ASSESSMENT OF LEARNING STRATEGIES ADOPTED BY CHEMISTRY EDUCATION STUDENTS IN THE FACULTY OF EDUCATION, UNIVERSITY OF BENIN

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A PROJECT PRESENTED TO THE DEPARTMENT OF CURRICULUM AND INSTRUCTIONAL TECHNOLOGY, FACULTY OF EDUCATION IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE EDUCATION (B.Sc. Ed) DEGREE IN CHEMISTRY OF THE UNIVERSITY OF BENIN, BENIN CITY, NIGERIA.

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CERTIFICATION

We, the undersigned, certify that this research project was carried out by Blessing Adesuwa IGBINOSA, Mat. No. EDU1803037 in the Department of Curriculum and Instructional Technology (CIT), Faculty of Education, University of Benin, Benin City, Nigeria.

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DEDICATION

This work is dedicated to God Almighty, the source of life, grace, knowledge and strength.

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To her friends and colleagues who has contributed positively to helping her achieve this degree, Thank you so much.

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ABSTRACT

This study was to investigate the learning strategies adopted by chemistry education students. The instrument used for data collection was questionnaire, which was developed and administered to 80 students from the department of Curriculum and Instructional Technology. The data from their responses were analyzed with the use of simple percentage.

The result revealed that reading is a fundamental activity, enabling chemistry students to absorb information from textbooks, articles, or digital resources. Accompanying this, note-taking helps organize and retain essential concepts. Chemistry students often ask questions, contribute to discussions, and engage in collaborative learning, fostering a deeper understanding of the subject matter. Furthermore, effective time management is critical for successful studying. Chemistry education students allocate dedicated time slots for each subject, break down tasks into manageable chunks, and create study schedules.

It is therefore recommended that Faculty officers and instructors should emphasize the importance of group study sessions, peer teaching and collaborative projects, fostering a conducive environment for chemistry education students to share knowledge and learn from one other, Chemistry education lecturers should play a vital role in incorporating diverse learning approaches, utilizing technology and encouraging interactive learning methods, School managements should provide guidance on time management techniques, setting achievable study goals and creating structured schedules to help chemistry education students prioritize their studies and maximize their learning potentials

CHAPTER ONE

INTRODUCTION

Background to the Study

Science is an intellectual activity involving human beings; it is designed to discover information about the natural world in which human beings and other organisms live or exist and to organize this information into meaningful patterns that are beneficial and developmental to both human beings and the environment. The word science is derived from the Latin word "Scientia" meaning knowledge. Science is said to have started with the origin of man and has continued to advance as man goes through his environment in search of answers to basic questions of life. Science is an intellectual activity involving human beings.

Science is very diverse and complex and has evolved into more diverse and complex areas, functions and application. The diverse nature of science has led to the division of science into various fields: physics, biology, chemistry and mathematics which are now regarded as the foundation of science. Science is the intellectual and practical activity encompassing the systematic study of the structure and behaviour of the physical and natural world through careful observation and experiment. Science is a systematically organized body of knowledge which ensures the ability to acquire skills, it is a search for meaning, exploration and manipulation of events in nature. Science can be defined in terms of its methods, what scientist do in terms of its product that is knowledge in the form of facts, principles, attributes, laws, theories and models. It can also be defined in terms of its ethics or motives (Nwosu, 2017).

Chemistry education is a crucial field that prepares students for careers in chemistry, scientific research, and teaching. It is essential to understand the learning strategies adopted

by chemistry education students to enhance the teaching and learning process in this discipline. By investigating the strategies employed by these students, educators can identify effective instructional methods and develop targeted interventions to improve chemistry education outcomes.

Chemistry, as a subject, is known for its complexity and abstract nature, often posing challenges for students to comprehend and apply its principles. Students pursuing chemistry education face unique learning demands, including mastering theoretical concepts, understanding laboratory techniques, and applying problem-solving skills. To succeed in these areas, students need to adopt effective learning strategies that align with the nature of chemistry education.

Research in the field of learning strategies has demonstrated that students' approaches to learning significantly impact their academic performance and conceptual understanding. Learning strategies encompass a range of cognitive, metacognitive, and affective processes that students employ to acquire, process, organize, and retain information. These strategies can involve various activities such as reading, note-taking, summarizing, concept mapping, practicing problem-solving, and seeking clarification.

However, the learning strategies employed by chemistry education students have not been extensively explored in the literature. While research on learning strategies has been conducted in general education contexts, the unique characteristics and demands of chemistry education necessitate a specific focus on this field. Understanding how chemistry education students approach their learning tasks can provide valuable insights into their cognitive processes, study habits, and preferences.

By investigating the learning strategies adopted by chemistry education students, researchers can identify patterns and trends that shed light on effective approaches to learning chemistry.

It can reveal the strategies most commonly employed by students, factors influencing the choice of these strategies, and their effectiveness in facilitating learning and academic success. This knowledge can be used to inform instructional practices, curriculum development, and the design of interventions targeted at addressing specific learning challenges faced by chemistry education students.

Additionally, the exploration of learning strategies in chemistry education can contribute to the broader field of educational research. It can add to the existing literature on learning strategies by providing insights into domain-specific approaches to learning and the transferability of strategies across disciplines. Comparisons can be made between the learning strategies employed by chemistry education students and those used in other STEM fields, allowing for a better understanding of discipline-specific learning processes.

Overall, studying the learning strategies adopted by chemistry education students is of paramount importance to improve the quality of chemistry education. By uncovering effective learning strategies and factors influencing their adoption, this research can inform educational practices, curriculum design, and instructional interventions. Ultimately, it aims to enhance students' conceptual understanding, engagement, and academic achievement in the field of chemistry education.

Statement of the Problem

Chemistry education is a critical field that shapes the knowledge and skills of future chemists, scientists, and educators. The effectiveness of chemistry education programs depends not only on the quality of instruction but also on the learning strategies employed by students. Understanding the specific learning strategies adopted by chemistry education

students is essential to identify areas of improvement and optimize the teaching and learning process in this domain.

However, despite the significance of learning strategies, there is a lack of comprehensive research that specifically investigates the learning approaches utilized by chemistry education students. This knowledge gap hinders the development of targeted interventions and instructional methods tailored to meet the unique needs of these students, hence the need for this study.

Research Questions.

The following research questions were raised to guide the study.

