

“The aspects of the formative assessments on improving the inquiry skills in science classes for middle and high school students in Al-Ain City, UAE”

"جوانب التقييمات التكوينية لتحسين مهارات البحث في فصول العلوم لطلاب المدارس المتوسطة والثانوية في مدينة العين ، الإمارات العربية المتحدة."

by

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**Dissertation submitted in fulfilment
of the requirements for the degree of
MASTER OF EDUCATION
at
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Abstract

Assessment for learning has been one of the growing targeted fields in education after conducting many research and studies globally, which proved how it positively affects the learning and teaching process. Formative assessment (FA) is one type of these informal evaluations, which is used in the classroom nowadays, and it highly leads and assists the students in their inquiry-based learning. This study aims to investigate the aspects of the formative assessments on improving the inquiry skills in science classes for middle and high school students in Al-Ain City, U.A.E. because the Arabic studies about this topic are so few compared to the importance of the inquiry-based learning in science classes.

A quasi-experiment was held to study the FA influence on students' inquiry skills. Add to that, a questionnaire that was performed using the mixed method as another instrument executed to collect data about the topic from twenty science teachers from two-privet school sector in AL-Ain city. Lesson plans were another tool that helped to gather the assumptions of teachers about aspects of the FA on improving the inquiry skills in science classes. The chosen participant were grade eleven boys in a private school in Al-Ain.

The results of this research show a positive connection between FA and IBL. Thus, the findings of this investigation, give few suggestions to involve FA more in the educational process, to assess IBL, and to advance learners' achievement in science in the UAE.

Keywords: Formative assessment, inquiry-based learning.

الملخص

يعد تقييم التعلم أحد المجالات المستهدفة المتزايدة في التعليم بعد إجراء العديد من البحوث والدراسات على مستوى العالم ، والتي أثبتت مدى تأثيرها الإيجابي على عملية التعلم والتعليم. يعد التقييم التكويني أحد أنواع هذه التقييمات غير الرسمية ، والتي يتم استخدامها في الفصل الدراسي في الوقت الحاضر ، وهي تؤدي بشكل كبير إلى الطلاب ومساعدتهم في التعلم القائم على الاستقصاء. تهدف هذه الدراسة إلى دراسة جوانب التقييمات التكوينية لتحسين مهارات البحث في فصول العلوم لطلاب المدارس المتوسطة والثانوية في مدينة العين ، الإمارات العربية المتحدة. لأن الدراسات العربية حول هذا الموضوع قليلة جدًا مقارنة بأهمية التعلم القائم على الاستقصاء في فصول العلوم. تم إجراء تجربة شبه لدراسة تأثير التقييم التكويني على مهارات استقصاء الطلاب.

أضف إلى ذلك ، استبيان تم إجراؤه باستخدام الطريقة المختلطة كأداة أخرى تم تنفيذها لجمع البيانات حول الموضوع من عشرين مدرسًا للعلوم من اثنين من مدارس القطاع الخاص في مدينة العين. كانت خطط الدروس أداة أخرى ساعدت على جمع افتراضات المدرسين حول جوانب التقييم التكويني لتحسين مهارات البحث في فصول العلوم. المشاركون المختارون كانوا في الصف الحادي عشر من الأولاد في مدرسة خاصة في العين.

تظهر نتائج هذا البحث وجود علاقة إيجابية بين التقييم التكويني والتعلم القائم على التحقيق. وبالتالي ، فإن نتائج هذا البحث ، تقدم القليل من الاقتراحات لإشراك التقييم التكويني بشكل أكبر في العملية التعليمية ، وتقييم التعلم القائم على الاستقصاء ، وتعزيز تحصيل المتعلمين في العلوم في الإمارات العربية المتحدة.

الكلمات والعبارات الرئيسية:

التعلم القائم على التحقيق - بين التقييم التكويني

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I want to thank all the special people who helped me to complete this study, including all my family members, friends, and colleagues.

Also, a special appreciation goes to Dr. Sufian Forawi for all his guidance and support during the past two years.

Dedication

I dedicate this research study to my late father Tahsein Mahdawi, and my beloved mother, Dumia Wasef, for being there for me all the time and supporting every single step I make.

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Chapter One: Introduction

The current and the past century witnessed an enormous revolution in all of life aspects and fields, especially in technology and science. Rationally these changes and developments that fundamentally changed our lives were not to occur without the presence of certain people who dared to think out of the box and away from the traditions which limited researchers and thinkers actions most of the time through centuries, their courage, ideas along with their work, shaped and structured the new world.

Being an educator or a teacher is a huge responsibility on one's shoulder, as you are guiding plus nourishing the future generations, particularly within this fast rate-changing era. You must be aware of preparing the children to face such a pace in wise and flexible ways, to solve or tolerate any challenges that could come on their way as they grow up.

Many methods of education were developed and argued for the past 100 years, to improve the quality of present teaching and learning processes as a science teacher in Al-Ain City. UAE, I chose to discuss the influence of Formative assessments on inquiry base skills of the students, which I feel is one of, if it is not the most critical skills in learning science.

1.0 Research problem

People regularly want to know "what works" in the education process. However, the truth is that everything works somewhere, and nothing works all everywhere. That is the reason research can never guide teachers—classrooms are dreadfully complex for any prescription to be conceivable, and varieties in context make what a useful course of action in one circumstance disastrous in another is. (D. Wiliam 2013) Moreover, we are living in a continually changing world, in which these changes are always accomplices with a massive amount of new and increasing challenges. Therefore, the teachers have to make their students brace to such problems; also, one of their tasks is to strengthen the students up against any obstacles they may face through their lives or jobs. (Ronis, 2008).

Numerous investigations have distinguished difficulties that impede its legitimate execution in science classrooms in two fundamental areas: educators' demeanor towards the efficiency of IBL to give an account of the presentation of every student (DiBiase& McDonald 2015; Harrison

2014), and learners' availability to assume liability of their own learning, and utilize self-managed learning abilities to improve their performance (Shawer 2010)

In addition to the previous, the core issue lies in the false, but a none-the-less widely spread, assumption that FA is a distinct kind of evaluation instrument rather than a process that is a basic and indigenous to the practice of teaching and learning. (J. Hudesman 2013). According to studies in related to assessment, the fundamental issue is that assessment practices, which are not merged into teaching, do not motivate pupils' conceptual understanding. (N.Bulunuz & M.Bulunuz. 2014).

The criteria of evaluation of Abu Dhabi Educational Council (ADEC) inspection reports for different private schools in Abu Dhabi, revealed that Irtiqa'a inspection reports have listed, encouraging independent learning as an angle to improve in most of the records that were revised. Other areas that should be worked on, according to the reports, are assessment strategies to emphasize learners' progress, and designing challenging activities for the students (S.Sabri 2015).

1.1 Background and significance of study

1.1.1 Formative Assessments (FA)

1.1.1.1 Formative assessment definition

Defining formative assessment was and is still the subject of controversy. Several studies argued, discussed and suggested many explanations to clarify the concept to educators, in a way that may assist and guide them in their journey of teaching.

