher mean (48.12) than the control group (18.13). Likewise females in the experimental group scored higher mean (47.06) than the control (15.74) respectively too. There is no significant difference in the mean achievement scores between males (48.12; n=69) and females (47.06; n=51). The table also indicated that treatment was significant (F = 1473.319; P < 0.05); Gender was not significant (F = 2.756, P > 0.05); interaction effect of treatment and Gender was not significant (F = 0.264; P > 0.05). Hence, the null hypothesis one was rejected, since the experimental group had higher mean than the control group. Hypotheses two and three were retained based on the results (F-calculated=0.826; Adjusted R=0.823 less than F-critical=3.86) at 0.05 significant level.

The table showed that 81.3% (0.813) of the variance was contributed by treatment; Gender was 2.1% (0.021) while interaction effect between gender and treatment was 16.6% (0.166). This result implied that student's gender did not significantly influence their mean performance scores in electrochemistry when taught with K.W.L chart as a brain-based learning tool. By extension, interaction effect of gender and treatment on the mean achievement scores of students taught Electrolysis using K.W.L instructional strategy was not statistically significant.

However, the findings of this study corroborates those of Zouhor *et al.,* (2016), Khaira (2015), Alfilimbani (2014), Saheh (2011), Riswanto and Lismayanti (2014), Alshatti & Watters (2012), Zhang (2010) and Al-Ataie (2010), whose studies on the effectiveness of K.W.L chart as a brain-based learning tool yielded positive results by way of enhancing academic achievement. Students who were exposed to the use of K.W.L instructional strategy most likely engaged their brains effectively through critical thinking processes involved/associated with the K.W.L chart. Perhaps their prior knowledge of the concepts taught were fully activated through recall of facts (ideas) stored in their brain's memory faster than those who were not exposed to the use of the K.W.L chart. The chart helped the students to learn the concepts taught more efficiently, and retained the knowledge longer and perhaps faster too as it enabled them to solve new problems administered in the Electrochemistry Achievement Test (EAT) within a given time frame.

This approach towards learning have helped them to reflect very fast on their learning, evaluated their successes, thoughts about their errors while performing their previous tasks, connecting and adjusting their learning responsibilities to tasks and perhaps improved their meta-cognition. Retrieving successfully the learned facts (ideas) helped them to obtain higher grades from EAT. The writing task or skills associated with K.W.L chart made the students' learning task easier and provided a concrete way for full participation in thinking critically about the topic even when some of the students were not too vocal in oral interactions. The K.W.L written worksheet provided the learning materials for revision before EAT was administered. Perhaps this accounts for why they did perform academically better than those students who did not use the chart for their revision before the EAT was administered. In other words, the K.W.L chart did provide a better test-base for comprehension of basic information about the topic or concepts taught in the classroom.

Gender of students was not significant according to this study. This implies that both male and female students achieved equally when exposed to K.W.L instructional strategy under the same condition in the teaching-learning process. This is so because achievement has to do with the mental and intellectual capabilities of the individuals and not the biological morphology of sex roles. The interaction effects of treatment and gender of students has never yielded much significant difference in relation to academic achievement from research findings (Agommuoh & Nzewi, 2003; Aiana & Adedo, 2013; Agommuoh, 2015; Alshatti & Watters, 2012; Shabatat and Al-Tarawneh, 2016; Nja, Kalu & Neji, 2015; Zouhor, Bogdanovic & Segedinac, 2016). Indeed, their results showed that gender was not statistically significant since achievement level is brain-based and synchronizes with mental and intellectual abilities without sex bias.

6. RECOMMENDATIONS AND CONCLUSION

Based on the above findings, the following recommendations are made:

1. There is need for teachers to show resourcefulness in innovative instructional strategies or approaches to science teaching. These approaches enhance academic achievement of science students generally.
2. There is also need for development of positive attitudes by teachers towards the use of K.W.L instructional strategies that activates prior knowledge of the student and connects new information to them for proper understanding or comprehension of scientific concepts taught.
3. Teachers should endeavor to bring their wealth of experience in teaching to bear on the students' aptitude level. This can be done by using instructional strategies that would engage the students on "hands-on" and "minds-on" activities, promote sustained interest, and enhance achievement through interactions among the ever inquisitive brains of students.

In conclusion, this study has shown that the use of K.W.L strategy is effective in enhancing achievement in chemistry. It encourages critical thinking, co-operative learning and active participation in the teaching-learning process in school.