1. What learning strategies are commonly adopted by chemistry education students in the faculty of Education, University of Benin?
2. How do learning strategies vary among students with different academic backgrounds and learning preferences?
3. What factors influence the choice and effectiveness of learning strategies in chemistry education students?

Purpose of the Study

The purpose of this study is to carry out assessment on study on the learning strategies adopted by chemistry education student. Specifically, the study intends to:

1. Assess the learning strategies commonly adopted by chemistry education students in the faculty of education

2. Identify how these strategies vary among students with different academic backgrounds and learning preferences.
3. Examine what factors influence the choice and effectiveness of learning strategies adopted by chemistry education students.

Significance of the Study

Findings from this study will serve as a compass and facilitate better learning in students for developing good learning strategies. It will help students to know different learning strategies and use them. It will help researchers or educators that want to carry out further work on the topic.

It will also contribute to the already existing bank of knowledge in this area of study. It will help or serve as a guide to anyone who comes across the work. And it will also assist teachers in placing emphasis on particular or effective learning strategies, which may be helpful to their students.

Scope and Delimitation of the Study

The study examined learning strategies adopted by Chemistry education students in the University of Benin, Benin City. The study is delimited to Education Chemistry students of the University of Benin, faculty of Education. Specifically students in 200 level to 400level will be used for the study

Definition of Terms

The following term are operationally defined and used in the study

Learning Strategies: The specific approaches, techniques, and methods used by students to acquire, process, and retain information in the context of chemistry education.

Chemistry Education Students: Individuals pursuing a formal education in chemistry, including undergraduate and graduate students enrolled in chemistry education programs.

Academic Performance: The level of achievement and success demonstrated by students in their chemistry-related coursework and assessments.

Conceptual Understanding: The depth of comprehension and grasp of fundamental concepts and principles in the field of chemistry.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter reviewed some of the available literatures that are related to this study. The study is on learning strategies that Chemistry education students of the University of Benin adopt. The review of Literature is based on the following sub-headings;

- The Concept of Science
- Relevance of Chemistry Curriculum
- Learning Strategies
- Types of Learning Strategies
- Importance of Learning Strategies
- Gender and Use of Learning Strategies
- Academic Performance and Learning Strategies
- Summary of Literature Reviewed

The Concept of Science

Webster's New Collegiate Dictionary (2015) defines Science as knowledge attained through study or practice or knowledge covering general truths of the operation of general laws especially as obtained tested through scientific method and concerned with the physical world. Ogunji in Ofuebe (2017) defines Science as a dynamic human activity concerned with the understanding of the working of our world. Science is defined as a complex human activity which culminates in the production of a body of universal statement, which serves to

explain the observable behaviour of the universe or part of it and that which is in them (Ogbonna, 2010). Ezendu (2012) defines Science as a body of knowledge, which is acquired through observation and systematic experimentation. Gottieb (2010) defines Science as an intellectual activity carried on by humans that is designed to discover information about the natural world in which humans live and to discover the ways in which this information can be organized into meaningful patterns. He also mentioned that the primary aim of science is to collect facts (data). An ultimate purpose of science is to discern the order that exists between and amongst the various facts. Okeke (2017) defines Science as a systematic process of obtaining testable and verifiable knowledge about nature and natural occurrences, utilizing careful observation and experimentation.

Importance of Science Education

The growth of any nation is a measure of its level of science education. That was why Orukotan (2007) stated that science education has introduced a lot of changes in our world today and it will continue to do so in the future. Achievement in science education will go a long way in reducing illiteracy and poverty, which are impediments to natural development (Nwachukwu,2008). Akpan (2008) opined that science contributes to the quality of life in such areas as health, nutrition, agriculture, transportation, material and energy production, and industrial development. He further stated that it ensures that the air we breathe, and the

water we drink are life sustaining, and not vector of disease and decay. Adikwu (2008) opined that for any nation to experience economic growth, there must be a strong stimulation of science. It is therefore follows that for a nation to take her rightful place technologically among the developed nations she must focus on science and technology (Akaninwor,2004). The growth of any nation is a measure of it's level of science education. Science has invaded every branch of modern life. The food we eat, the clothes we wear, the books and papers we read, the recreations we enjoy, the games we play all have something or other to do with the application of science (Pawan, 2015).

Relevance of Chemistry Curriculum

Chemistry education Curriculum has received considerable support with regard to providing meaningful learning experiences that enhance knowledge and conceptual understanding (Yager & Lutz, 2014; Leung, 2016). Integrated across disciplines is interrelated in a natural world, as compared to a program utilizing single- subject courses that narrow the learner's perspective and are less efficient in the learning process (Wolf & Brandt, 2008).

In the selection of learning experiences, for any course, it is important to know what learning experiences to select through sociological, philosophical and epistemological

analyses and another to be guided by appropriate principles or criteria in the process of such selection. These include:

1. **Relevance to life**: Learning experience must not be far-fetched or abstract. They must satisfy the principles of utility and be useful for its purpose
2. **Relevance to learner's interest**: in terms of those things that really concern them at that particular time.
3. **Relevance to the learner's level of attainment**: The selected learning experiences must not be isolated from one another; they must blend and buttress one another.
4. **Learnability**: Most students face so much pressure to succeed, that stress can undermine learning ability. So it supposed to be a special program design for them, it supposed to be fun and rewarding also.
5. **Integration**: D'Arbon (2012) in his study of the Concept of Science Subjects in Secondary School wrote that integration when applied to science courses, means that the course is devised and presented in such a way that students gain the concept of the fundamental unity of science; the commonality of approach to problems of scientific nature; and are helped to gain an understanding of the role and function of science in everyday life, and the world in which they live. Wolf and Brandt, (2008) still on curriculum integration, pointed out that one of the best ways to promote problem-

solving is through an enriched environment that makes connections among several disciplines. Educational researchers have found that an integrated curriculum can result in greater intellectual curiosity, improved attitude towards schooling, enhanced problem-solving skills, and higher achievement in college (Austin, Hirstein & Walen, 2017; Kain, 2013).

Educational Aims/Goals/Objectives (NPE 2012:7)

- The inculcation of national consciousness
- The inculcation of the right type of attitudes and values for the arrival of individual and Nigerian society.
- The training of the mind in the understanding of the world around us.
- Acquisition of appropriate skills, abilities and competences both mental and physical as equipment for the individual to live in and contribute to the development of the society.
- The inculcation of permanent literacy and numeracy and ability to communicate effectively
- Citizenship Education as a basis for effective participation in and contribution to the life of the society.