(Andersson & Palm. 2017) Said that practice in a class is formative and developmental to the degree that proof about student accomplishment is extracted, translated, and utilized by instructors, students, or their companions. All of the mentioned above aim to settle on choices about following stages in guidance that is probably going to be better or be better established, than the decisions they would have taken without proof that was elicited.

It was also defined as a series of planned processes. While tests can be components of these processes, proofs are only some of the elements in an assessment process. It also involves a series of actions, the focus of which is to improve student learning in the classroom. (Enger & Yager. P.16.2009). unlike summative assessments, it is held and conducted during the learning process to enrich it. (Yang. et al., 2016). FA involves all those activities attempted by teachers,

and by their students, which equipped information to be used as feedback to adjust and alter the teaching and learning activities in which they are participating. This type of assessment clearly, stresses in the learning process and is usually conducted daily. (Yan & Cheng 2014)

Orlich. et al., Explained formative assessment, to be the continuing assessment to observe your students' progression. (P 323.2009). In other words, FA is an activity planned to provide meaningful feedback to learners and teachers, moreover, to improve professional implementations and student performance and achievements. (Bailey & Jakicic. P, 14. 2012). It includes the continuous collection and utilization of assessments amid guidance to understand where students are relative to proposed objectives, just as the usage of that information to make a quick move—to adjust educating and learning—to enable students to get to where they have to go. (Herman. 2013).

It was also elucidated that the power of assessments as an instructional instrument is liberated into the classroom when teacher begin to think of them for learning rather than of learning, as it had been argued that assessment for learning takes place when it is used to promote student achievement. (Orlich. et al., P 328.2009) & (Enger & Yager. P.16.2009).

Pro. Dylan Wiliam, a professor at the University of London, pointed in his paper “Formative assessment and contingency in the regulation of learning processes”, how is using the term FA is not helpful anymore, and many researchers preferred to use the term assessment for learning instead in their studies and books such as Broadfoot, Harlen, and many others. Then he proceeded in explicating how assessment for learning is the way toward looking for and interpreting, proof for use by students and their instructors or teachers to detect where the students are in their realizing, where they have to go and how best to arrive".

In consonance with all what has mentioned above, Formative Assessment is commonly known among educators as, collection of activities, practices, and experiences held via the teaching and learning procedures in classrooms, or gained from their environment to enhance students' learning efficiency and life skills.

1.1.1.2 Some examples of formative assessment activities.

Enger and Yager put a chart to illustrate the types of formative assessment. (Enger & Yager. P.17.2009).

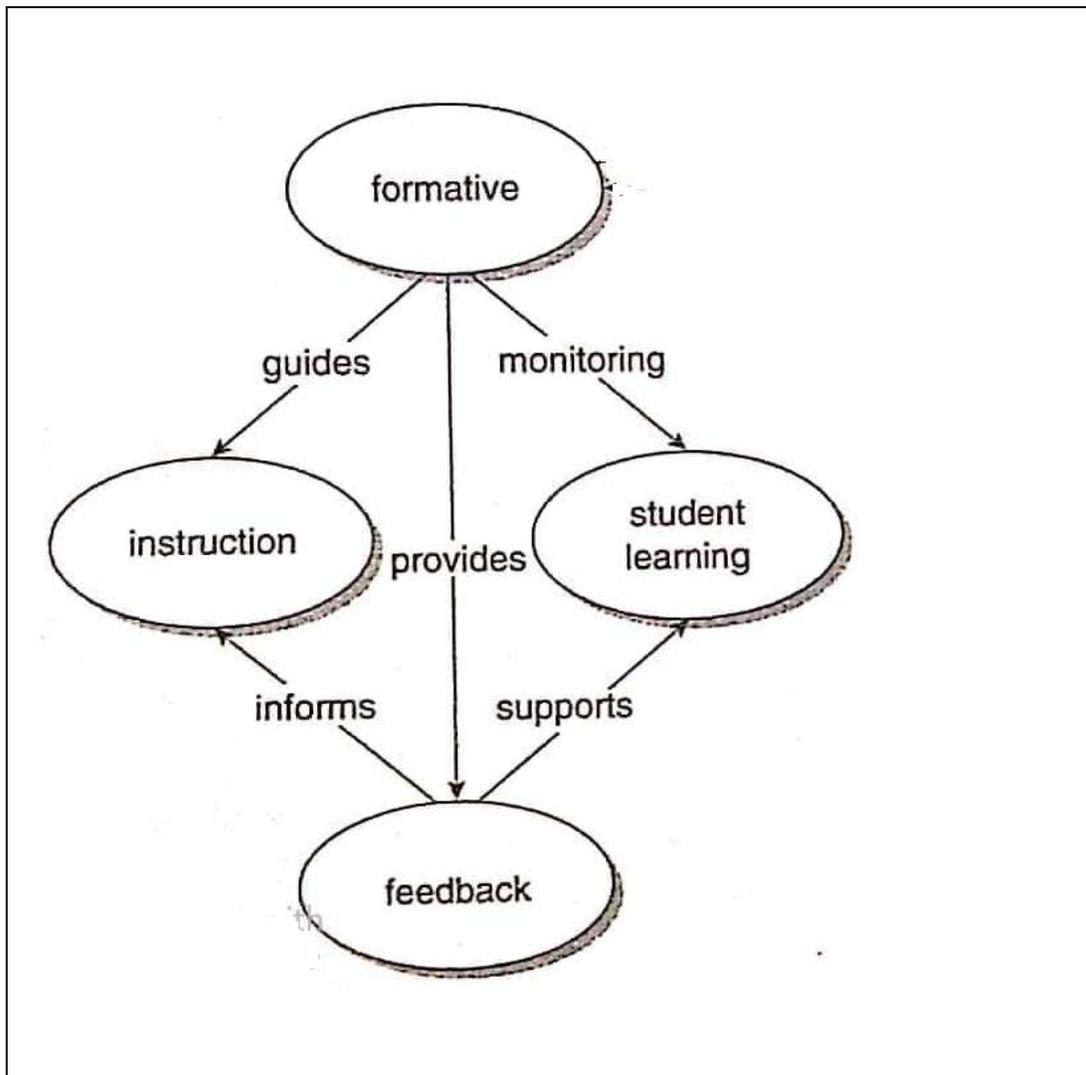


Figure 1 (formative assessment)

Formative assessment serves multiple tasks in instructions and learning, as is illustrated

- No comparison should be avoided between colleagues, and feedback to either student should be about particular qualities to his/her work, accompanied with advice to improve and encourage the student's educating progress.
- Practicing self-assessment can lead the students to understand the master goal of their learning process, and let them realize all the needs they require to equip themselves with to accomplishing their target, which makes FA productive.

