

CHEMISTRY PRIVATE TUTORING IN MALAYSIA

LOW SUAN EE

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DEDICATION

This project report is dedicated to my parents who provides me with continuous encouragement to achieve the best I can. The completion of project report is the result of their endless consultation and support throughout my journey.

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ABSTRACT

The unsatisfactory result obtained by Malaysian secondary students in international assessment has caused the Ministry of Education to put much effort in structuring the curriculum. Variety of teaching pedagogies has been suggested but not all the approaches are applicable in the formal education classroom with many constraints. It leads students to enrol in extra private tutoring classes after their regular school hours and believes that it helps them to gain more exceptional learning experiences and to improve their results academically. While most research on private tutoring focuses on finding the reason for enrolling in a tuition class, it often loses sight of the exploration of pedagogies being used in helping students to cater their learning needs. Hence this research aimed 1. To identify the reason why students attend Chemistry private tutoring, 2. To explore the teaching pedagogies used in Chemistry private tutoring, and 3. To identify the perceptions of students on the pedagogies used in Chemistry private tutoring. This research is an exploratory qualitative study to identify the needs of tutoring, to explore the teaching pedagogies used and its perception in Chemistry private tutoring, among 4 tutor and 5 students who teach or receive tuition in a registered tuition centre in Malaysia. The result was analysed through thematic analysis. Interestingly, the study has indicated that despite improving their academic results, students attend tuition to enhance their understanding and knowledge of Chemistry as they were exposed to a variety of teaching methods by their tutor. A new insight on pedagogies used in private tutoring lessons were also being determined, for instance inductive learning, inquiry-based teaching and contextualisation. In conclusion, it is found out that students' learning needs are highly emphasized in tuition class. Tutor tailor their lesson based on students' needs, meanwhile tutoring lesson would also complement the regular lesson by providing more exposure on experiment and practice. Students experience a more meaningful learning and obtain interesting learning experience in tuition, driving them further to their learning goals and promotes lifelong learning.

ABSTRAK

Pencapaian yang tidak memuaskan diperoleh oleh pelajar Malaysia dalam penilaian antarabangsa telah menyebabkan Kementerian Pendidikan berusaha untuk menyusun semula kurikulum. Pelbagai pedagogi telah dicadangkan tetapi tidak semua pendekatan dapat dilaksanakan. Ini mendorong pelajar untuk mendaftar di kelas tuisyen tambahan selepas waktu persekolahan biasa dan meyakini bahawa ia membantu mereka memperoleh pengalaman pembelajaran yang berupaya meningkatkan keputusan akademik. Walaupun telah banyak penyelidikan dilaksanakan tentang tuisyen, kajian terhadap penerokaan pedagogi di pusat tuisyen masih kurang dilaksanakan. Oleh itu, penyelidikan ini bertujuan 1. Untuk mengenal pasti tujuan pelajar mengikuti kelas tuisyen tambahan Kimia, 2. Untuk meneroka pedagogi pengajaran yang digunakan dalam kelas bimbingan swasta Kimia, dan 3. Untuk mengenal pasti persepsi pelajar terhadap pedagogi yang digunakan dalam pengajaran kelas bimbingan Kimia. Penyelidikan ini menggunakan pendekatan kajian kualitatif bagi mengenal pasti tujuan pelajar mengikuti kelas tuisyen tambahan, meneroka pedagogi pengajaran yang digunakan dan persepsi pengajaran tuisyen dalam kalangan 4 tutor yang mengajar dan 5 pelajar di pusat tuisyen berdaftar di Malaysia. Hasilnya dianalisis menerusi teknik analisis tematik. Dapatan menunjukkan selain daripada meningkatkan hasil pencapaian mereka, pelajar mengikuti tuisyen untuk meningkatkan pemahaman dan pengetahuan mengenai Kimia kerana mereka mendapat pendedahan pelbagai kaedah pengajaran oleh tutor mereka. Pedagogi yang digunakan di pusat tuisyen juga ditentukan, misalnya pembelajaran induktif, pengajaran berdasarkan pertanyaan dan kontekstual. Sebagai kesimpulan, didapati bahawa keperluan pembelajaran pelajar sangat dititikberatkan di kelas tuisyen. Tutor menyesuaikan pengajaran mereka berdasarkan keperluan pelajar, sementara itu pengajaran di tuisyen juga akan melengkapkan proses pembelajaran pelajar di sekolah dengan memberi lebih banyak pendedahan mengenai eksperimen dan latihan. Pelajar mengalami proses pembelajaran yang lebih bermakna dan memperoleh pengalaman belajar yang menarik dalam tuisyen. Hal ini secara tidak langsung mendorong pelajar untuk belajar dengan bersungguh-sungguh dan mempromosikan pembelajaran sepanjang hayat.

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LIST OF ABBREVIATIONS

STEM	-	Science, Technology, Engineering and Mathematics
MOE	-	Ministry of Education
TIMSS	-	Trends in International Mathematics and Science Study
PISA	-	Programme of International Students Assessment
HOTS	-	Higher Order Thinking Skills
KSSM	-	Kurikulum Standard Sekolah Menengah
SPM	-	Sijil Pelajaran Malaysia
PBL	-	Problem-Based Learning

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CHAPTER 1

INTRODUCTION

1.1 Overview

The advancement of global science education has brought a greater emphasis on STEM (Science, Technology, Engineering and Mathematics) to combat with the social needs in line with the 4th Industrial Revolution. Ministry of Education (MOE) Malaysia has revised our national science curriculum to be instil with the STEM education philosophy . The government are in need to enforce STEM education to ensure our nation possess the ability to fulfil the workforce of the STEM-driven economy (Bahrum, Wahid, & Ibrahim, 2017). Therefore, the government has infused tremendous effort in promoting STEM related programme to elevate the interest of youth in STEM subject, expecting more youth to join the workforce of STEM related field.

The well-recognize international assessment Trends in International Mathematics and Science Study (TIMSS) and Programme of International Students Assessment (PISA) has reveal that the Malaysian Secondary students has achieved unsatisfactory result (lower than mean score) (Tajudin & Chinnappan, 2016). This result has urged the MOE to restructure the curriculum to incorporated with a wider range of teaching pedagogies and assessment method. They realised that the knowledge that students have obtained and mastered it are no longer enough to cope with the needs for our country's future development. It required students to creatively applied the knowledge in unpredictable challenged faced, and able to provide reasonable justification (Ismail, Salleh, Aris, & Campus, 2017). The Malaysia Education Blueprint 2013-2025 has also emphasized on shifting the traditional

teacher-centred learning to students-centred learning, where knowledge is constructed by students themselves and Higher Order Thinking Skills (HOTS) are cultivated.

The conceptual shift of the curriculum has posted difficulties to students and teachers, as they were not well-prepared for the sudden spiked in examination difficulties. The nature of science that are more abstract compared to concrete knowledge such as Mathematics has even lowered the interest of students choosing science subject, especially Chemistry as their elective courses. A variety of teaching pedagogies has been chosen by teacher to enhance student learning experience in Chemistry classroom. However, there were students who choose to enrol in private tutoring lesson that is offered outside of their regular schooling hour for a number of reasons. Thus, the purpose of this research is to identify the reason why students attend Chemistry private tutoring and to explore the teaching pedagogies used in Chemistry private tutoring and students' perception towards the pedagogies used.