Learning Strategies

Learning Strategies implies operations followed to minimize error during decision making process and involves a conscious choice of alternatives and is dependent on the task or context. Some people think that the difference between a good student and a bad student is just a matter of aptitude. While it may be true in some cases, generally, the difference can actually be attributed to learning strategies. With effective learning strategies, students can learn faster and easier.

Schumaker and Deshler (2016) define a learning strategy as an individual approach into a task. It includes how a person thinks and acts when planning, executing and evaluating performance on a task and its outcomes. A learning strategy is an individual's way of organizing and using a particular set of skills in order to learn content or accomplish other task more effectively and efficiently in school as well as in non-academic settings (Schumaker & Deshler, 2012). According to Tay (2013) learning strategies are the total effort that the student's need to possess understand and adopt the information introduced in learning-teaching processes or in their individual preparation. In other words, learning strategies can be described as the whole of the performed activities of learner to give meaning to information in cognitive and affective processes (Kafadar, 2013a).

According to Hasabegoric (2011) “Learning strategies refers to student’s self-generated thoughts, feelings and actions which are systematically oriented towards attainment of their goals”. Therefore, implementation of appropriate learning strategies is related to student’s self-regulation behaviour which in turn should be encouraged by pedagogical designs. Learning strategies refers to methods that students use to learn. This ranges from techniques for improved memory to better studying or test-taking strategies. Some learning strategies involves changes to the design of instruction for example, the use of questions before, during or after instruction has been shown to increase the degree of learning (Ausubel, 2018). Mayer (2018) defines learning strategies as “behaviours of learner processes information”. Weinstein (2011) discusses learning strategies in the context of social interaction, an important aspect of situated learning theory as:

- Double loop learning (Argyris)
- Conversation theory (pask)
- Lateral thinking (De Bono).

Weinstein and Mayer (2016) define learning strategies broadly as “behaviours and thoughts that a learner engages in during learning” which are intended to influence the learner's encoding process”.

Types of Learning Strategies

Students need to be mentally active processors of information if learning is to occur. In this section, we will be talking about learning strategies for science. O' Malley and Chamot (2011) classified learning strategies into three major types: Metacognitive Strategies, Cognitive Strategies, and Social/Affective Strategies. Also, Jone et al (2007) identified three learning strategies for science as follows:

- Metacognitive Strategies
- Cognitive Strategies
- Social/Affective Strategies.

Here we have:

1. Metacognitive strategies, under it we have advance organization, concept mapping, selective attention, self-monitoring and organizational planning.
2. Cognitive strategies, under it we have summarizing, elaborating prior knowledge, resourcing, using image, paraphrasing and note taking.
3. Social/Affective strategies, here we have co-operative learning, self-talk, studying alone and seeking helps.

Metacognitive Strategies

Metacognitive strategy refers to higher order thinking which involves active control over the cognitive processes engaged in learning. Metacognition is “an appreciation of what

one already know, together with a correct apprehension of the learning task and what knowledge and skills it requires, combined with the ability to make correct inferences about how to apply one's strategic knowledge to a particular situation and to do so efficiently and reliably" (Peirce, 2003). Metacognition has been shown to lead to deeper, more durable and more transferable learning (Bransford, Brown & Cocking 2010).

Veenman (2014) said that to develop metacognition among students, teachers need to have tools to apply metacognition within classes, beneficial to those activities. This is to show how important meta-cognitive strategy is. Metacognition is also described as thinking about one's own thinking (Cooper & Sabndi-Urena, 2009) and "Monitoring and Controlling one's mental processing" (Rickey & Stacy, 2010).

Metacognition is the higher order thinking which involves active control over the cognitive processes engaged in learning. Metacognition plays a critical role in successful learning. Metacognition has been shown to lead deeper, more durable and more transferable learning (Bransford, Brown and Cocking, 2010). Wang et al, (2019) argued that metacognitive reading strategies have various benefits on students reading comprehension and fostering their learning activities. According to Wang, et al (2019) students who have confidence in their learning process can utilize metacognitive reading strategies such as

planning, monitoring and evaluating. They are more successful than those students that do not use this strategy in their learning or reading programme.

Advance organization - An advance organization is a cognitive instructional strategy used to promote the learning and retention of new information. “An advance organizer is information that is presented prior to learning to organize and interpret new incoming information” (Mayer, 2013). “An advance organization is not an overview, but rather a presentation of information (either verbal or visual) that are “umbrellas” for the new material to be learned”.

Concept mapping - Concept mapping serves several purposes for learners:

- It helps students brainstorm and generate new ideas.
- It encourages students to discover new concepts and the preposition that connect them.
- It allows students to more clearly communicate ideas, thoughts and information.
- It helps students to integrate new concepts with older concepts.
- It enables students to gain enhanced knowledge of any topic and evaluate the information.

This is why Hibberd, Jones and Morris (2012) and Derbentseva, Safayeni and Canas (2014) explained that the heuristic of concept mapping a kind of a metacognitive strategy which assists learners in understanding concepts and relationships between them, and in

seeing the hierarchical, conceptual, propositional nature of knowledge. The proponents of the concept mapping strategy posit that meaningful learning ensues when a learner is aware of and can control, the cognitive processes associated with learning. Indeed, some research on concept mapping seems to demonstrate that meaningful learning results from its use in science and mathematics classrooms (Okebukola & Jegede, 2010; Markow & Lonning 2010; Alaiyemola & Okebukola 2012).

Selective attention - Selective attention talks about the most important information to pay attention to or concentrate on, while reading or studying. Our attention can also focus on one thing at a time. People who are proficient at mediation practices require intense focus on a single item for long periods of time. According to Gagne and Driscoll (2018), self-learning student can adopt a few attention strategies depending on targeted learning.

Self-monitoring - Studies about how people learn have shown that when you pay attention to what and how well you are learning, it improves your learning. Remembering and applying new knowledge and skills become easier when you keep an eye on you progress while learning something. Self-monitoring include forming learning targets for educational activities of students, assessing to what extent these targets occurred and changing these strategies conditionally to achieve objective (Weinstein & Mayer, 2016). Self-monitoring strategy was developed via social cognitive behaviour theory and it involves

individual's recording their own practices or their own behaviour systematically in order to improve practice (Oliver, 2015).