- The assessment process must embed and plan, along with the teachers' instructions; so it will open the opportunities for the students to express what they have learned and understood during the lesson's all parts.
- Teachers should discuss with students about their work. Such conversation should be thoughtful, reflective, focused on teachers' behalf, to elicit their pupils' understanding, and should involve all of them. Likewise, that should give them the space to express, plus to explain themselves freely and confidently in front of their teachers or any other person.
- ❖ As shown above, on the diagram that Enger and Yager created, feedback takes up first part in the framework of FA, as assessment directly driven to it or end in it after a few steps. The last two points clarify the importance of the feedback:
 - Feedback on tests seatwork and homework should supply teaching on how each learner can improve. In addition to the previous, each student has to be provided with an opportunity to act on their teacher's suggestions for strengthening their skills and their own learning process.
 - The main advantage of feedback is that instructors provide it without a grade, so pupils tend to concentrate more on it because of that.

Standard FA is developed and written by the teachers/ or instructors. (Kim & Chris, 2012. p21) the teacher should be planned and design efficiently the FA that is going to be used in the classroom, to get the best results out of it on students' learning process.

There are some specific tactics a teacher or an educator can utilize for planning and formulate FA. To assure you receive the right information about what you have taught- information you can employ to know what to do upcoming for your students, Bailey and Jakicic, both suggested five steps in their book that might guide an instructor to do so:

Stages of designing FA	Brief Description
➤ Decide what to assess	1. Identify the targets are mostly could cause specific students difficulty 2. Which goals are necessary skills for information to come later in the unit? 3. Which targets are necessary for students to know?

<p>➤ Decide how to assess</p>	<p>After planning what to use as an assessment should be decided.</p> <p>There are three primary assessment strategies:</p> <ol style="list-style-type: none"> 1. Selected response: multiple-choice, matching, true/false questions 2. Constructed and extended written response: short-and long-essay responses. 3. Performance assessments: oral reports and demonstrations. <ul style="list-style-type: none"> ➤ Probing discussion or personal communication was discussed as a fourth type of FA when a student conference held to ask questions and reveal what learners know about a topic.
<p>Develop the assessment plan</p>	<p>Designing the assessment</p> <p>Considering the sample size (how many items do the teacher need)</p>
<p>Determine the timeline</p>	<p>Depend on the academic level, as primary need FA more frequently than middle and high school, but it is so important to understand, the more we use this type of assessments the better the efficiency of learning a one could get</p>
<p>Write the assessment</p>	<p>The authors offered general guidelines to help in writing the assessment.</p> <ol style="list-style-type: none"> 1. Writing Selected –Response items

	<ol style="list-style-type: none"> 2. Writing constructed-Response and Extended Written- Response Items. 3. Designing Performance Assessments. 4. Additional Guidelines for Writing Assessment Questions.
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Table 1, Stages of designing FA

(J. R. Evans et al. 2014) mentioned in their article that, the center of interest should be on three specific drivers when scheming any FA:

1. using a technique to educate students of gaps in their learning;
2. acquaint students with the anticipations of summative assessments;
3. providing feedback that directs the trend of student learning

Hypothetically and contrasting to summative assessments, formative assessment should occur in a non-threatening environment, be presented at a time that applies to the students' learning journey and be one where the student takes an active part in the approach.

1.1.2 Inquiry skills

1.1.2.1 Inquiry definition

The inquiry is a term generally utilized in regular day-to-day existence just as in education and other professional activities. It is occasionally compared with research, examination, or 'scan for truth.' Regarding education, inquiry can be connected in most subject areas – including history, geography, the arts, science, mathematics, and technology – when questions are raised, the proof is accumulated, and potential clarifications are considered. (Harlen 2014).

Inquiry-based science Learning or education (IBSL) is a way to deal with teaching and learning science that is carried on by questions' raising and searching for answers. (Harrison 2014). It is outlined even as a student-centered focus instructional method that places students responsible for their learning. Established in a constructivist approach, IBL centers on experiential procedures that enable students to take an interest in both information acquisition and development, bringing about more drew in and more profound learning than standard pedantic instructional practices. (Ting. et al., 2019). It can also be defined as a process of searching and explore new causal relations, with the students composing hypotheses and examining them by performing experiments and making observations. (Pedaste et al. 2015).

1.1.2.2 How to execute inquiry-based learning.

Inquiry processes, as a model of “scientific practices,” consist of determining problems, rise research questions, designing and performing investigations, analyzing, and clarify data, and formulating, convey, and defending hypotheses, models and explanations. (ALLCHIN et al., 2014).

IBL is a methodology that is incorporated in dynamic learning and implies students in different classroom exercises, which can upgrade their certainty, comprehension, and help them to accomplish scholarly merit. In this methodology, inquiry triggers learners' reasoning to foster and enhance their understanding of ideas in a study hall setting. (Chan et al. 2016). IBL includes a cluster and a variety of learning and teaching approaches where inquiry or research manages the learning experience. Students actively engage by several means and ways, for example, by asking questions and by sharing their knowledge. Another tactic is Hands-on experiments, which can give a sound basis for creating queries, for working with peers, and for applying the common research mechanisms. (Sofoklis et al., 2017).

IBL is a knowledge obtained as students gather data, analyze it, and solve problems. It is considered, an approach promoting significant and meaningful science learning via utmost student involvement. (MAXWELL et al. 2015). IBSL is a type of science instruction that not at all like the perpetual model where the educator delivers facts, and the students learn them, on the contrary, this approach offers youngsters the chance to investigate "hands-on" to analyze, to pose inquiries and to create reactions dependent on thinking. (Daniele & Pina. 2019).

1.2 Purpose and study questions

The current study purpose was to investigate the aspects of the formative assessments on improving middle and high school students’ science inquiry skills in Al-Ain City, UAE.

Popham very plainly marked that formative assessments contain a series of actions, the pivot of which to mend and expand students' learning in the classroom and he identified FA as transformative evaluation. (Enger & Yager. P.16.2009).

The following questions drive the study:

- What aspects of formative assessments exhibited in science inquiry-based learning documents?

- What perceptions do science teachers have about formative assessments on inquiry-based learning?
- What, if any, differences of demographic variables related to teachers and student formative assessments of IBL

1.3 Context of the study

This study was conducted in a private school that follows the American Curriculum, in AL-Ain city, United Arab Emirates.

All participating students are UAE nationals, and the experiment was carried in grade 11, in which all the participant are between 15-16 years old totaling 24 students to investigate their response toward FA and its effects on their inquiry skills. In addition to this, 11 science teachers volunteered with their lesson plans and 20 teachers -including the 11 - participate in the survey to obtain teachers' perceptions about aspects of the formative assessments on improving middle and high school students' science inquiry skills.

1.4 Structure of the dissertation

Chapter one introduced the importance of the selected topic and related the significance of the study to preceding researches and displayed the questions that lead this research. Chapter two argues the theoretical framework behind FA and IBL and their history, the value of improving students' understanding and learning progress. Section three describes the methodology used to conduct this study and provides details on the samples and instruments used within the dominion of a mixed methods approach. Chapter three is followed by chapter four, which outlines the results of the study. Section five discusses the data, draws conclusions, and presents recommendations and limitations of the study.

Chapter Two: Literature Review

The fundamental motivation behind this case study is to explore teachers' view of Formative Assessments on Inquiry-Based Learning in some science classes, in Al-Ain city, United Arab Emirates. It additionally aims to measure the students' inquiry and scientific skills towards Formative Assessment implementation in science classes. This chapter conveys a review of the literature from a few points or angles linked to FA and IBL. Specific consideration is paid to the historical and hypothetical research foundations that shed light on FA and IBL, pursued by the connection between FA and IBL in science classes. Ending with some perspectives of FA and IBL usage in UAE.