1.2 Background of Study

Chemistry is a natural science subject that provide understanding on reactions between matters and with the environment. It explains on the phenomena happened around us, which was believed to equip human with the ability to make rational decision in our everyday life. In the Malaysia context, our Chemistry subject covered a huge range of topic from atoms to reaction, from theoretical knowledge to application. Chemistry as one of the branch of science covers also the theoretical knowledges such as structure, properties and composition of matter, its interaction and reaction among each other (Omwirhiren & Ubanwa, 2016). Main types of Chemistry knowledge include organic, inorganic and physical has been included in the curriculum.

1.2.1 Overview of Chemistry Teaching and Learning in Malaysia

In Malaysia, Chemistry subject is learnt during Form 4 and Form 5 (equivalent to age 16 and 17) in higher secondary level as elective subject. There are 4 themes in the Form 4 curriculum that includes Importance of Chemistry, Fundamental of Chemistry, Interaction between Matter and Industrial Chemistry. While there are also 4 themes in Form 5 curriculum namely Chemical Processes, Organic Chemistry, Heat and Technology in Chemistry. According to the aim of Standard Based Curriculum for Secondary Schools (KSSM) Chemistry, learning Chemistry not only focus on delivery of knowledge, but varying teaching method also allow students to develop scientific skills with noble value, which in turn are able to appreciate the knowledge of Chemistry being applied in everyday life (Malaysia, 2018).

Traditional lecture-based classroom is still being implement in science class has shaped students to become a passive learner (Hayes, Inouye, Bae, & Toven-Lindsey, 2020). Teaching method that is commonly use is lecturing, answering questions, explaining important notes and completing worksheet. More teacher-centred learning focusing on delivery knowledge from textbook has led to little student's participation (Senne, 2020). This situation results in the lack of practicability of their knowledges in their daily life, as they learn for the sake of knowing and understanding the theoretical parts of the concepts. Students may soon lost interest and motivation in learning as they perceived that they can't apply the knowledge being transferred and is less relevance to their life.

Furthermore, the issue of large class size has also been emphasized on as one of the challenges in teaching and learning of science subject. In Malaysian National School, the average class size ranges from 25 to 35 students with one teacher, yet this has made teaching more difficult. Teachers are not able to give individual attention to each of the students. Individual needs are also not being able to cope fully due to time constraint and large workload of teacher (Nartey, 2018). The situation is made worse when students are slow learner or require different approaches other than lecture to learn.

This situation give rise to parents or students themselves who opt for extra classes after their regular school lesson. In Malaysia, the additional classes attended is commonly known as tuition. It is conduct in either one-to-one or in groups. It is conducted in a fee-paying basis and in a more flexible timeframe (Bhorkar & Bray, 2018). In general, private (one-to-one) tutoring allow student to receive more customized teaching pedagogies that are able to provide supplementary knowledge to students. It also benefitted students by providing more personalized attention and additional assistant to weak students, especially those who can't cope with the fast-paced regular education in school (Chowdhury, 2018). On the other hand, group tuition is also one of the choices chosen by parents or students themselves. They wanted to have extra knowledge on certain topics, have more time expose to their weak subject and obtain techniques for answering their examination.

The enrolment of tuition for science subject has gained its popularity in the recent year as parents has heighten their expectation on their children and gained increase in their socio-economic status. They expect their children to gain a more exceptional learning experiences and to improve their results academically, especially in their national examination through having tuition (Hafeez-Baig, Gururajan, & Nguyen, 2020).

1.2.2 Suitable Pedagogies Needed to Overcome Student's Difficulties in Chemistry Learning

Malaysian government has placed tremendous effort in encouraging students to enrol in STEM subject for the purpose of fulfilling the demand of workforce and economic development driven by STEM (Shahali, Ismail, & Halim, 2017). However, students still possess negative attitude and lack of motivation towards the subject of science. Much research has classified Chemistry subject as one of the difficult subject to learn (Hadinugrahaningsih, Rahmawati, & Ridwan, 2017; O'Dwyer & Childs, 2017). The complication of Chemistry subject itself has made students develop

“chemophobia” or is known as chemistry anxiety. Students might have poor experience with chemistry subject in either their learning or assessment process (Herridge, 2016).

There are three level of representation of chemistry education namely macroscopic, sub-microscopic and symbolic. Macroscopic level is represented by chemical phenomena that can be experienced by students such as through experiment. Sub-microscopic level is represented by atom, electron, molecule that can't be seen through naked eye and sometimes should be represent by models of entities. Symbolic level are physical or computational forms of chemistry question such as empirical formula or chemical equations (Koopman, 2017) . The three level of representation of chemistry education, also called as chemistry triangle are displayed as Figure 1.1.

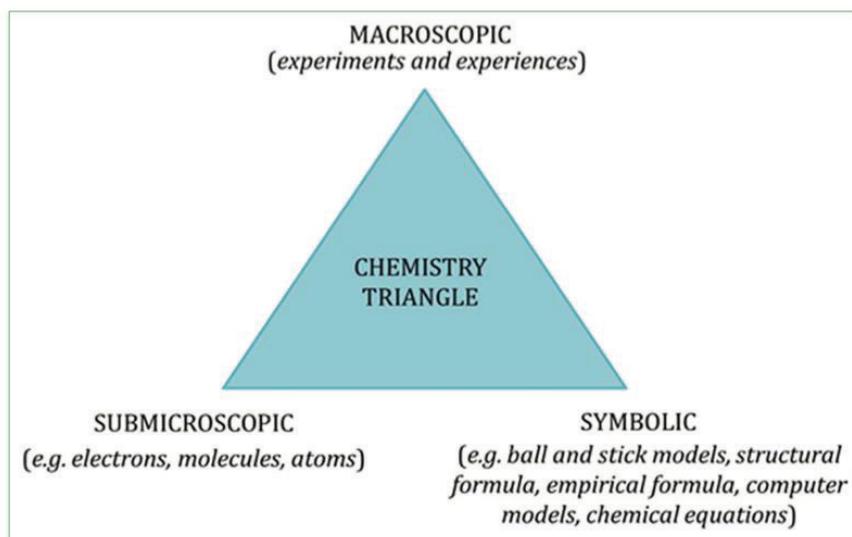


Figure 1.1 Three Level of Representation of Chemistry Education (Koopman, 2017)

The interplay between the levels often difficult to learn and confuses students. According to Rodić, Rončević, and Segedinac (2018), it is found out that misconception often occurs in the sub-microscopic level as it is explained in an

abstract way when it can't be seen or touched. Students find it difficult to master since students need to be equipped with imaginary and spatial skills. Furthermore, educator should also explain the abstract concept accurately using the right model, language or technique. Besides, switching between levels also caused students to find chemistry difficult, especially at the sub-microscopic and macroscopic level. For instance, students were expected to link between both levels when being taught about chemical reactions and changes theoretically, and to understand the chemical equation by balancing them (Sanchez, 2017). Without proper demonstration by teachers and practical work being conducted, students often rely on memorizing the facts but do not understand how the reaction actually happens or explained through these two levels. Thus, teaching pedagogies adopted or constructed by teachers are crucial in helping them to link similar concepts across different levels.