The self-monitoring strategy has also been defined as a secondary strategy to utilize in order to prevent inappropriate behaviour by training independently so they can decide if they are engaging in a target behavioural and social skills are being developed (Bell et al, 2013). The implementation of self-monitoring strategy has been recommended in different studies to improve academic and behavioural performance in students, especially for those who have special needs (Joseph & Eveleigh 2011). Boswell (2013) reported that the self-monitoring strategy is an effective strategy to use with students who have disabilities. Self-monitoring is very important to all students. To sum up, self-monitoring involves thinking and asking questions about how well you are learning something and making any necessary changes to your learning practices in order to optimize your learning.

Organizational planning - Organizational planning talks about the necessary steps one need to follow, it also involves imposing structure on the material by dividing it into parts and identifying super-ordinate - subordinate relationships. In simple rote learning, organizational strategy involves breaking lists into chunks. Organizational strategy for complex meaningful learning includes outlining the text, creating a hierarchy of network of

concepts. This strategy consists of issues grouping and organizing, creating hierarchies and a conceptual plan (Cohen & Macaro, 2017).

Cognitive Strategies

Schleifer and Dull (2019) believe that Cognitive Strategies relate to the methods which directly act on learning subjects and prepare the tendency to increase information acquiring, understanding and interpreting. Cognitive processes reinforce thought processes and help to access cognitive purpose such as comprehension and memorizing. Cognitive strategies are presented as practical strategies, semantic extension and organization and help to save and restore information (Pintrich, 2014). Cognitive strategies are reminders, which relate new information to the past learned one (Duke & Pearson, 2012). According to Hatti and Timperly (2017), learning strategies (Cognitive and Meta-cognitive) have the most influence on learning.

The learning strategies application has the most effect on facilitating learning, remembering and reminding process in which cognitive strategies have the most influence on student's learning and increase their self-instruction skills, independence and learning abilities (Yang, 2015). Cognitive strategies are methods through which learners direct their learning and thought. Learners use cognitive strategies to control their attention, help to code new information in their memory and remember it in the needed time (Hoffman & Spatariu,

2018). Cognitive strategies or skills are covert and overt thoughts and behaviours which are related to learning success and can be changed through educational intervention. Also these strategies are defined as cognitive, emotional or behavioural activity which facilitate saving and retrieval processes and using knowledge or learned points (Dignath, 2008).

One of the reasons in student's disability in the educational process is related to weak awareness and use of cognitive strategies. In recent years, information processing theory, learning is facilitated through using cognitive strategies and students with learning problems can overcome their difficulties (Sheri, 2008). Cognitive learning strategies are strategies which improve learner's academic functioning through facilitating learning processes (Scruggs & Mastropieri, 2013). Cognitive strategies are instruments which help student learning. Therefore, the strategies can help students to be more successful learners in solving their educational problems and play an active role in their academic performance (Graham & Harris, 2013).

Summarization - in summarization, students read a section of prose (typically a paragraph) and then writes a sentence that describes what that prose was about. Research has demonstrated that summarization can improve memory for prose by about 33% (Perin, 2012), Graham and Hebert (2010) talks about the importance of summary.

Note taking - Note taking helps students to remember lectures. This is very important for studies have shown that forgetting begins almost immediately. Within two weeks you will forget 80% or more of what you have heard. In four weeks, you will be fortunate if 5% remains (Langan, 2011). Kiewra (2009) concluded that students who take more notes learn and remember classroom subject matter better. Note taking is an effective information-processing tool that is commonly used both in daily life and in many professions (Hartley, 2012).

Affective or Social Strategy

To Oxford (2010), affective strategies consist of lowering one's anxiety, encouraging oneself, and taking one's emotional temperature whereas social strategies deal with asking questions, cooperating with others, and empathizing with others. Affective or social strategy helps in establishing and maintaining motivation, focusing attention, maintaining concentration, managing performance, anxiety and managing time effectively.

Affective strategies strongly consider the student's relation to society as a whole ranging from family to the global community. Among these strategies, socio/affective strategies are considered as the most essential ones in developing learner's skills (Anderson, 2011). On the other hand, learners who have developed their social/affective strategies are likely to become more successful learners (Hauck, 2015). Andres (2012) argues that “if we

want our students to develop their inherent potential to learn, the affective variables such as anxiety, motivation, self-esteem and inhibition and the inner needs of the learners can no longer be neglected". Goh (2012) emphasizes the importance of socio/affective strategies by arguing that learner's socio/affective strategy is related to effective learning in all learning contexts.

As Luo-xiang (2015) concludes, more discussion is needed to increase learners' socio/affective strategies in reading. According to Habte-Gabr (2006) socio-affective strategies are those which are non-academic in nature and involve stimulating learning through establishing a level of empathy between the instructor and student. They include considering factors such as emotions and attitudes (Oxford, 2010). Social strategies (e.g. asking questions to get verification, asking for clarification of a confusing point, asking for help in doing task and exploring cultural and social norms) help the learner work with others and understand the target culture.

Co-operative learning - Anaekwe (2016) and Akinsete (2016) found out that co-operative learning strategy is better than lecture method in promoting positive attitude. Analyse of co-operative learning's effect on critical thinking, self-esteem, racial/ethics relations and pro social behaviour, have consistently demonstrated that

Co-operative learning is superior to more traditional forms of instruction and rarely has detrimental effect on student outcomes (Cooper et' al, 1994).

Research also shows that co-operative learning strategy leads to academic achievement, higher level thinking skills, interest in subject matter, likelihood of attending class, time on task, ability to diagnose own knowledge of subject matter, amount of class morale and rapport with the teacher, frequency and quality of student-student interactions and frequency and quality of student-teacher interactions (Cooper & Mueck, 2019).

Problem solving - Problem solving helps in understanding the problem. Polya (2017) identified four phases of problem solving as:

1. Understanding the problem
2. Devising a plan
3. Carrying out the plan
4. Looking back checking out the result.

It was noted, that the process of solving one problem or the solution of that problem often creates a solution to some other problems

Elaboration strategy - Elaboration strategy helps the student in making connections between the new and the familiar. For rote learning, elaboration strategy helps in forming mental images to associate with the material; it also helps in generating sentences that relates

to the items to be learned to more familiar items or using mnemonic devices like the keyword method.