2.1 Conceptual Framework

In light of this investigation objective, the conceptual framework is intended to clarify the main thematic points that direct this examination, more specifically, on the theoretical basis for Formative Assessment (FA) and Inquiry-Based Learning (IBL). Additionally, it includes their definition, their role in the education process, and some educators' perceptions of using them in the teaching and learning process in UAE.

2.2 Historical and Theoretical Background of Formative Assessment (FA) and IBL

Traditional classroom's methods, or which we call it nowadays, Lecturing Methods or Teacher-Centered Approaches, were proven to be incredibly dull to the majority of students across the globe, as a result of that, many students were left behind during the lessons, and didn't follow up with the given knowledge. Add to the previous, students have different abilities and academic levels, which mean not all of them, may comprehend and understand the same approach, because of the reasons mentioned above. Educators did many types of research and experiments to improve the teaching and learning processes. Among the discovered tactics and methods, are the IBL and FA.

Most educators and even the ordinary people, especially students' parents, agree that learning is the center's mission of schools, regardless of the academic level. Thus, teaching ought to on its best to get the top norms of knowledge. (Rutto, 2017). So researchers always pay enormous efforts to achieve the best teaching ways, which may help the students understand and absorb the materials they are learning in schools. As Ronis mentioned in his book, "Problem- Based Learning for Math & Science", (2008), the intent of Problem-Based learning for Math and

Science is to incorporating inquiry and the internet to enable instructors or teachers to comprehend present-day studies in the brain sciences and the subsequent products for the instruction of math besides science and appraisal.

John Dewey, an American philosopher, psychologist, and notable educators in the 20th century, stressed on the experiential learning where the student discovers by doing and should be treated as a free spirit and individual with his/her interests. Dewey also shed light on how education has the scope of furnishing a child with social competence, via the integrating between a child's life and experience in and out of the school. These experiences should be accompanied by guidance and assessments from students' instructors and teachers. (Sikandar. 2015). Slavin, in his book "Educational Psychology," emphasizes the importance of environment and experiences on the child's development. Also, how they have more influences on students' lives than heredity does. (Ch. 2, 2006).

Formative Assessments are inserted and merged into the learning and teaching processes and includes consistently assembling data to create input for the students. Instructive feedback encourages the learners to adjust, settle on choices about, and improve their learning procedure. (Campas et al. 2016). In another article written by (Havens et al. 2012), it attracts regard for parts of formative feedback that have a positive effect on learning. FA can assist educators with anticipating ahead of time treating the holes of the students and changing these techniques, if vital, in the learning style. (Tridane. et al. 2015).

Orlich. Et al., Explained formative assessment, to be the continuing assessment to observe your students' progression. (P 323.2009). In other words, FA is an activity planned to provide meaningful feedback to learners and teachers. Moreover, improving professional implementations and student performance and achievements. (Bailey & Jakicic. P, 14. 2012). It includes the continuous collection and utilization of assessments, which amid guidance to understand where students are relative to the proposed objectives. Therefore, the use of that information makes a quick move to adjust educating and learning as well as to enable students to get to where they have to go. (Herman. 2013).

It was also elucidated that the power of assessments as an instructional instrument is liberated into the classroom when teacher begin to think of them for learning rather than of learning, as it had been argued that assessment for learning takes place when it is used to promote student achievement. (Orlich. et al., P 328.2009) & (Enger & Yager. P.16.2009).

Pro. Dylan William, a professor at the University of London, pointed in his paper “Formative Assessment and Contingency in the Regulation of Learning Processes”, how -using the term FA is not helpful anymore, and many researchers preferred to use the term assessment for learning instead in their studies and books such as Broadfoot, Harlen, and many others. Then he proceeded in explicating how assessment for learning is the way toward looking for and interpreting, proof for use by students and their instructors or teachers to detect where the students are in their realizing, where they have to go and how best to arrive."

IBL is a methodology that is incorporated in dynamic learning and implies students in different classroom exercises, which can upgrade their certainty, comprehension, and help them to accomplish scholarly merit. In this methodology, inquiry triggers learners' reasoning to foster and enhance their understanding of ideas in a study hall setting. (Chan et al. 2016). IBL includes a cluster and a variety of learning and teaching approaches where inquiry or research manages the learning experience. Students actively engage in several means and ways. For example, asking questions and sharing their knowledge. Another tactic is “Hands-on experiments,” which can give a sound basis for creating queries, for working with peers, and for applying the common research mechanisms. (Sofoklis et al. 2017). Chan et al. 2016, described IBL to be a student-centered methodology that can upgrade students’ confidence, comprehension, and scholarly execution in learning.

Inquiry approach fits in a constructivist paradigm in that it requires the student to observe new thoughts and settings besides questions on how these fit with their current comprehension. It is not about the teacher conveying an educational curriculum of information to the student but instead about the student constructing a perception through direction and challenge from their instructor and their peers. (Harrison. 2014).

2.3 Formative Assessment

Any assessment that does not chase the goal of grading, but is made for learning and teaching is FA. What is meant by “assessment for learning” is to identify what learners know about the concept taught. (N. Bulunuz & M.Bulunuz. 2014).

Formative Assessment is known as assessment utilized by teachers and learners to modify teaching and learning, as compared to temporal estimate that notifies policymakers or educators at the classroom, district level, or school. (E. Dunn & Mulvenon 2009). FA, including every

activity embraced by the teacher or potentially by their students, which give data to be utilized as feedback to alter the educating and learning exercises in which they are engaged in. (H. Dumont 2010). It is as well defined as a systematic activity in which evidence about pupils' learning is collected based on which students are furnished feedback during instruction. (I. Ali and H.Iqbal. 2013)

It was suggested that if teachers had the option to build up students' dedication towards education, they will utilize the robust feedback given by educators to produce interior input, and figure out how to survey their presentation, not just supporting their capacity to comprehend the moment results. Also, helping them in forming their future and making sense of how pertinent information adds to their learning for an incredible duration. (Ya-Su. 2015) FA is any task that supplies feedback to learners on their learning achievements during the learning process. It contains, for example, essays open-ended response questions, and performance tasks, such as posters and charts, presentations, or projects. (N. Glazer. 2014)

FA is a prerequisite in the Mexican educational modules for secondary school, which empowers teachers to give feedback to students amid the learning procedure by creating learning methodologies. Researches and studies on Formative Assessments demonstrate that it can significantly improve understudies' learning by helping them to comprehend the learning goals and Enhancing Historical Reasoning the appraisal criteria dependent on the feedback. (Méndez & Tirado). Gina Chinese proposed that assessment for learning, which includes FA, could make it possible to monitor and track the learning process since this sort of evaluation emanate of that learning is a functioning procedure, not an exchange of thoughts. For students to be effectively occupied with characterizing their very own knowledge is significant to ponder their accomplishment profoundly, relate it to earlier information or circumstance, to make self-evaluation exercises. (Chianese. 2012)

FA powerfully affects student learning. In general terms, FA aims to assist pupils in improving their own education. Practically speaking, FA is a self-reflective process that intends to promote learners accomplishment (SUMANTRI & SATRIANI. 2016). The FA process clarifies that while an agenda is in the developmental and planning phases, it is still pliable, and the data collected from the evaluation can thus contribute to altering in the program, which makes FA a way to inform educators on student learning, while the learning is taking place. Moreover, establishing a comprehensive FA system requires three parts to be taken into consideration; the

learning objectives, student feedback, and the planning of learner instruction based on glaring areas of improvement or errors. Thus, when a comprehensive FA program has been founded and is used systemically, teachers will be able to recognize pupils' strengths and remedy defects to attain a higher level of student learning. (Huisman. 2018)

Treating learning difficulties are held, either by altering the course as indicated by the pace of students adapting or by modifying the instructional setting through FA, which enables instructors to foresee ahead of time to fill the gaps and change the techniques in the learning process. (Tridane et al. 2015).