Chemistry subject are often taught on its theory, thus it may seems too abstract for students to imagine how it is applicable to daily life (Üce & Ates, 2016). Besides, too much chemistry knowledge or analogy need to be understood thoroughly and sometimes it can't be done by only reading it from the textbook. Learning Chemistry also involve high level of scientific thinking skills and technical skills, in which students have to learn through discovery and mastery (Sihite, 2016). Chemistry subject that are complicated and covers too many aspects has brought about challenges towards teachers and students. Research by Ibrahim and Iksan (2018) has shown that there is a declined number of students participating in science stream. This situation was due to several reasons such as lack of language proficiency, unclear instructional method, low laboratory practice and the application of traditional teaching pedagogies. Since there were a lot of obstacles that students might face while learning chemistry in the formal education as mentioned above, students opt for extra tuition to receive different pedagogical approaches, to gain extra knowledge and skills and to perform better in examination (Bray, 2013a; Da Wan & Weerasena, 2017).

1.2.3 The Pedagogies used in Chemistry Teaching

The teaching pedagogies being adopted by teachers in class are also crucial in determining whether students are learning effectively. Inappropriate teaching method used would hinder students to understand science concept thoroughly and lower the interest of students towards chemistry. One of the challenges faced is the packed curriculum used in chemistry urged teacher to finish their syllabus before examination. According to Okorie, Agah, Orakwe, and Oyiga (2019), many teachers tend to structured their lesson plan in a timely manner, often focusing on the important fact to be covered in each topic. Not all activities that is used to arouse and sustain students' interest can be applied in classroom as proposed in the curriculum. Rushing of syllabus also result in inadequate coverage of the syllabus which includes lacking of practical work (Ojukwu, 2016). Dull pedagogies applied in classroom and simple go through the concepts causes students could only grab the shallow content of the theory of chemistry. Without appropriate pedagogies used, it hinders students from understanding how it originates or how to apply in contextually.

Learning Chemistry can become difficult and less meaningful when students have the perception of learn for answering the examination. In Malaysia curriculum, the result of Chemistry subject in our national examination, Sijil Pelajaran Malaysia (SPM) are solely depends on the written examination but not considering practical work and scientific skills as it was not being assess comprehensively (Wright, Read, Hughes, & Hyde, 2018). Most of the time, teachers would spend time teaching students on the technique of answering examination and important fact or concepts to be noted. Students who are weaker and need more detailed explanation might sometimes be neglected due to time constraint or lack of opportunities. Conversely, an abundant of time given in tuition provide tutors with ample opportunities to use variety of pedagogies, rather than only focusing on important facts or concept theoretically. It helps students to perceive science knowledge in a more interesting way and they would not learn for the sake of examination.

1.2.4 Perception Towards Private Tutoring

In Malaysia, it is common to see students opt for private tutoring, either in one-to-one or group sessions to enhance their learning. The purpose of enrolling in tuition might differ as some students wanted to improve themselves academically, yet others might attend as their parents want them to (Subedi, 2018). Private tutoring, also known as shadow education, is educational activity that is conducted informally outside the mainstream education. It can either be done at home of students or tutor, and for large classes it will be held in tuition centres. In some tuition centre, the classes can have one or two times the ratio of teachers to students in the formal classroom, 1 teacher to 35 students (Da Wan & Weerasena, 2017). Tutoring often being conducted by full-time tutors, but there are also some university students who worked part-time. Besides, there are also school teacher, retired school teachers or professor as part of the private tutoring field.

Finding by Da Wan and Weerasena (2017) indicates that students choose to participate in shadow education as the society has overemphasized on the grades in their national examination. They are often trapped in the perception where students have spent more time in tutoring often do well in their examination. They have the assumption of attending tuition would often help them perform better in examination. Students who possess anxiety of not catching up in their regular classroom and have low confidence level would also choose to spend more time on tutoring to improve their weakness (Sharma, 2019). Students that achieve excellent result in the centralized examination would have a greater opportunity to apply for scholarship or entrance to a better university.

In the social dimension however, parents also consider that allowing their children to attend tuition helps them to remain competitive among their peers (Subedi, 2018). This situation sometimes results a social inequity among the community. Wealthy family that are able to afford higher tuition fee would be able to send their children to more tuition. They also assume that teacher can teach better in during tuition as they are sometimes being paid in a higher fee compared to in school. Parents

perception towards private tuition become positive when it is conducted in small group, as teacher can have more focus on each student and be able to cater their needs. Furthermore, the insecurities arises among parents who worried about their children not getting a high paying job in future are also one of the factor of the increased popularity of shadow education (Sharma, 2019). Parents would pressurize their children in any cost to become the elite of the society in order to achieve their best academic performance so that they would be successful in their career and would not be left out by the community.

The perceptions of students and parents are similar as they rely on attending private tutoring sessions to gain better understanding and excellent result in their national examination. Nevertheless, overemphasis of the grades alone has made students lost their ability to construct new knowledge during the process of learning. Skill gained while learning progress has no longer to become their priority, resulting weak cognitive skills such as critical thinking and problem-solving skills among students. Thus, it is worth to explore the possibility of incorporating learning activities focusing on cultivating student's cognitive skill through different pedagogies. It is not only limited to formal education, but also private tutoring lesson.

1.2.5 Pedagogies Commonly Used in Private Tutoring

Despite spending most of their time in school receiving their formal education, students still enrol in private tuition with variety of motives. Majority of research have reported the common factor for students to enrol in private tutoring, which is to improve their academic result or grades, especially in their national examination (Ömeroğulları, Guill, & Köller, 2020; Subedi, 2018; Zhan, Bray, Wang, Lykins, & Kwo, 2013). Meanwhile, other research also highlighted that students participate in tuition to gain a better understanding on syllabus content or concepts that are not well understood in school (Tse, 2014). It can be seen that students attend tuition for several reasons, yet not only limited to preparation for examination.

However, a lot of literature has highlighted students' emphasis on examination. Some students believed that private tutoring help them to better prepare for examination by providing technique in answering examinations (Bhorkar & Bray, 2018; Zhan et al., 2013). Tuition class often promotes an examination-oriented learning culture that motivates students to enrol in tuition class. Research by Zhan et al. (2013) found out that tutors in Hong Kong who taught language subject help their respondent in improving their examination skills, not the knowledge. It makes students to be aware of the marking scheme and how each mark is allocated for the keywords of answer given. Handouts given not only focus on the theoretical knowledge, but it also provides technique for students to identify or remembering keywords that are commonly being required in the marking scheme. This 'trick' allows students to answer the examination in a more advanced manner, without memorizing rigidly the whole sentence or text.