Importance of Learning Strategies

Ignacio (2016), strategies encourage independent learning. Strategy use helps students to become more efficient and more effective learners. Learning strategies are particularly important for helping students to bypass their areas of weakness and to rely on their areas of competence. Strategies play an important role as they promote and facilitate language learning', and act as 'problem solving mechanisms' that aid the complex learning processes (Ignacio, 2016).

Wenden (2017) states that “learning strategies are the various operations that learners use in order to make sense in their learning”. Likewise, Williams & Burden (2017) say that when learners are involved in a learning task, they have several resources which they use in different ways to finish or solve the task; allowing students to reflect on their own learning process to be aware of what criteria influence their learning is important. Ignacio (2016) states further that students need to learn how to apply strategies according to what actually works for them.

Time management - Time is a priceless resource and continues to pass by without coming back. Time management is the act of planning and exercising conscious control over

the amount of time spent on specific activities, especially to increase effectiveness, efficiency or productivity (Wikipedia, 2014). For those who cannot perform the necessities of time management effectively in their private lives, it will result in failure and unhappiness (Mercanlioglu, 2010; Shellenbarger, 2009).

Nehru (2012), time management is a process by which an individual manages use of time available to him/her. Time can be managed by keeping record of all activities throughout the day. If a student is able to manage his time properly, he can be successful in his studies as well as in extra-curricular activities. It is of immense importance to plan the time of study, as time schedule helps to adjust the study periods and other activities according to individual's needs. It helps the learner to carry their day-to-day activities effectively which results in achieving their goals easily.

The overall process of time management is composed of three major functions:

i) Planning
ii) Organization
iii) Controlling

The following aspects play important role in time management:

- Proper planning is very essential to get success. Failing to plan is planning to fail.
- Accurate implementation of the plan.
- Prioritizing of task.
- Setting of achievable deadline to complete task.

- Avoiding procrastination; procrastination is a big hurdle in time management. It may give undue stress. Proper planning and organizing helps to minimize worry and indecision that may arise in case of any extra work.

Acronyms - Acronyms are useful when a small number of grouped items need to be remembered. Acronyms work for two reasons. First, it helps in reducing a large amount of information. Second, and more importantly, it helps in imposing an organization on information that enhances retrieval of information.

Self-assessment - Self-assessment is the practice of testing yourself to see how well you are learning the material you are studying. Self-assessment may also help students to become realistic judges of their own performance, by enabling them to monitor their own learning, rather than relying on their teachers for feedback (Crip, 2017; Sambell, McDowell & Sambell, 2016).students ability to self-assess can provide valuable clues to the teacher about how deeply they have understood the tasks and this information can improve teaching and learning (Montgomery, 2010).

Research conducted by Tan (2017) involving interviews of academics across 12 discipline areas in three Universities in Australia identified three progressive conceptions of self-assessment teacher driven, programme driven and future driven self-assessment. The future driven conception of self-assessment seeks to help students to develop skills to construct assessment criteria, negotiate against external standards and make judgements

using those criteria. According to Tan (2009) only this future driven assessment helps students to sustain their self-assessment capacity independent of the teacher in future contexts because it permits greater reflection by forcing students to look beyond the academic and the programme of study when judging what and how well they have learned. This seems to provide students with more scope to reflect critically on their learning as well as their assessment practices. Self-Assessment helps students to learn in two ways first, the mere act of going through the materials and creating questions or other assessments is for them to help them learn the content. Second, of course, students learn by taking the assessment and getting immediate feedback about their performance. The faster the feedback, the more effective it is for learning.

Note-taking - In general, students who take more notes learn and remember classroom subject matter better (Kiewra 2017). However, the quality of the notes is equally important. Useful notes typically reflect the main ideas of a lesson or reading assignment (Brown, Campione & Day, 2011: Brobst, Graham & Shaw, 2013). Note-taking implies comprehending either a writing document or a lecture and recording information by writing it down (Piolat, Annie, Olive, Thierry & Kellogg, Ronald, 2015).

According to Castello and Monereo (2015), note-taking is the hegemonic study activity at university and, in many cases, the main ground for education interaction between

teacher and students. Note taking is recognized as a critical activity which enhances learning in learning contexts. Notes are essential for recalling what has been heard or seen, and can promote reflection after wards (Nguyen, 2016). According to Allen and Reeson (2008) note taking is one of the strategies students can cultivate to increase academic achievement. Two potential benefits of Note-taking are encoding and artefacts. The encoding hypothesis is the idea that the act of Note-taking facilitates learning. The external artefact hypothesis states that having notes for review facilitates learning: notes aid students most when they can be reviewed (Baur & Koedinger, 2014).

Gender and Use of Learning Strategies

Gender is the condition of being a female or male. Combating gender imbalance in all sphere of the society and especially in the education is a long term challenge. It involves structural, psychological, sociological gender stereo type changes and a redefinition of genders roles. Serigeour (2013) found out that girls prefers Co-operation, open- ended and organized activities while boys prefer competition and individualism. Okeke, 2016; Obande, (2013) submitted that as females and male grows, their difference in achievement in Chemistry tends to diminish. Studies that have reported about the under achievement of females in sciences include Lie (2014); Keller (2011); Walding and Richard (2014); Abubakar and Ihiegbulem (2010) and Abubakar and Eze (2010) have reported that females

performed better than male students in Mathematics at the Federal College of Education (Technical), Omoku, Rivers State in the 2007/2008 academic session. FEBS- WISE (2008) advocated that women are as academically active as men but do not make it to the top in numbers that reflect their abilities and contribution to science. Bembenutty (2017) investigated gender difference in academic achievement and learner's use of self-regulation of learning and suggested that males had lower rehearsal scores than females. It was also reported that male students had less frequent use of organizational strategies than female.

Academic Performance and Learning Strategies

It is well- documented that learning and study strategies used by students (including distance-learning students and college students with learning disabilities) is one of the many important variables in predicting their respective academic performance (Akyol, Sungur, & Tekkaya, 2010; Caballos and Esteban, 2018; Diseth & Martinsen, 2013; Erdamar, (2011) found that the variable of time management was a good predictor for academic performance of students. Good self-regulated learners understand how to manage and use their time efficiently in order to complete assignments and set learning schedule in a sensible way. They prioritise different learning tasks and self-evaluate the difficulty of different learning tasks with respects to the time required to complete them. They are also aware of the need to evaluate how their study time is spent on each task and then to reprioritize if necessary

(Zimmerman & Risemberg, 2017). Similarly, self-assessment strategy is one variable confirmed to be critical in affecting students' academic performance to a certain extent (Husman, Wadsworth, Duggan & Pennington, 2017).