In FA, the prior information, knowledge learning, and the misconceptions of learners direct the way of covering the lesson. Since the assessment is given amid the activities, it furnishes both students and teachers with feedback concerning the learning and the instructing of the lesson. (Bulunuz & Bulunuz. 2013)

2.4 Inquiry-Based Learning

Five sciences have recognized the fundamental capacities that are normal for secondary school students. Threshold Learning Outcomes (TLOs) as an establishment to express the required logical aptitudes of a science graduate (Yates, Jones and Kelder 2011) which are exhibiting an excellent comprehension of science as a request, speaking to the expansiveness and profundity of the substance information, and imparting learning to reality (Yates et al. 2011).

The Science Students Skills Inventory (SSSI), sorted these abilities in six critical territories, which are cooperating, oral correspondence, logical composition, relevant information, quantitative aptitudes, and moral reasoning. (Matthews and Hodgson 2012).

Five of these abilities are grown viably by upgrading intuitive learning exercises in possible classes that actualize IBL guidance (Aurora 2010) particularly, an in research center examinations. As more of late, Hodgson, Varsavsky, and Matthews (2014) contended that conventional training directions give understudies the required substance information without building up any of their learning aptitudes, while commonsense research center classes dependent on IBL exercises use all the six designated logical abilities as seen by 93% of the understudies in their examination.

Efficient IBL curricula must give students the necessary information, assets and aptitudes required, and, as needed, at each point amid the inquiry cycle. (Ting. et al., 2019).

Fundamentally, learning science is a physical endeavor to decidedly comprehend the natural events in the encompassing condition through perception, addressing an examination that requires acquires some essential logical aptitudes (Cincera 2014). IBL, a strategy that was found to have much more positive influences on the attitudes of the learners towards science, in contrast to the traditional teaching approach (AKTAMIŞ. et al.2016).

Inquiry-Based Learning is the key in setting up a workforce that is adjustable in its reasoning and ready to work with more noteworthy self-sufficiency. While abilities in set routines were wanted properties previously, today, every laborer is relied upon to think, take care of conceptual issues and produce new thoughts for development (Ramnarain and Hlatswayo. (2018)

The group of approaches that can be characterized as IBL includes Project-based Learning, Design-Based Learning, and Problem-Based Learning.

Project-Based Learning includes the completion of a complex undertaking that commonly results in a reasonable item, occasion, or representation to the audience.

Problem-Based Learning performs a cousin of Project-Based Learning and is frequently arranged as an explicit sort of task that means to instruct problem definition and arrangement strategies.

Design-Based Learning has grown out of the possibility that kids more adapt when they are asked to plan an artifact that requires the comprehension and use of knowledge. (H. Dumont 2010). Inquiry Approach teaches learners how scientists work. This method can stimulate students to become curious, cooperative, thinkers, and problem solvers. (A. Widowati et al. 2017)

Numerous science researchers have actualized inquiry science training projects to improve the current situation of science learning and educating by putting more accentuation on cultivating students' profound logical understanding and less emphasis on memorizing and remembering science facts. (Ou Liu et al. 2010)

Inquiry practices appear as constructing clarifications, assessing accessible sources of data to report one's perceptions, interpreting information or results, and testing hypotheses. (Gubbels. et al. 2013). Inquiry-based learning tightens active participation and students' responsibility for finding the knowledge that is new to them. In this process, learners frequently carry out a self-directed, partly deductive and partly inductive learning process by conducting experiments to

investigate the relations for minimum one set of independent and dependent variables. (M. Pedaste. 2015).

Inquiry is a multifaceted activity that includes posing questions; making observations; checking books and different sources of data and info to perceive what is as of now known; planning investigation; checking what is already known in light of exploratory evidence; utilizing tools to assemble, analyze, and decipher information; proposing answers, clarifications, and predictions; and conveying the results. (Forawi & Liang. 2011)

2.5 The Correlation between Inquiry-Based Learning & Formative Assessment

In FA, the prior knowledge and the misconceptions of learners direct the manner of delivering the lesson. Within the scope of this method, assessment is made before and during teaching to learners' imperfect and inadequate learning. (N. Bulunuz & M.Bulunuz. 2014).

Obviously, the possibility that assessment can help to learn is not new, however, what is going on is a developing assortment of evidence that proposes that regard for what is in some cases called FA, or assessment for learning, is a standout amongst the most dominant methods for improving student accomplishment. (D. Wiliam 2013)

In FA instructor and kids have roles in gathering and utilizing proofs and evidence of learning as it happens. The students' job necessitates that they know the objectives of their work and the quality criteria to be connected so they would themselves be able to survey where they are in connection to the targets to set the next step in their learning process.

The job of educators in utilizing evaluation along these lines is not just to discover where kids are in this progress, and to give exercises the appropriate measure of a test to propel their current thoughts and abilities, yet to impart the objectives to students and help them assess their progress towards them. (Harlen 2014). Evaluation during the inquiry in progress instead of depending entirely on the proof in the written work that the kids delivered was a new experience for the educators. By listening cautiously to students' discussion, or their solutions for issues or to the group reflections on an inquiry action, enables instructors to assemble evidence of their students' developing understanding. Therefore, educators can note confusions and misconceptions, distinguish somewhat responded to inquiries from full answers, and perceive blunders and possible reasons why such mistakes are happening. (Harrison. 2014)

FA also rouses the pupils to be increasingly engaged and gives a chance to screen various parts of their learning. Moreover, it is expected to support students and educators to keep tracking on students' development casually and to make a therapeutic move when learning challenges rise. (SUMANTRI & SATRIANI. 2016). FA is more likely to increase learning by a substantial amount (H. Dumont, 2010).

Pre-questions could be used to guide the inquiry process, which may be considered a sort of feedback as (Rodríguez et al. 2019) wrote; teachers might start with stimulating questions in guided inquiry to motivate the searching procedure, but learners are self-directed in scouting these questions.

(Heeneman. et al. 2015) Suggested that the active participation of students in their own learning is conceivable when education is bolstered by programmatic assessment. Specific highlights of the extensive program of appraisal were found to affect the teaching, and this impact can either strengthen or restrain students' learning reactions.