It is common that the exam-oriented system has made teacher to rush their syllabus, in order to complete all the topic in their curriculum so that students can cope with examination (Ismail, Salleh, & Md, 2019). Time constraint faced by teacher has result in teacher emphasize only on the important fact to be covered in textbook or reference book, while fewer exercise was given. Research by Bray, Kobakhidze, Liu, and Zhang (2016) has reported that their interviewees felt the lesson are moving rapidly to cover the curriculum. In regular school, exercises were less being covered, making students to face difficulties of not knowing how to solve problems given. Meanwhile, private tutoring act as a supplementary in helping them to recall the knowledges by giving more exercise or compilation of pass year questions. Their private tutor has more time to provide clarification for them that help them to sharpen their understanding and learn how to solve questions relating to the topic (Zhan et al., 2013). The question-and-answer session and immediate feedback given in private tutoring lesson allow student to retain their knowledge easily. Thus, students would take private tutoring as their supplementary by gaining more chances to expose to variety of questions that might probably being asked in the examination.

In tutoring class, tutors offer less variety of teaching method in student's learning. With the aim of helping them to cope with their examination better, the pedagogy adopted in tutoring lesson are more teacher-centred (Chan & Bray, 2014; Kwok, 2004). However, what differs them from the regular class in their formal education is that tutor would provide more drilling exercise on lesson revision and practice. Although students depend largely on tutors for knowledge to be obtained and tutors will lecture most of the time, tuition classes in small size have provide opportunities for students to get more attention than regular classroom. More personal care, attention and corrections can be given immediately, alongside with more encouragement is given during student-teacher interaction (Subedi, 2018). It seems to be the reason of why students opting for tuition classes, although the teaching pedagogies is not as interesting or challenging as the formal education.

1.3 Statement of Problem

According to Mubarak and Razak (2017), the result of Malaysian form 2 (year 8) students has declined significantly since 2007 on their Science and Mathematics subject in Trends in International Mathematics and Science Study (TIMSS). On the other hand, study by Da Wan and Weerasena (2017) highlighted that there was an inflation of grade in the Malaysian national examination SPM since 2007. In Malaysia, students learnt to answer their exam by memorizing chemical equation or formula, chemical and physical properties, or even procedures in practical work have made students less flexible in applying concepts creatively in genuine situation. Increasing students participating in tuition does not seems drive students to master Chemistry knowledge better, but to make them memorize all the fact less meaningfully without being able to apply it accurately. Thus, this research intended to investigate on the teaching pedagogies used in Chemistry private tutoring in coping students' needs.

1.4 Research Objectives

For this purpose, this study will emphasize on determining how chemistry tuition has been conducted and the perceptions of students towards it. The research objectives are as follow:

- i. To identify the reasons why students attend Chemistry private tutoring.
- ii. To explore the teaching pedagogies used in Chemistry private tutoring.
- iii. To identify the perceptions of students on the pedagogies used in Chemistry private tutoring.

1.5 Research Questions

The research questions are stated below:

- i. What are the needs of students that drives them in enrolling Chemistry private tutoring?
- ii. What are the teaching pedagogies that are commonly adopted in Chemistry private tutoring in coping student's needs?
- iii. In the students' perspectives, is the pedagogies used in private tutoring suitable and effective to be used to improve students' achievement?

1.6 Significance of the Study

The teaching pedagogies used in Chemistry private tutoring lesson will be identified in order to understand how both teacher in formal and shadow education can complement each other. The teaching pedagogy being applied in private tuition might be different from the regular education as it is conducted in a smaller scale and focus on needs of each students. Furthermore, it is not restricted by the curriculum and tutors are free to create their own lesson plan according to their teaching style. There might be a possibility of improved understanding of Chemistry concept for a student after being taught using the pedagogies created by tutors. It is expected that a more detailed understanding on teaching pedagogies being applied in private tutoring can allow different tutor to cross reference and provide the best service for needy student.

This research also aimed to understand the perceptions of students on their needs to enrol in Chemistry private tutoring. This can provide information to the teachers in both formal and shadow education on their students concern while learning Chemistry. Teachers in formal education would be able to know their students view in Chemistry being learnt in school and realized their gaps in teaching. Tutor can have gained awareness of what is their tutee expecting from their lesson. Both teachers gained advantage as they may cater the students' needs when they understand from the student's perspectives. A deeper insight can be gained in this research when students have channel to voice out their needs and weakness in detail, and teachers can adjust their current teaching method to further enhance students' learning process. It is expected that teacher can aid students to construct their scientific knowledge not only for the purpose of examination, but also inspired students to realize their potential and arouse their interest in self-directed learning.

1.7 Research Framework

A research framework is crucial in identifying important concept utilised in the research and to outline general procedure in completing the research. It is often used as a guide in helping researcher to visualise the relationship between concepts and to ensure the flow of the research. There are two main frameworks applied in this research, namely theoretical and conceptual framework.

1.7.1 Theoretical Framework

This research is grounded with constructivist theory which based on the process of knowledge is constructed by utilizing their prior knowledge (Dennick, 2016). It represent the conceptual shift of behaviourism (traditional method used) to constructivist approach which integrate with exploration, construct meaning and interaction of knowledge with the environment (Voon, Wong, Looi, & Chen, 2020). It is believed that teachers in both formal and shadow education have applied the constructivism theory in their current lesson as suggested by Ministry of Education Malaysia. Teachers play an important role to provide students with relevant environment to interact with so that they can make sense of their learning experience successfully. Social constructivism theory by Lev Vygotsky which emphasize on the construction of knowledge comes from interaction with community and culture (Amineh & Asl, 2015). This research investigates the environment being provided by private tutor in term of pedagogy used. Social constructivism can be shown through how the community of private tutoring interact with each other to allow students to build their knowledge to fulfil their learning needs.

1.7.2 Conceptual Framework

This research aims to identify reasons of students enrolling in private tutoring. It is done in the form of descriptive research to make interpretation on their current problem and struggle faced in their academic study. Variables that are expected include students' needs, parents' expectation and society requirements (Bray, 2013a; Tse, 2014; Zhan et al., 2013).

Reasons of students enrolling in private tutoring would exemplify the needs of students in constructing their learning. This in turn become the factors that drive them to take part in more tuition classes. It also determines how different pedagogies will be used by the tutor as it correlates with the variables in this research. At the same time, teaching pedagogies adopted by tutor represent their reputation, and it is the largest factor where students decide to enrol in their classes.

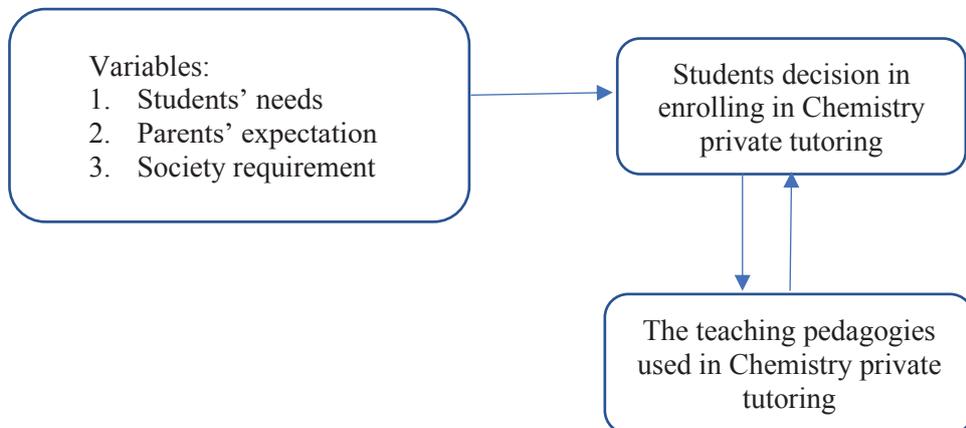


Figure 1.2 Conceptual Framework

1.8 Scope and Limitation of the Study

This research is to identify the needs of students to enrol in Chemistry tuition, teaching pedagogies used in Chemistry tuition and the perceptions of students towards it. The scope of private tuition can be considered in this research limit to group tuition that conducted in registered tuition centre in state of Johor. It can either be a small group tuition (2-10 students) and big class tuition (more than 10 students). The student's samples include students in Form 4 and Form 5 in Malaysian National School who take Chemistry course in Johor Bahru district. The teacher sample includes tutor who teaches using the national curriculum in tuition centre in Johor Bahru District. The sampling process of teacher and student stop after the answer obtained has reached its saturation. Considering the current situation of pandemic, the interview session might be conducted online using zoom application, with the session being recorded after obtaining consent from the interviewees.