Summary of Literature Reviewed

Ogunji in Ofuebe (2017), defines Science as a dynamic human activity concerned with the understanding of the working of our world. There are numerous importance of science and science education. The growth of any nation is a measure of its level of science education. It is agreed that countries that are scientifically and technologically vast and buoyant have transformed and modified their economic system into a sustainable economic standard.

Learning is concerned with positive change in behaviour as a result of teaching experience (Yoloye, 2014). Learning strategies are the thoughts and actions that students use to complete learning tasks. Learning strategies, however, are tools that students themselves can employ independently to complete a task. Jone (2017) identified three learning strategies for science as follows;

1. Metacognitive strategies
2. Cognitive strategies and
3. Affective or Social strategies.

Under these learning strategies stated by Jone (2017), we have learning strategies such as Co-operative learning, Note taking, Organizational planning etc. All these learning strategies serve as an effective tool to promote learning and increase academic performance of students.

CHAPTER THREE

METHODOLOGY

This chapter is mainly concerned with the research methodology. The following sub-heading was considered:

- Research Design
- Population of the Study
- Sample and Sampling Techniques
- Research Instrument
- Validity of the Instrument
- Method of Data Collection
- Method of Data Analysis

Research Design

The descriptive survey design will be used to carry out the research. Surveys, simply defined, are series of questions used to gain information (Ary, Jacobs and Razavieh, 2011). This research will be from cross sectional model because data will be collected at once from Chemistry education students of the Faculty of Education, University of Benin, Benin City.

Population of the Study

For this study, the population will consist of all 200, 300 and 400 levels Chemistry education students of the Faculty of Education, University of Benin, Benin City.

Sample and Sampling Techniques

A sample of eighty (80) students in 200 - 400 levels in Chemistry education, of the Faculty of Education, University of Benin will take part in the study. Stratified and random sampling techniques will be adopted.

Research Instrument

The instrument for the study will be a structured questionnaire used to elicit information from respondents. The questionnaire comprises of two sections A and B. Section A contains information about the student's demographic data, while section B contains items related to the research questions.

Validity of the Instrument

In order to establish the validity of the instrument, the researcher presented the questionnaire to the project supervisor and two other professional researchers from the Department of Curriculum and Instructional Technology, Faculty of Education, University of Benin for screening before administering the instrument on the respondents. Necessary corrections and suggestions were taken into consideration in producing the final draft of the questionnaire.

Method of Data Collection

The researcher will personally administer the questionnaire to Chemistry education students in 200, 300 and 400 levels in the Faculty of Education. The purpose of the exercise will be explained to the respondents and the need for their honest response. The researcher will also collect the questionnaire from the respondents after they have given their responses on the spot to guide against loss.

Method of Data Analysis

The data will be collected and analyzed using frequency count and simple percentage.

CHAPTER FOUR

PRESENTATION OF RESULT AND DISCUSSION OF FINDINGS

The purpose of this chapter is to report, illustrate and discussed the findings of the research.

Presentation of Results

Table 1: Demographic Data for the Students

SEX	FREQUENCY	PERCENTAGE (%)
FEMALE	33	41.25
MALE	47	58.75
TOTAL	**80**	**100%**

Source: Researcher's fieldwork, 2023

Answering of Research Questions

Research Statement: When studying I do the following activities:

Table 2: Activities carried out by students when studying

S/N	ITEM	Every time	Most of the time	Seldom	Never	TOTAL %
1.	I study in group	6 **(7.5%)**	37 **(46.25%)**	31 **(38.75%)**	6 **(7.5%)**	100
2.	I like taking note during class	18 **(22.5%)**	49 **(61.25%)**	13 **(16.25%)**	Null **(0%)**	100
3.	I prefer listening in class alone	17 **(21.25%)**	33 **(41.25%)**	26 **(32.5%)**	4 **(5%)**	100
4.	I like to mark out difficult words and later find out the meaning	26 **(32.5%)**	45 **(56.25%)**	9 **(11.25%)**	Null **(0%)**	100
5.	I summarize whenever I read	49 **(61.25%)**	27 **(33.75%)**	4 **(5%)**	Null **(0%)**	100
6.	I quiz myself after each study	46 **(57.5%)**	25 **(31.25%)**	9 **(11.25%)**	Null **(0%)**	100
7.	I take practice test before exam	54 **(67.5%)**	14 **(17.5%)**	10 **(12.5%)**	2 **(2.5%)**	100
8.	Each time I am studying I use past questions for practice	54 **(67.5%)**	20 **(25%)**	6 **(7.5%)**	Null **(0%)**	100

9.	I like underlining important points while reading, because it helps me to concentrate more next time while reading	40 **(50%)**	30 **(37.5%)**	10 **(12.5%)**	Null **(0%)**	100
10.	I like visiting library because I find all the materials, I am looking for there	6 **(7.5%)**	25 **(31.25%)**	32 **(40%)**	17 **(21.25%)**	100
11.	I like reading online	12 **(15%)**	35 **(43.75%)**	30 **(37.5%)**	3 **(3.75%)**	100
12.	I normally ask for help from my fellow students if I do not understand a particular course	20 **(25%)**	33 **(41.25%)**	25 **(31.25%)**	2 **(2.5%)**	100
13.	I use images to represent ideas	15 **(18.75%)**	27 **(33.75%)**	34 **(42.5%)**	4 **(5%)**	100
14.	I use my own words to simplify complex concepts	40 **(50%)**	34 **(42.5%)**	5 **(6.25%)**	1 **(1.25%)**	100
15.	At the beginning of my study period. I usually plan my work so that I can make the best use of my time	36 **(45%)**	31 **(38.75%)**	11 **(13.75%)**	2 **(2.5%)**	100
16.	I usually re-read materials several times for a better understanding	47 **(58.75%)**	28 **(35%)**	3 **(3.75%)**	2 **(2.5%)**	100
17.	When reading my notes or textbooks, I normally stop now and then to remember what I have read	40 **(50%)**	32 **(40%)**	8 **(10%)**	Null **(0%)**	100
18.	Each time I am absent from class I usually make up my missed lessons and note immediately am back	33 **(41.25%)**	27 **(33.75%)**	13 **(16.25)**	7 **(8.75%)**	100
19.	I read few weeks to exam, because that is when I usually concentrate more	38 **(47.5%)**	24 **(30%)**	10 **(12.5%)**	8 **(10%)**	100
20.	I go for tutorial when I don't understand class work very well	24 **(30%)**	38 **(47.5%)**	10 **(12.5%)**	8 **(10%)**	100