Components from the exhaustive program of assessment, for example, criticism, was found to have both supporting and repressing consequences for learning. These supporting and inhibiting components influenced students' development of education. Discoveries demonstrated that: learners' apparent developmental appraisal as summative; automatic evaluation was a significant trigger for learning, and the portfolio's reflective exercises were acknowledged for their generation of information, the activities drawn from feedback, and the chances for follow up. A few students, in any case, were less keen on reflective exercises. For them, the components saw as repressing appeared to rule the learning reaction. As promoting thinking is the primary aspect of IBL, It can be made evident through procedures, for example, whiteboarding, discussion, FA, journaling, and prompts for clarification. (C. English & Kitsantas. 2013).

It was found that teachers required planning assessments properly; thereby, their students would effectively be led towards viewing a scientific event in a similar way to what their instructors perceive it. Such a method needs the teachers to notice of what their pupils struggle with and then plan and carry out teaching that assists their students to improve. In other words, the strategy that teachers need to apply is formative. (Harrison. 2014). For inquiry to be utilized more widely, there is a need to perceive approaches to evaluate students that different esteem sorts of understandings, as opposed to concentrating and detailing just on restricted content.

Challenges emerge in an essential mathematics inquiry classroom when utilizing FA, which prompts for their viability in inspiring valuable appraisal data and gathering this data that would help teachers to provide students with helpful feedback. (FRY 2011). Peer assessment was revealed to be a unique element of FA practice, which collaborative learning by promoting students to give task-focused criticism to one another, which thus, progressively supports individual learning, as students increase more prominent comprehension of value results in scholarly subjects. (B. Gardiner. 2017). FA is used as a source of continuous feedback to improve education, on the other hand, useful formative feedback is not only based on observing the progress towards lesson's goals, but it also encourages students to develop efficient learning strategies, (M-SanJosé. 2015) including inquiry skills.

A research carried by (I. Ali and H.Iqbal. 2013) gives some confidence about the validness of the outcomes and encourage on using FA while teaching science. Therefore, the science teachers should merge FA tactics, such as think-pair-share, questioning, and dialogic feedback, and so on, into teaching for enhancing learners' achievement in science.

2.6 Formative Assessment and Inquiry-Based Learning in the UAE.

A research study that was conducted by (Sura Sabri 2015) investigated students' and educators' vision and practices of FA of IBL exercises in the education environment in the UAE. Teachers' practices and perceptions reflected positive directions for utilizing FA in physics and chemistry lessons. Nevertheless, biology teachers appeared to display less involvement in using distinctive FA procedures. A study of the effectiveness of Inquiry-Based Learning and Project-Based Learning of science and language subjects at high school level in the UAE found that IBL strategies could have an enormous positive impact on learning outcomes, at least based on the plan that was employed using pre and post-test scores. It also found that IBL was most suitable in settings where Science, SPED, and English subjects, were being taught; but it was incompatible with Math. (T. YOUNIS 2018).

According to a study's results, carried by Dr.Areej ElSayary, it was found that moving the harmony between the three sorts of appraisal (evaluation of, for and as learning) is significant, to concentrate more on the assessment as learning that expects students to reflect and receive feedback for their work to improve it. (2018).

Inquiry-Based Learning Professional Development (IBPD) is essential for science educators to enhance their attitude, practices, and knowledge when teaching science using the IBL method. Teachers who attended IBPD sessions had positive perceptions about using IBL in their classes as they began to engage their learners in inquiry activities more regularly and professionally. Their self-effectiveness had been improved as they became more confident of their successfulness in implementing these types of lessons. (R. Amaireh 2016)

The PBL (Project-Based Learning) initiative at UAEU establishment program is found to inspire and engage students and to give chances to create curriculum competencies. Learners were seen to build up various associations that support their learning all through their college instruction and beyond. The two students and scholarly staff identified that the PBL course firmly added to the improvement of the educational curriculum competencies. (Chowdhury 2015).

Chapter Three: Methodology

The current study investigates the aspects of the formative assessments on improving middle and high school students' science inquiry skills in Al-Ain City, UAE. Consequently, it seeks to identify perceptions and influence of utilizing and embedding FA in science classrooms on students' inquiry based-learning skills.

This section will assure the authenticity and reliability of the study, by conducting quasi-experimental, provide details on ethical considerations, and study limitation. On the other hand, it will lay out the study design and methods, including the sampling, participants, site, study means, and instruments.

3.1 Study Design

The nature of this study needed practical and experimental work to gather reliable evidence, as its main aim is to collect information and data about the efficiency and influence of formative assessment- with its different forms - on the inquiry skills of the pupils.

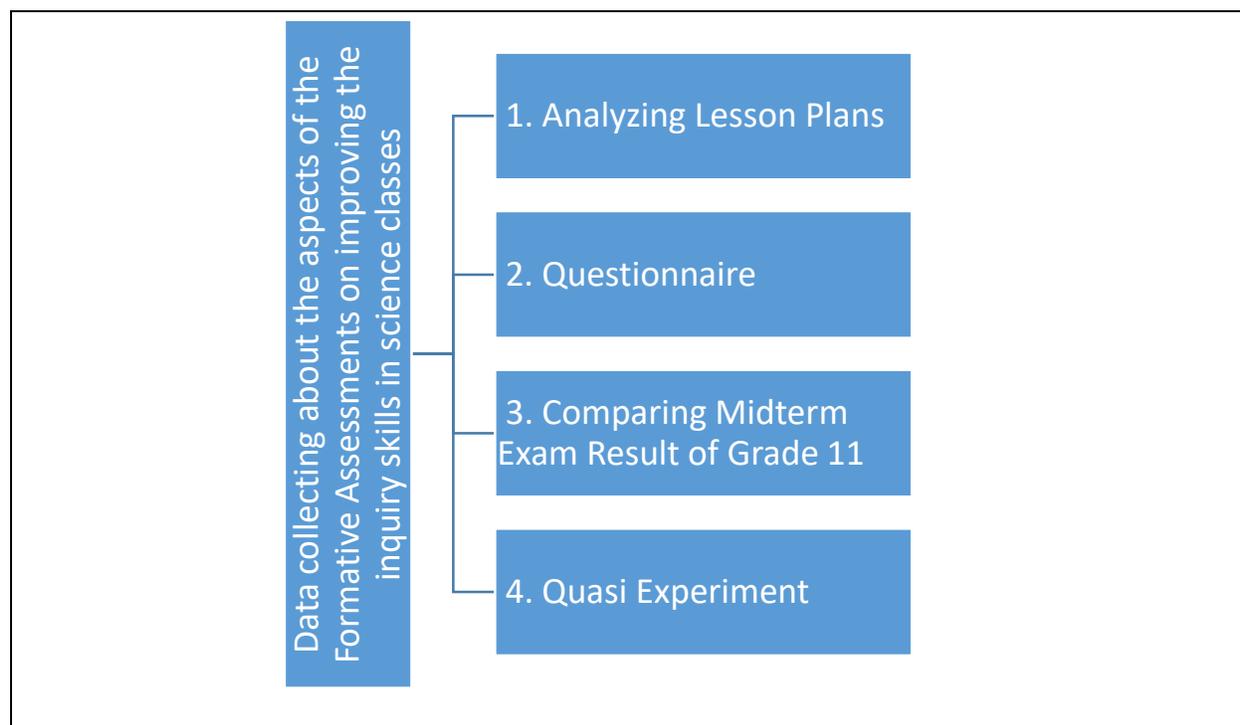


Figure 2; displays the main steps that have been followed to collect the needed data

Firstly, lesson plans from K-12 private schools in Al-Ain City that both follow the American curriculum were collected to study if the FA was used in the science classes, and how often it had stated in the lesson.