1.9 Operational Definition

The following section would describe terms that are used by the researcher for common understanding.

1.9.1 Shadow Education

Shadow education is a private supplementary tutoring that were conducted outside their formal education schooling time. It was often indistinct as there was no exact curriculum used in shadow education to teach the students on the subject matter. However, it mimics much of its content in the mainstream schooling (Ghosh & Bray, 2020; Zhang & Bray, 2018). It is usually conducted aligning with the school curriculum and their progress, taking the examination timeline into consideration. In

Malaysia, it is often known as tuition class or private tutoring. In this study, it gives the same meaning as private tutoring that is conducted by private tutor outside regular school hour, following the national curriculum.

1.9.2 Private Tutor

Private tutor is educator or teacher that teaches in tuition class. They do not need to have a degree in teaching, meaning to say anyone can be a tutor (Ömeroğulları et al., 2020). Their academic qualifications and age limit would only be the factor of their qualification by the means of tuition centre or the parents' requirement. Not all tutors are provided with training by their institution, while the training being provided are usually not standardize across different tuition centre. Tutors are free to use any teaching method to help to cater students and parents needs in their lesson. In this study, private tutors are teacher that conduct any private tutoring lesson.

1.9.3 Teaching Pedagogies

Pedagogies is the act or approach of teaching and the classroom practice implemented, usually by teacher. It consists of the subject matter, skills to deliver and the ability of making appropriate decision when teaching is constituted. The engagement of teacher using their pedagogies are often concern with students, their learning, teaching and curriculum (Alexander*, 2004; Black & Wiliam, 2018). The approach being adopted by teachers are unique according to their own teaching style or their preference. In this study, it refers to approach or method being used by teacher or private tutor while conducting their Chemistry lesson.

1.9.4 Perceptions

Perception refers to how something can be seen or perceived when someone approaches a situation. In this study, students' reflection on how effective the pedagogies used by their tutors are identified. This study aims to obtain information on how students regard their learning experience in tuition classes when different approaches are used by their tutor. Their learning experience would relate to whether their learning needs have been attained.

1.10 Summary

In short, this chapter highlights the decreasing interest of students towards science subjects, and the struggle of students while learning Chemistry in their secondary school year. The existing problem is that although the participation of students enrolling in private tuition increases, the results of TIMSS and PISA do not provide any significant improvement. Although private tutoring has gained popularity, students don't seem to learn the knowledge in a scientific way, but just memorize the concept for the sake of examination. Thus, it is crucial to identify why students want to enrol in tuition to ensure that educators understand the struggles faced by students. The pedagogies used in Chemistry private tutoring and students' perceptions are also worth being researched to see how it helps students in learning scientific knowledge actively. It is essential for both teachers from formal and shadow education to gain insight on students' weaknesses so that they can complement each other to cater to the students' needs in Chemistry learning.

References

- Acat, M. B., Anilan, H., & Anagun, S. S. (2010). The problems encountered in designing constructivist learning environments in science education and practical suggestions. *TOJET: The Turkish Online Journal of Educational Technology*, 9(2).
- Açışlı, S., Yalçın, S. A., & Turgut, Ü. (2011). Effects of the 5E learning model on students' academic achievements in movement and force issues. *Procedia-Social and Behavioral Sciences*, 15, 2459-2462.
- Addi-Raccah, A., & Dana, O. (2015). Private tutoring intensity in schools: a comparison between high and low socio-economic schools. *International Studies in Sociology of Education*, 25(3), 183-203.
- Akpan, J. P., & Beard, L. A. (2016). Using Constructivist Teaching Strategies to Enhance Academic Outcomes of Students with Special Needs. *Universal Journal of Educational Research*, 4(2), 392-398.
- Alexander*, R. (2004). Still no pedagogy? Principle, pragmatism and compliance in primary education. *Cambridge Journal of Education*, 34(1), 7-33.
- Amineh, R. J., & Asl, H. D. (2015). Review of constructivism and social constructivism. *Journal of Social Sciences, Literature and Languages*, 1(1), 9-16.
- Asrizal, A., Amran, A., Ananda, A., & Festiyed, F. (2018). *Effectiveness of adaptive contextual learning model of integrated science by integrating digital age literacy on grade VIII students*. Paper presented at the IOP Conference Series: Materials Science and Engineering.
- Avargil, S., Herscovitz, O., & Dori, Y. J. (2012). Teaching thinking skills in context-based learning: Teachers' challenges and assessment knowledge. *Journal of science education and technology*, 21(2), 207-225.
- Azam, M. (2016). Private tutoring: evidence from India. *Review of Development Economics*, 20(4), 739-761.
- Bächtold, M. (2013). What do students "construct" according to constructivism in science education? *Research in Science Education*, 43(6), 2477-2496.

- Bahrum, S., Wahid, N., & Ibrahim, N. (2017). Integration of STEM Education in Malaysia and Why to STEAM. *International Journal of Academic Research in Business and Social Sciences*, 7(6), 645-654.
- Bartle, E. K., Longnecker, N., & Pegrum, M. (2011). Collaboration, contextualisation and communication using new media: Introducing podcasting into an undergraduate chemistry class. *International Journal of Innovation in Science and Mathematics Education*, 19(1).
- Baskarada, S. (2014). Qualitative case study guidelines. *Başkarada, S.(2014). Qualitative case studies guidelines. The Qualitative Report*, 19(40), 1-25.
- Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The qualitative report*, 13(4), 544-559.
- Bhattacharjea, S., Wadhwa, W., & Banerji, R. (2011). *Inside primary schools: A study of teaching and learning in rural India: ASER*.
- Bhorkar, S., & Bray, M. (2018). The expansion and roles of private tutoring in India: From supplementation to supplantation. *International Journal of Educational Development*, 62, 148-156.
- Black, P., & Wiliam, D. (2018). Classroom assessment and pedagogy. *Assessment in Education: Principles, Policy & Practice*, 25(6), 551-575.
- Bleiker, J., Morgan-Trimmer, S., Knapp, K., & Hopkins, S. (2019). Navigating the maze: Qualitative research methodologies and their philosophical foundations. *Radiography*, 25, S4-S8.
- Bodner, G. M. (1986). Constructivism: A theory of knowledge. *Journal of Chemical Education*, 63(10), 873.
- Bray, M. (2006). Private supplementary tutoring: Comparative perspectives on patterns and implications. *Compare*, 36(4), 515-530.
- Bray, M. (2013a). Benefits and tensions of shadow education: Comparative perspectives on the roles and impact of private supplementary tutoring in the lives of Hong Kong students. *Journal of International and Comparative Education (JICE)*, 18-30.
- Bray, M. (2013b). Shadow education: Comparative perspectives on the expansion and implications of private supplementary tutoring. *Procedia-Social and Behavioral Sciences*, 77, 412-420.
- Bray, M. (2015). What is private tuition really doing to—or for education. In: The Head Foundation. Singapore. Working Paper.