Researcher Fieldwork 2023

Table 2 above shows the various activities carried out by students when studying. 31(38.75%) seldomly study in groups, 37(46.25%) of the respondents never study in groups, while 6(7.5%) of the respondents' study in groups every time and 37(46.25%) of the respondent's study in groups most of the time. On the other hand, 13(16.25%) likes taking notes during class seldomly, but 18 respondents representing (22.5%) takes notes during class every time and 49(61.25%) takes notes during class most of the time. Seeking opinion of the respondents on whether they prefer listening in class alone, 17 of the respondents representing 21.25% chose every time, 33 respondents representing 41.25% chose most of the time, while 26(32.5%) chose seldom, none of the respondents chose never. On the opinion of marking out difficult words and later finding out the meaning, 9 of the respondents representing 11.25% chose seldom, 4 respondents representing 5% chose never, while 26(32.5%) chose every time and 45(56.25%) chose most of the time. 4 respondents representing 5% seldomly summarize whenever they read, 49(6125%) summarize whenever they read every time, while 27(33.75%) summarize whenever they read most of the time.

The responses of 46 of the respondents representing 57.5% showed that they quiz themselves every time after each study, 25(31.25%) of the respondents quiz themselves after each study most of the time, while 9(11.25%) of the respondents seldomly quiz themselves after each

study. 4%). Similarly, 54 respondents representing 67.5% take practice test before exam every time, 14(17.5%) take practice test before exam most of the time, while 10(11.25%) seldomly take practice test before exam, and 2(2.5) of the respondents never take practice text before exam, 54 of the respondent representing 67.5% claimed that each time they are studying they use past questions for practice every day, 20 representing 25% established that each time they are studying I use past questions for practice, while 6(7.5%) of the respondents seldomly use past questions for practice each time they study. Correspondingly, 40 of the respondents representing 50% affirmed that every time they like underlining important points while reading, because it helps them to concentrate more next time while reading, 30 representing 37.5% most of the time underline important points while reading, because it helps them to concentrate more next time while reading, while 10(12.5%) seldomly underline important points while reading, because it helps them to concentrate more next time while reading. 6 of the respondents representing (7.5%) every time likes visiting library because they find all the materials, they are looking for there, 25(31.25%) of the respondents most of the time likes visiting library because they find all the materials, they are looking for there, while 32 of the respondents representing (40%) seldomly visits the library, 17(21.25%) never visits the library. The table above revealed that 12(15%) of the respondents like reading online every time, 35(43.75%) of the respondents like reading online most of the

time, while 30 of the respondents representing 37.5% seldomly like reading online and 3(3.75%) of the respondents never like reading online. 20 respondents representing 25% normally ask for help from their fellow students if they do not understand a particular course every time, 33(41.25%) revealed that they normally ask for help from their fellow students if they do not understand a particular course most of the time, while 25(31.25%) seldomly ask for help from their fellow students if they do not understand a particular course, 2(2.5) never ask for help from their fellow students if they do not understand a particular course. Similarly, 15(18.75%) of the respondents use images to represent ideas every time, 27 of the respondents representing (33.75%) use images to represent ideas most of the time, while 34 representing (42.5%) seldomly use images to represent ideas, 4(5%) of the respondents never use images to represent ideas. 40 respondents representing 50% uses their own words to simplify complex concepts every time, 34(42.5%) uses their own words to simplify complex concepts most of the time, while 5(6.25%) seldomly uses their own words to simplify complex concepts and 1(1.25%) never uses their own words to simplify complex concepts. The respondents affirmed that at the beginning of their study period, they usually plan their work so that they can make the best use of their time, as 36 of the respondents representing (45%) chose every time, 31(38.75%) chose most of the time, while 11 of the respondents representing (13.75%) chose seldom and 2(2.5%) chose never. The table reveals that

47(58.75%) of the respondents usually re-read materials several times for a better understanding every time, 28(35%) usually re-read materials several times for a better understanding most of the time while 3 of the respondents representing 3.75% seldomly re-read materials several times for a better understanding and 2(2.5%) never re-read materials several times for a better understanding. Similarly, 40 respondents representing 50% affirmed that when reading notes or textbooks, they normally stop now and then to remember what they had read every time, 32(40%) affirmed that when reading notes or textbooks, they normally stop now and then to remember what they had read most of the time, 8(10%) of the respondents seldomly stops now and then to remember what they had read when reading notes or textbooks. 33 respondents representing 41.25% agreed that each time they are absent from class they usually make up their missed lessons and note immediately they are back every time, 27(33.75%) agreed that most of the time when they are absent from class, they usually make up their missed lessons and note immediately they are back, 13(16.25%) seldomly make up their missed lessons and note each time they are absent from class, while 7(8.75%) never make up their missed lessons and note each time they are absent from class. The respondents affirmed that they read few weeks to exam, because that is when they usually concentrate more. This was evidenced by the respondents' opinion which showed that

38 of the respondents representing (47.5%) chose every time, 24 representing (30%) chose most of the time, while 10(12.5%) chose seldom and 8(10%) chose never.

Finally, 24(30%) of the respondents go for tutorial when they don't understand class work very well every time, 38 of the respondents representing (47.5%) go for tutorial when they don't understand class work very well most of the time, 10(12.5%) seldomly go for tutorial when they don't understand class work very well, while 8 of the respondents representing (10%) never go for tutorial when they don't understand class work very well.

In the research statement, the various activities carried out by students when studying. Based on the result in the table, the study therefore concludes that majority of the students have different activities they carry out to boost their study habits and to achieve academic excellence.

Discussions of Findings

The result of this study has been quite instructive, informative and revealing. Based on the analysis of data or information collected from the opinion of the respondents on: the learning strategies adopted by chemistry education students.