Secondly, the questionnaire was distributed to science teachers in both schools to learn about their perspective for embedding FA in their classes.

Thirdly, comparing the results of midterm exams for the 1st and 2nd semesters, of two classes was done; as that the researcher had taught “11B1” and “11B2” for the current academic year.

In the first semester, lessons were conducted by using Teacher-Centered Approach in the first month and a half, as the student's behavior starts to improve a minimum cooperative and inquiry-based learning was carried out with a minimum of FA usage in the classes.

On the contrary, Student-Centered Strategy and IBL method were carried out in the 2nd term with the FA implementation throughout the lessons.

I need to note that 11B1 students were taught with the student-centered Approach, with no to least use of FA; for experimental causes for only two weeks.

Finally, a Quasi-Experiment was delivered to 11B1, for four weeks on semester two, to test the FA effects and aspects with scientific and practical base, to prove the arguments, discussions, and results of this study on a solid ground floor.

An Exploratory Sequential Mixed Method was chosen to perform this study, because it unites or integrates of qualitative and quantitative research, that makes it a better choice as it posses many pros than the other methods. Some of its properties, for example; it is comparing several viewpoints pulled from quantitative and qualitative data. Also, it is promoting a better measurement tool by collecting information, followed by analyzing the information. Afterward, it administrates the instruments to the selected sample. Add to the previous advantages it gives a more satisfying and full understanding of the modifications needed for a private group through the combination of qualitative and quantitative data (W. Creswell. 2014). It looks into embraced by at least one scientist which consolidates different components of both quantitative and qualitative methods to deal with research together with the idea of the derivations produced using analysis, the motivations behind which are to give a more extravagant and more dependable comprehension of a phenomenon than a solitary methodology yield. It includes information accumulation, investigation, and understanding of concentrating that, separately or together,

address a specific aspect. (Cohen et al. 2018). Manmeet Kaur, an Associate Professor of Health Promotion, in Post-Graduate Institute of Medical Education and Research, India, justify using the mixed method in his article as it harnesses thorough quantitative research to survey size of the issue and thorough qualitative research to investigate the importance and comprehension of the build and the unique circumstance. It is the deliberate joining or mix of the two strategies, that is, quantitative and qualitative, to draw on the qualities of each to address particular research questions. It outlines examination inside the philosophical and hypothetical places of both quantitative and qualitative strategies. (2016). On the medicine field studies was also written that mixed methods research offers critical chances for scientists to pick up a more profound comprehension of complex medical problems than would some way or another be conceivable through the utilization of either quantitative or quantitative information on its own. (J. Halcomb & Hickman. 2015).

The mixed method also has the capacity whereby the whole is more worthy than the total of its parts. The blend of qualitative and quantitative methodologies holds the guarantee of making a synergistic research venture in which one strategy empowers the other to be increasingly successful. Together, the two techniques may give a full comprehension of the examination issue. (Biber. 2016)

3.2 Context

It was aforementioned in 3.1, which this study was run in four directions as illustrated and briefly discussed in the first section of this chapter.

Proceeding with the study design, the reasons behind choosing these particular schools are; firstly, the easy access to the resources and teachers working in both school, due to my work in one of them and personal connections in the other one.

Secondly, these two schools are under the umbrella of Next Generation Science Standards (NGSS), which lead to applying the 21st-century skills and inquiry-based learning skills in teaching science, resultantly, it is a classroom routine to use FA among the lesson. Hence it will facilitate and eased up my study.

3.3 Study instruments.

Several instruments and tools were used to collect data for the sake of this study, for instance, lesson plans, questionnaire, midterm exams, and a quasi-experiment.

Lesson plans provided a summary of the education process' rote in the science classes and how FA was operated during them. The most known gizmo of them is the teacher questionnaire, which conveyed the teachers' perceptions of the FA. Also, comparing summative exam results between two semesters was used as a tool to weight the effect of FA in classes, since FA was not used during science lessons in one of the term highly but was used heavily in the other one.

The last exciting tool was the quasi-experimental; this appliance provides a link with real life for the study and actual proof of Formative assessment's imprints on the inquiry skills.

3.3.1 Lesson Plan

In order to track FA utilizing in science classrooms in both schools, ten teachers voluntarily provided me with their lesson plans, two plans per teacher as a minimum number, totalling of 22 lesson plans, as one teacher gave four plans because she/he is teaching two science branches- environmental science and biology.

Figure 3, presents some lesson plans samples. Additional samples of lesson plan are in appendix 1

DAILY LESSON PLAN 2018-2019						
Subject:	Biology	Teacher's Name	Mirna Abou Matar	Week	4	Term [] First [x] Second [] Third
Name of Lesson	Nervous System	Grade level	11	Date: From	27/1/2018 to 31/1/2018	Period number: 2/3
Standard	HS-LS1-2: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.					
Relevance to UAE culture and everyday life: (My identity standard)	1. Arabic Language: Language of communication and thoughts. How can we communicate with each other? What allows us to think?					
Implementation of STEM and HOTS	Phet simulation for neuron and action potential					
Student competency Framework standard/Theme	Communication, Self-confidence, Critical thinking, Independent learning					
Moral education Standard	Respect, Resilience, Tolerance					
Prerequisite and Prior Knowledge required	Cells, nucleus					
Lesson Objectives (in bullet points) Use Bloom taxonomy	By the end of the Lesson students would be able to: <ul style="list-style-type: none"> - All: define resting potential and action potential. - Most: Describe the movement of ions across the neuron membrane in a resting neuron and a stimulated neuron. - Some: Deduce why do we say that an impulse can reverse the resting potential. 					Key Words and terminologies Action potential Resting potential Nerve impulse

DAILY LESSON PLAN 2018-2019							
Subject:	Biology	Teacher's Name:	Mona Zahra	Week:	9	Term: [#] First [] Second [] Third	
Name of Lesson:	12.1- Identifying the substance of genes	Grade level:	12	Date:	28/11-1/11	Period number:	3/4
Standard	HS-LS3-A. Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming specific characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no						
Relevance to UAE culture and everyday life: (My Identity standard)	Emphasizing on the importance of study of genetic materials to be able to deal with many genetic problems in the UAE						
Implementation of STEM and MOET	Constructing a chart that shows the sequence of discovery of genetic material						
Student competency Framework Standard/Theme	Self-confidence and Initiative						
Moral education Standard	Resilience						
Prerequisite and Prior Knowledge required	The steps and conclusion of the 3 experiments.						
Lesson Objectives (in bullet points)	By the end of the Lesson students would be able to: Creating a chart that shows the sequence of discovery the genetic materials				Key Words		
Resources required (to accomplish your Objectives)	Computer, projector, PPT, animation, textbook, chart, colored pens						
Starter	I will bring my students to my Lesson by: Recalling the experiments of discovery of genetic materials by asking questions (Blind fold) Max 10 min.						