- Bray, M., Kobakhidze, M. N., Liu, J., & Zhang, W. (2016). The internal dynamics of privatised public education: Fee-charging supplementary tutoring provided by teachers in Cambodia. *International Journal of Educational Development*, 49, 291-299.
- Bray, M., & Lykins, C. (2012). *Shadow education: Private supplementary tutoring and its implications for policy makers in Asia*: Asian Development Bank.
- Brehm, W. C., & Silova, I. (2014). Hidden privatization of public education in Cambodia: Equity implications of private tutoring. *Journal for educational research online*, 6(1), 94-116.
- Bretz, S. L. (2001). Novak's theory of education: Human constructivism and meaningful learning. In: ACS Publications.
- Buhagiar, M. A., & Chetcuti, D. A. (2013). The private tuition phenomenon in Malta: Moving toward a fairer education system. In *Private tutoring across the Mediterranean* (pp. 129-149): Brill Sense.
- Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). The BSCS 5E instructional model: Origins and effectiveness. *Colorado Springs, Co: BSCS*, 5, 88-98.
- Cetin-Dindar, A. (2015). Student motivation in constructivist learning environment. *EURASIA Journal of Mathematics, Science and Technology Education*, 12(2), 233-247.
- Chalmers, A. F. (2013). *What is this thing called science?* : Hackett Publishing.
- Chan, C., & Bray, M. (2014). Marketized private tutoring as a supplement to regular schooling: Liberal Studies and the shadow sector in Hong Kong secondary education. *Journal of Curriculum Studies*, 46(3), 361-388.
- Cheng, I., Basu, A., & Goebel, R. (2009). Interactive Multimedia for Adaptive Online Education. *IEEE Multim.*, 16(1), 16-25.
- Chih-Hao, C. (2019). Effects of Private Tutoring on English Performance: Evidence from Senior High Students in Taiwan. *International Journal of Educational Development*, 68, 80-87.
- Chittleborough, G., & Treagust, D. F. (2007). The modelling ability of non-major chemistry students and their understanding of the sub-microscopic level. *Chemistry education research and practice*, 8(3), 274-292.

- Choi, H., & Choi, Á. (2016). Regulating private tutoring consumption in Korea: Lessons from another failure. *International Journal of Educational Development, 49*, 144-156.
- Chowdhury, A. (2018). Private Tuition Dependency: Causes, Consequences and Possible Ways-Out.
- Clarke, V., Braun, V., & Hayfield, N. (2015). Thematic analysis. *Qualitative psychology: A practical guide to research methods*, 222-248.
- Cooper, R. (2007). An investigation into constructivism within an outcomes based curriculum. *Issues in educational research, 17*(1), 15.
- Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative*: Prentice Hall Upper Saddle River, NJ.
- Da Wan, C., & Weerasena, B. (2017). Shadow education in Malaysia: Identifying the determinants of spending and amount of time attending private supplementary tutoring of Upper Secondary School students. *Journal of International and Comparative Education (JICE)*, 91-103.
- Dang, H.-A. (2007). The determinants and impact of private tutoring classes in Vietnam. *Economics of education review, 26*(6), 683-698.
- Dennick, R. (2016). Constructivism: reflections on twenty five years teaching the constructivist approach in medical education. *International Journal of Medical Education, 7*, 200.
- Dongre, A., & Tewary, V. (2015). Impact of private tutoring on learning levels. *Economic and Political Weekly, 50*(41), 71-80.
- Dressman, M. (2009). *Using social theory in educational research: A practical guide*: Routledge.
- Driver, R., Asoko, H., Leach, J., Scott, P., & Mortimer, E. (1994). Constructing scientific knowledge in the classroom. *Educational researcher, 23*(7), 5-12.
- Dunlap, J. C., & Grabinger, R. S. (1996). Rich environments for active learning in the higher education classroom. *Constructivist learning environments: Case studies in instructional design*, 65-82.
- Edomwonyi-Otu, L., & Avaa, A. (2011). The challenge of effective teaching of chemistry: A case study. *Leonardo Electronic Journal of Practices and Technologies, 10*(18), 1-8.
- Elby, A. (2000). What students' learning of representations tells us about constructivism. *The Journal of Mathematical Behavior, 19*(4), 481-502.

- Ertmer, P. A., & Newby, T. J. (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance improvement quarterly*, 6(4), 50-72.
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics*, 5(1), 1-4.
- Fensham, P. J., & Bellocchi, A. (2013). Higher order thinking in chemistry curriculum and its assessment. *Thinking Skills and Creativity*, 10, 250-264.
- Fossey, E., Harvey, C., McDermott, F., & Davidson, L. (2002). Understanding and evaluating qualitative research. *Australian & New Zealand Journal of Psychiatry*, 36(6), 717-732.
- Ghosh, P., & Bray, M. (2020). School systems as breeding grounds for shadow education: Factors contributing to private supplementary tutoring in West Bengal, India. *European Journal of Education*, 55(3), 342-360.
- Gilakjani, A. P., Lai-Mei, L., & Ismail, H. N. (2013). Teachers' use of technology and constructivism. *International Journal of Modern Education and Computer Science*, 5(4), 49.
- Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The qualitative report*, 8(4), 597-607.
- Griffiths, M. (2009). Justice, joy and educational delights. *Professorial inaugural lecture, Moray House School of Education, University of Edinburgh*, 24.
- Guey, C.-c., Cheng, Y.-y., & Shibata, S. (2010). A triarchal instruction model: integration of principles from Behaviorism, Cognitivism, and Humanism. *Procedia-Social and Behavioral Sciences*, 9, 105-118.
- Gugiu, P. C., & Rodríguez-Campos, L. (2007). Semi-structured interview protocol for constructing logic models. *Evaluation and Program Planning*, 30(4), 339-350.
- Hadinugrahaningsih, T., Rahmawati, Y., & Ridwan, A. (2017). *Developing 21st century skills in chemistry classrooms: Opportunities and challenges of STEAM integration*. Paper presented at the AIP Conference Proceedings.
- Hafeez-Baig, A., Gururajan, R., & Nguyen, N. (2020). How Does Private Tutoring Knowledge Influence Parental Perceptions of Private Tutoring? A Case Study in Vietnam.
- Handcock, M. S., & Gile, K. J. (2011). Comment: On the concept of snowball sampling. *Sociological Methodology*, 41(1), 367-371.