REFERENCES

1. Agummuoh, P.C. & Nzewi, U.N. (2003). Effects of videotaped instruction on secondary school students' Achievement in physics. *JSTAN*, 38 (1&2): 88-93.
2. Agummuoh, P.C. (2015). Enhancing the teaching of physics through the use of ICT in senior secondary schools. *56th Annual conference Proceedings (STAN),* 274-283.
3. Aina, J.K. & Adedo, G.A. (2013). Correlation between continuous Assessment (CA) and students' performance in physics. *Journal of Education and Practice,* 4(6), 6-9.
4. Al-Ataie, S. (2010). The Effect of applying K.W.L technique on teaching ESP students. *Retrieved;* May 5, 2013 from http://www.iasj.net/iasj?func=fulltext&aId=2694.
5. Alfilinbani, D. (2014). The Impact of Brain-based training program and level of mastery on the Development of skills of Para-Learning and Academic Achievement in Saudi-Arabia. *Unpublished Doctoral Dissertation*. University of Cairo, Egypt.
6. Allen, J. (2004). *Tools for teaching content Literacy*. Portland, ME; Stenhouse Publishers.
7. Alshatti, S. and Watters, J. (2012). Teaching and learning Family and Consumer Sciences through K.W.L chart. *Family & Consumer Sciences Education*, 30 (2), 1-21.
8. Altiti, M. (2014). The Impact of a Brain-Based teaching program on improving the Achievement of 5th Grade students in Sciences. *Journal of Islamic University,* 22 (1), 111-138.
9. Bojovic, M. (2010). Teaching Foreign Language with K.W.L technique for specific purpose. *Teacher Development Journal*, 6 (1), 216-221.
10. Caine, R.N. and Caine, G. (1990). Understanding a Brain-based Approach to learning. *Educational Leadership*, 12 (1), 66-98
11. Carr, E. & Ogle, D. (1987). K.W.L Pius: A strategy for comprehension and summarization. *Journal of Reading*, 30, 626-631.
12. Carr, E. & Ogle, D. (1998). *K.W.L Pius: Effects on Poor Readers' summarization and Memory of content*. Paper presented at the national Reading Conference (Annual Conference), Austin-Texas, U.S.A.
13. Colorado Spring school District (2010-2011). The world is changing. Meet the future: Highly Effective Instructional Strategies. Retrieved September 3, 2016 from *http://www.&11.org/professional Development/achieve/continous%20/improvement%20Tools/Highly-Effective-Instructional-strategies.pdf*
14. Dhull, I. (2011). *Brain compatible learning and its strategies*. Being paper presented at Maui International Conference Maui, Hawaii-USA.
15. Duman, B. (2010). The Effects of Brain-based learning on the Academic Achievement of students with different styles. *ERIC Journal Education Sciences,* 10(4), 2077-2103.
16. Ibrahim, N.N. (2012). The use of K.W.L technique in teaching Reading Descriptive text: A quasi-experimental study in the first-grade of a senior High School in Bandung. Retrieved; November 6, 2014 from *http://www.a-research.upiedu/operator/upload/sing0608702chapter3.pdf*.
17. Khaira, U. (2015). The use of K.W.L Strategy to improve reading comprehension. *English Education Journal (EEJ),* 6 (3), 411-423.
18. Lin, Y. C; Lin, Y. T. & Huang, Y. M. (2011). Development of Diagnostic system using a testing-based Approach for strengthening students' prior knowledge. *Computer and Education*, 57, 1557-1570.
19. Najeefi, T. (2013). Human Brain. Retrieved 5th August, 2013 from *http://wwww.jilpress.com*.
20. Nja, C., Kalu, I. and Neji, H. (2015). Gender, Kitchen Resources and students' Academic performance and Retention in Thermochemistry in cross River state, Nigeria. *Global Journal of Educational Research*, 14, 25-29.
21. Ogle, D.M. (1986). K.W.L: A Teaching Model That Develops Active Reading Expository Text. *The Reading Instructor*, 39(6), 564-570.
22. Ogle, D.M. (2009). K.W.L. in Action: Secondary teachers find applications that works. In E.K. Dishner *et al*. (Eds), *Reading in content Areas: Improving classroom Instruction,* 453-494. Dubuque, IA: Kendal & Hunt.

23. Ozden, M. and Gulteki, M. (2008). The Effects of Brain-based learning on Academic Achievement and Retention of knowledge in science course. *Electronic Journal of Science Education*, 12 (1), 1-17.
24. Riswanto, R. and Lis Mayanti, D. (2014). The Effect of using K.W.L. strategy on EFL students' Reading Comprehension Achievement. *International Journal of Humanities and Social Sciences,* 4(7), 225-233.
25. Saheh, S. (2011). The Effectiveness of the Brain-based Teaching Approach in Enhancing Scientific understanding of Newtonian Physics among form four students. *International Journal of Environmental and Science Education*, 7 (1), 107-122.
26. Shabatat, K. and Al- Tarawneh, M. (2016). The impact of a teaching- Learning Program Based on Brain-Based learning on the Achievement of the female students of 9th Grade in chemistry. *Higher Education*, 6(2), 162-173.
27. Szabo, S. (2007). The K.W.L Strategy: Helping struggling Readers Build evidence of their learning. *Thinking classroom Journal*, 8(2), 213-224.
28. Yuksel, I. (2012). Activating Students' Prior knowledge: The core strategies. *Turkey University: World Applied Science Journal*, 20 (8), 1197-1201.
29. Zhang, F. (2010). The Integration of K.W.L Strategy into English language teaching for Non-English Majors. *Chinese Journal of Applied Linguistics*, 33(4), 77-86.
30. Zouhor, Z., Bogdanovic, I. & Segedinac, M. (2016). Effects of the K.W.L strategy on primary school students' meta-cognition and physics Achievement. *Journal of Subject Didactics*, 1(1), 39-49.