Some of the findings gotten from the study were:

Reading and Note-taking: The research findings revealed that reading is a fundamental activity, enabling chemistry students to absorb information from textbooks, articles, or digital

resources. Accompanying this, note-taking helps organize and retain essential concepts. Students often highlight key points, jot down summaries, or create mind maps to aid comprehension and future revision. According to Castello and Monereo (2015), note taking is a hegemonic study activity at the University and in many cases, the main ground for education interaction between teacher and students.

Active Engagement in Classes: The research findings highlight that active participation in lectures and discussions promotes comprehension and retention of information. Chemistry students often ask questions, contribute to discussions, and engage in collaborative learning, fostering a deeper understanding of the subject matter.

Self-Quizzing and Testing: The study indicates that self-quizzing involves evaluating one's knowledge and understanding by attempting practice questions or flashcards. Testing, whether formal or informal, helps in gauging student's progress and identifying areas that require further review, reinforcing memory and understanding.

Utilization of Technology: The research findings emphasize the Importance of technology. With the proliferation of digital tools and platforms, students incorporate technology into their study routines. This includes accessing online resources, using

educational apps, watching instructional videos, and participating in virtual study groups, enhancing engagement and facilitating interactive learning.

Group Study and Peer Teaching: The research findings also highlights the importance of group study. Collaborative study sessions involve group discussions and teaching concepts to peers. This technique encourages active engagement with the material, fosters different perspectives, and often reinforces comprehension through explaining concepts to others.

Time Management and Planning: The research findings revealed that effective time management is critical for successful studying. Chemistry education students allocate dedicated time slots for each subject, break down tasks into manageable chunks, and create study schedules. Planning allows for a balanced approach to academic responsibilities, reducing stress and enhancing productivity.

Critical Thinking and Problem Solving: The study indicates that students engage in analyzing and evaluating information critically. This involves interpreting data, identifying patterns, and developing solutions to problems. Encouraging critical thinking skills enables students to apply knowledge in practical situations.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The purpose of this research was designed to carry out an assessment on study on the learning strategies adopted by chemistry education students. 80 students from the department of Curriculum and Instructional Technology, University of Benin were used as a sample size for this study. The researcher made effort in assessing the learning strategies commonly adopted by chemistry education students, identifying how these strategies vary among students with different academic backgrounds and learning preferences and examining what factors influence the choice and effectiveness of learning strategies in chemistry education. All of which have been discussed in details under the review of literature.

The collection of data was carried out through the administration of questionnaire to eighty (80) students from which will be drawn from 200-400 level of the Department of Curriculum and Instructional Technology. The data were interpreted and discussed using percentages and frequency table. The sampling technique used for the research is the stratified random.

Conclusion

Following the analysis of the data collected and findings were made: Effective utilization of visual aids, such as molecular models and diagrams, proves to be a common learning strategy among chemistry education students, aiding in visualization and conceptualization of abstract theories. Peer teaching and tutoring are prevalent learning strategies, enabling chemistry education students to reinforce their comprehension by explaining concepts to fellow students and engaging in interactive learning sessions. Problem-solving exercises and practice quizzes are widely embraced learning strategies, empowering chemistry education students to develop critical thinking skills and effectively apply theoretical knowledge to solve real-world chemical problems. Integrating technology, including educational apps, online tutorials and interactive simulations is a growing trend among chemistry education students, offering them a dynamic and engaging platform for self-paced learning.

Recommendations

Based on the conclusion of the study, the following recommendations are made;

1. Education institutions and Departments should advocate for a blend of learning strategies, including hands on experimentation, group discussions, visual aids and interactive technology to cater to different learning styles and enhance comprehension.

2. Faculty officers and instructors should emphasize the importance of group study sessions, peer teaching and collaborative projects, fostering a conducive environment for chemistry education students to share knowledge and learn from one other.
3. Chemistry education lecturers should play a vital role in incorporating diverse learning approaches, utilizing technology and encouraging interactive learning methods. They should align their teaching strategies with students learning methods.
4. And finally, School managements should provide guidance on time management techniques, setting achievable study goals and creating structured schedules to help chemistry education students prioritize their studies and maximize their learning potentials.

Suggestion for further studies

This study investigated the learning strategies adopted by chemistry education students, using 200 respondents. The future researcher may repeat this study by using larger population such as more than one local government area.

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APPENDIX

DEPARTMENT OF CURRICULUM AND INSTRUCTIONAL TECHNOLOGY, FACULTY OF EDUCATION UNIVERSITY OF BENIN

QUESTIONNAIRE ON STUDY OF LEARNING STRATEGIES CHEMISTRY EDUCATION STUDENTS ADOPT IN UNIVERSITY OF BENIN

Dear Students,

The purpose of this questionnaire is to enable the researcher carryout effective study on learning strategies that Chemistry education student adopt in the University of Benin. You are kindly requested to complete the questionnaire as sincerely and objective as possible. Your responses will be treated confidentially.

Thanks for your anticipated cooperation.

Yours faithfully,

Adesuwa Blessing Igbinosa

Instruction: the questionnaire will be used for this study alone please endeavor to fill accurately by ticking (✓) to identify your response.

Section A

Sex: Male [ ]; Female [ ]

Level: 200 [ ]; 300 [ ]; 400 [ ]

Section B: Items

S/N	When studying I do the following activities	Every time	Most of the time	Seldom	Never
1.	I study in group				
2.	I like taking note during class				
3.	I prefer listening in class alone				
4.	I like to mark out difficulty words and later find out the meaning				
5.	I summarize whenever I read				
6.	I quiz myself after each study				
7.	I take practice test before exam				
8.	Each time I am studying I use past question for practice				
9.	I like underling important points while reading, because it helps me to concentrate more next time while reading				
10.	I like visiting library because I find all the materials I am looking for there				

11.	I like reading online				
12.	I normally ask for help from my fellow students if I do not understand a particular course				
13.	I use images to represent ideas				
14.	I use my own words to simplify complex concepts				
15.	At the beginning of my study period, I usually plan my work so that I can make the best use of my time				
16.	I usually re-read materials several times for a better understanding				
17.	When reading my notes or textbooks I normally stop now and then to remember what I have read				
18.	Each time I am absent from class I usually make up my missed lessons and note immediately am I back				
19.	I read few weeks to exam, because that is when I usually concentrate more				
20.	I go for tutorial when I don't understand class work very well				