- Hassan, O. R., & Rasiah, R. (2017). Poverty and student performance in Malaysia. *Institutions and Economies*, 61-76.
- Hayes, K. N., Inouye, C., Bae, C. L., & Toven-Lindsey, B. (2020). How facilitating K–12 professional development shapes science faculty's instructional change. *Science Education*.
- Hein, G. (1991). Constructivist learning theory. *Institute for Inquiry*. Available at: <http://www.exploratorium.edu/ifi/resources/constructivistlearning.html>.
- Herga, N. R., Čagran, B., & Dinevski, D. (2016). Virtual laboratory in the role of dynamic visualisation for better understanding of chemistry in primary school. *EURASIA Journal of Mathematics, Science and Technology Education*, 12(3), 593-608.
- Herridge, M. D. H. (2016). Student Identification Of Problem Topics In General Chemistry.
- Huang, H. M. (2002). Toward constructivism for adult learners in online learning environments. *British journal of educational technology*, 33(1), 27-37.
- Hutchison, D., & Schagen, I. (2007). Comparisons between PISA and TIMSS: Are we the man with two watches. *Lessons learned: What international assessments tell us about math achievement*, 227-261.
- Ibrahim, N. H. B., & Iksan, Z. B. H. (2018). Level of Chemophobia and Relationship with Attitude towards Chemistry among Science Students. *Journal of Educational Sciences*, 2(2), 52-65.
- Ismail, M. H. B., Salleh, M. F. M., & Md, N. A. (2019). The Issues and Challenges in Empowering STEM on Science Teachers in Malaysian Secondary Schools.
- Jonassen, D. H., & Rohrer-Murphy, L. (1999). Activity theory as a framework for designing constructivist learning environments. *Educational technology research and development*, 47(1), 61-79.
- Jung, J. H., & Lee, K. H. (2010). The determinants of private tutoring participation and attendant expenditures in Korea. *Asia Pacific Education Review*, 11(2), 159-168.
- Kaderali, F., Sans, O., Schaup, S., & Sommer, D. (1998). Experiences in online tutoring of multimedia courses in distance education. *Proc. IFIP Teleteaching, Vienna-Budapest*.
- Kanselaar, G. (2002). Constructivism and socio-constructivism. *Constructivism and socio-constructivism*, 1-7.

- Kenayathulla, H. B. (2013). Household expenditures on private tutoring: Emerging evidence from Malaysia. *Asia Pacific Education Review, 14*(4), 629-644.
- Kenayathulla, H. B., & Ubbudari, M. (2017). PRIVATE TUTORING IN MALAYSIA: THE NEXUS BETWEEN POLICY, PEOPLE AND PLACE. *MOJEM: Malaysian Online Journal of Educational Management, 5*(2), 42-59.
- Khaydarov, S. (2020). Shadow Education in Uzbekistan: Teachers' Perceptions of Private Tutoring in the Context of Academic Lyceums. *Orbis scholae, 14*(2), 81-104.
- Kiger, M. E., & Varpio, L. (2020). Thematic analysis of qualitative data: AMEE Guide No. 131. *Medical teacher, 42*(8), 846-854.
- Kim, S., & Lee, J.-H. (2010). Private tutoring and demand for education in South Korea. *Economic development and cultural change, 58*(2), 259-296.
- Kivunja, C., & Kuyini, A. B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of higher education, 6*(5), 26-41.
- Koopman, O. (2017). Investigating how science teachers in South Africa engage with all three levels of representation in selected chemistry topics. *African Journal of Research in Mathematics, Science and Technology Education, 21*(1), 15-25.
- Kwok, P. (2004). Examination-oriented knowledge and value transformation in East Asian cram schools. *Asia Pacific Education Review, 5*(1), 64.
- Lee, J. Y. (2013). *Private tutoring and its impact on students' academic achievement, formal schooling, and educational inequality in Korea*. Columbia University,
- Liu, J. (2012). Does cram schooling matter? Who goes to cram schools? Evidence from Taiwan. *International Journal of Educational Development, 32*(1), 46-52.
- Mahmud, S. N. D., Nasri, N. M., Samsudin, M. A., & Halim, L. (2018). Science teacher education in Malaysia: challenges and way forward. *Asia-Pacific Science Education, 4*(1), 1-12.
- Majumdar, M. (2014). The Shadow School System and New Class Divisions in India: Multitudes of customers through the gates of the education bazaar.
- Malaysia, M. o. E. (2018). *Dokumen Standard Kurikulum dan Pentaksiran*.
- Mischo, C., & Haag, L. (2002). Expansion and effectiveness of private tutoring. *European Journal of Psychology of Education, 17*(3), 263-273.
- Mubarak, A. A., & Razak, N. A. (2017). MALAYSIAN STUDENTS' ACHIEVEMENT IN TIMSS 2011: DOES SCIENCE INQUIRY REALLY MATTER? *Malaysian Journal of Learning and Instruction, 1*-25.

- Murtonen, M., Gruber, H., & Lehtinen, E. (2017). The return of behaviourist epistemology: A review of learning outcomes studies. *Educational Research Review, 22*, 114-128.
- Nartey, L. T. (2018). Class Size And Students' Achievement In General Science In Junior High Schools Of Cape Coast.
- Neo, M., & Neo, T.-K. (2010). Students' Perceptions in Developing a Multimedia Project within a Constructivist Learning Environment: A Malaysian Experience. *Turkish Online Journal of Educational Technology-TOJET, 9*(1), 176-184.
- Ngugi, M. N. (2011). *EFFECTS OF PRIVATE SUPPLEMENTARY TUTORING ON STUDENTS' ACADEMIC PERFORMANCE: A CASE OF SECONDARY SCHOOLS IN GATUNDU SOUTH DISTRICT, KENYA*. KENYATTA UNIVERSITY,
- O'Dwyer, A., & Childs, P. E. (2017). Who says organic chemistry is difficult? Exploring perspectives and perceptions. *EURASIA Journal of Mathematics, Science and Technology Education, 13*(7), 3599-3620.
- Ojukwu, M. (2016). Perception of students on causes of poor performance in Chemistry in External Examinations in Umuahia North Local Government of Abia State. *International Journal of Education and Literacy Studies, 4*(1), 67-73.
- Okorie, E., Agah, J., Orakwe, C., & Oyiga, F. (2019). Effect of Examination and Teaching Curriculum-based Scheme of Work On Secondary School Students' Interest and Achievement in Chemistry.
- Ömeroğulları, M., Guill, K., & Köller, O. (2020). Effectiveness of private tutoring during secondary schooling in Germany: Do the duration of private tutoring and tutor qualification affect school achievement? *Learning and Instruction, 66*, 101306.
- Omwirhiren, E., & Ubanwa, A. (2016). An analysis of misconceptions in organic chemistry among selected senior secondary school students in Zaria local government area of Kaduna state, Nigeria. *International Journal of Education and Research, 4*(7), 247-266.
- Paily, M. (2013). *Creating constructivist learning environment: Role of "Web 2.0" technology*. Paper presented at the International Forum of Teaching and Studies.

- Piaget, J. (1976). Piaget's theory. In *Piaget and his school* (pp. 11-23): Springer.
- Pikoli, M. (2020). Using guided inquiry learning with multiple representations to reduce misconceptions of chemistry teacher candidates on acid-base concept. *International Journal of Active Learning*, 5(1), 1-10.
- Qu, S. Q., & Dumay, J. (2011). The qualitative research interview. *Qualitative research in accounting & management*.
- Richardson, V. (2003). Constructivist pedagogy. *Teachers college record*, 105(9), 1623-1640.
- Ridwan, A., Rahmawati, Y., & Hadinugrahaningsih, T. (2018). STEAM integration in chemistry learning for developing 21st century skills. *MIER Journal of Educational Studies, Trends and Practices*, 7(2).
- Rodić, D. D., Rončević, T. N., & Segedinac, M. D. (2018). The Accuracy of Macro–Submicro–Symbolic Language of Future Chemistry Teachers. *Acta Chimica Slovenica*, 65(2), 394-400.
- Rudnick, A. (2014). A philosophical analysis of the general methodology of qualitative research: A critical rationalist perspective. *Health Care Analysis*, 22(3), 245-254.
- Rushforth, K. (2011). *The quality and effectiveness of one-to-one private tuition in England*. Institute of Education, University of London,
- Safarzyńska, K. (2013). Socio-economic determinants of demand for private tutoring. *European Sociological Review*, 29(2), 139-154.
- Samy, M., & Robertson, F. (2017). From positivism to social constructivism: an emerging trend for CSR researchers. In *Handbook of research methods in corporate social responsibility*: Edward Elgar Publishing.
- Sanchez, J. M. P. (2017). Integrated macro-micro-symbolic approach in teaching secondary Chemistry. *Kimika*, 28(2), 22-29.
- Savery, J. R., & Duffy, T. M. (1995). Problem based learning: An instructional model and its constructivist framework. *Educational technology*, 35(5), 31-38.
- Schunk, D. H. (2012). *Learning theories an educational perspective sixth edition*: Pearson.
- Schwandt, T. A. (1994). Constructivist, interpretivist approaches to human inquiry. *Handbook of qualitative research*, 1, 118-137.
- Scotland, J. (2012). Exploring the philosophical underpinnings of research: Relating ontology and epistemology to the methodology and methods of the scientific,

- interpretive, and critical research paradigms. *English Language Teaching*, 5(9), 9-16.
- Senne, P. (2020). *Enhancing the academic performance of Archbishop Porter Girls' Senior High School students using laboratory based practical activities in selected Chemistry topics*. University of Education, Winneba,
- Shahali, E. H. M., Ismail, I., & Halim, L. (2017). STEM education in Malaysia: Policy, trajectories and initiatives. *Asian Research Policy Science and Technology Trends*, 122-133.
- Sharma, H. (2019). The Perception on Need and Impact of Private Supplementary Tutoring at Higher secondary level in Delhi Region of India: An Exploratory Study. *The Eurasia Proceedings of Educational and Social Sciences*, 13, 5-16.
- Sihite, F. R. Y. (2016). *The Differences of Student's Achievement and Critical Thinking by Implementing Problem Based Learning (PBL) and Guided Inquiry Learning on Stoichiometry Topic*. UNIMED,
- Silova, I. (2010). Private tutoring in Eastern Europe and Central Asia: Policy choices and implications. *Compare*, 40(3), 327-344.
- Silova, I., & Bray, M. (2006). The hidden marketplace: Private tutoring in former socialist countries. *Education in a hidden marketplace: Monitoring of private tutoring*, 71-98.
- Singh, S., & Yaduvanshi, S. (2015). Constructivism in science classroom: Why and how. *International journal of scientific and research publications*, 5(3), 1-5.
- Šťastný, V. (2017). Private tutoring lessons supply: Insights from online advertising in the Czech Republic. *Compare: A Journal of Comparative and International Education*, 47(4), 561-579.
- Stevenson, D. L., & Baker, D. P. (1992). Shadow education and allocation in formal schooling: Transition to university in Japan. *American Journal of sociology*, 97(6), 1639-1657.
- Subedi, K. R. (2018). Shadow Education: A Role of Private Tutoring in Learning. *Online Submission*, 1(2), 29-42.
- Sulaiman, T., Muniyan, V., Madhvan, D., Hasan, R., & Rahim, S. S. A. (2017). Implementation of higher order thinking skills in teaching of science: A case study in Malaysia. *International Research Journal of Education and Sciences (IRJES)*, 1(1), 2550-2158.

- Suryawati, E., & Osman, K. (2017). Contextual learning: Innovative approach towards the development of students' scientific attitude and natural science performance. *EURASIA Journal of Mathematics, Science and Technology Education, 14*(1), 61-76.
- Tajudin, N. a. M., & Chinnappan, M. (2016). The Link between Higher Order Thinking Skills, Representation and Concepts in Enhancing TIMSS Tasks. *International Journal of Instruction, 9*(2), 199-214.
- Tse, S. K. (2014). To what extent does Hong Kong primary school students' Chinese reading comprehension benefit from after-school private tuition? *Asia Pacific Education Review, 15*(2), 283-297.
- Üce, M., & Ates, I. (2016). Problem-Based Learning Method: Secondary Education 10th Grade Chemistry Course Mixtures Topic. *Journal of Education and Training Studies, 4*(12), 30-35.
- Ulfah, M., Harahap, M. B., & Rajagukguk, J. (2018). *The Effect of Scientific Inquiry Learning Model for Student's Science Process Skill and Self Efficacy in The Static Fluid Subject*. Paper presented at the 3rd Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2018).
- Ventura, A., & Jang, S. (2010). Private tutoring through the internet: Globalization and offshoring. *Asia Pacific Education Review, 11*(1), 59-68.
- Von Glasersfeld, E. (1984). An introduction to radical constructivism. *The invented reality, 1740*.
- Voon, X. P., Wong, L. H., Looi, C. K., & Chen, W. (2020). Constructivism-informed variation theory lesson designs in enriching and elevating science learning: Case studies of seamless learning design. *Journal of Research in Science Teaching*.
- Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes*: Harvard university press.
- Wilson, B., Teslow, J., & Osman-Jouchoux, R. (1995). The impact of constructivism (and postmodernism) on ID fundamentals. *Instructional design fundamentals: A review and reconsideration, 137-157*.
- Wittwer, J. (2014). Discussion: Conditions, processes, and effects of private tutoring. *Journal for educational research online, 6*(1), 124-138.

- Wright, J. S., Read, D., Hughes, O., & Hyde, J. (2018). Tracking and assessing practical chemistry skills development: practical skills portfolios. *New Directions in the Teaching of Physical Sciences*, 13(1).
- Zhan, S., Bray, M., Wang, D., Lykins, C., & Kwo, O. (2013). The effectiveness of private tutoring: Students' perceptions in comparison with mainstream schooling in Hong Kong. *Asia Pacific Education Review*, 14(4), 495-509.
- Zhang, W. (2014). The demand for shadow education in China: Mainstream teachers and power relations. *Asia Pacific Journal of Education*, 34(4), 436-454.
- Zhang, W., & Bray, M. (2018). Equalising schooling, unequalising private supplementary tutoring: access and tracking through shadow education in China. *Oxford Review of Education*, 44(2), 221-238.