Lesson Information			
Teacher: Hani	Grade Level: 11		
Term :2	Date:10/02/2019	Week:1	Period:4
Strand/Domain:Physical science		Lesson Title:Expressing reaction rate	Class: A
Key/ New Vocabulary:Reaction rate		Number of students: 16	
Learning Attributes		Required Resources:White board, data show, white boxes.	
Value of the Month:Honesty		Homework or Out-of-School Learning	
Competence(s): o collaboration/teamwork o communication o critical thinking o creativity o cultural awareness/citizenship o digital competence o entrepreneurship o global and environmental awareness o independent learning o initiative/self-direction o leadership and responsibility o problem solving o self-confidence		Search to find out the relation between Boyle's law and emphysema Date due:13/02/2019	
Expectation(s) – Use of Prior Data		Application and relevance of this lesson to: OTHER SUBJECTS/ REAL WORLD/ UAE Physics: speed, Math: Average//average of speed of the car//Reaction rate in summer in UAE	
Standard(s): HS-PS1-B (1-4) (1-5)		My Identity Themes: o UAE Culture o Emirati Community o UAE Values o Arabic Language o Citizenship o UAE History	
Learning Objective(s): To calculate the average reaction rate		Assessment Menu	
STUDENTS' PRIOR LEARNING: What relevant skills do they already know?		Diagnostic	
OTHER DATA ABOUT STUDENTS TO BE TAKEN INTO CONSIDERATION		Formative	
Students' Performance Results (Based on the Most Recent Assessment Data)		Pre-test	
Class		Class work	
80%-100%		Homework	
60%-79%		Practice Quiz	
Below 60%		Self-Evaluation	
		Peer-Evaluation	
		Other: Investigation	
		Other:	
Learning Development		Time	
Starter		5 min	
		-distribution of groups by cards and remind them for their tasks -Do you know how to strengthen your lung? -Exc. -1 min.video	

Figure 3, Samples of lesson plans

Figure 3.2. Illustrates a table that was created and organized, in order to summarize the plans' details; So their info would be more accessible and readable.

of the plan, which shows the lesson’s title, objectives, number of times FA were used and in which sections of the lesson it was used.

3.3.2 Teacher questionnaire

Figure 5, questionnaire

Formative Assessment and Inquiry Questionnaire

This is a brief questionnaire to elicit teachers’ perceptions of the aspects of the formative assessments on improving the inquiry skills of the middle and high school students. Please, answer to your best knowledge. The data and result will be presented with confidentiality and that your participation is voluntary. Thanking you in advance.

Part A- Background Information (kindly place (x) on the appropriate response)

1. Gender: _____ Male _____ Female

2. Type of School you Currently Work in:
 _____ Public School _____ Private School

3. Level:
 _____ Kindergarten _____ Primary School
 _____ Middle School _____ High school

4. Subject taught:
 _____ General _____ Biology _____ Chemistry
 _____ Physics Other (please specify.....)

5. Teaching Experience:
 _____ Less than 5 years _____ 5 – 10 years _____ More than 10 years

B- Please place (x) in one appropriate box

First table is a questionnaire about teacher FA instruction

No	Statement	Responses			
		All the times	Most of the Times	Several times	Few times
1.	I usually use formative assessments in in my classes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Formative assessment helps you in delivering the information effectively.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Formative assessment motivates my students.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Formative assessment provides my students with self-confident.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Formative assessment improves the student’s competency and inquiry skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The second part: Teacher perceptions of how students with the formative assessment.

No.	Statement	Responses			
		All of them	Most of them	Some of them	Few of them
1.	Students response easily and effectively to the formative assessments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Students are confused and misled by formative assessment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	The creativity of the students is triggered by formative assessments.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Students show better inquiry behavior in lessons when formative assessments are provided.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Part C: Open-ended Questions

This section of the survey contains open-ended questions related to various aspects of the formative assessments on improving the inquiry skills. Kindly answer them with as much clarity as possible.

1. In which part of the lesson do you usually choose to give the formative assessments?
Why?

2. Do the formative assessments lead the students to unexpected solutions of a question or to a problem they are facing? If it does, how often it happens in your classes.

3. From your point of view, what is the impact of formative assessment on the inquiry skills of the students?

One of the best data-collecting instrument is the questionnaire, where you can use any research methodology you prefer, put the types of questions most suitable to your study and distribute it sufficient to numbers of people even if they are not participating in your research.

The objective of written questionnaires is to assemble semantic information. In addition to that, they have various inherent points of interest, including a simple setup for comparative examinations, the potential of summation data from numerous members/respondents, and alternatives for multiple kinds of execution. Concerning the last mentioned, a composed questionnaire for aimed developments can, for example, be executed as an adequacy judgment task, a fill-in-the-clear assignment, an interpretation task, or a redress task. (Klok & Conners. 2019).

In this questionnaire, I used the mixed-approach, which is put to use to accomplish the integral outcomes by utilizing the strengths of one strategy to improve the other one in a single study. Moreover, two theoretical explanations behind the mix of quantitative and qualitative methods in a such a study, that is picking up a progressively complete comprehension of the phenomenon and accomplishing parallel outcomes by employing the qualities of one strategy to upgrade and improve the other one. Besides, the essentialness of blend is that by consolidating tactics in a similar report, the specialists can somewhat defeat the lacks or predispositions that emerge from one technique. (Qazi Abro et al. 2015).

Questionnaires are valuable for unique get-together information about individuals, their conduct, encounters and social cooperation, mentalities and assessments, and attention to occasions. They, for the most part, include the accumulation of quantitative and qualitative information. Polls present institutionalized, formally organized inquiries to a gathering of people, frequently attempted to be an example of a more extensive populace. (M. McGuirk & O'Neill. 2016).

The primary purpose of this study questionnaire is to elicit teachers' perceptions of the aspects of the formative assessments on improving the inquiry skills of middle and high school students. I started it with some personal questions about the participant, followed by three parts of assessments.

In the first two sections, the quantitative approach was applied, on the contrary with the third where the qualitative method was used.

The advantage of using the quantitative approach in any research is its final report, which has a set body consisting of an introduction, literary text, hypothesis, tactics, results, and discussion. so anyone can examine scientific theories by testing, the relationship via variables. These variables can be weighted, typically on instruments, so that the numeric data can be analysed using statistical processes. (W. Creswell. 2014).

In contrast to the final quantitative report, is a qualitative approach's final report, one usually has a flexible structure, which was caused by the absolute dependence on this method on understanding and scouting. Furthermore, the meaning person or crowds ascribes to social or human troubles and issues. It involves emerging questions and procedures, data gathered in the participant's setting, data analysis inductively structurally from particulars to main topics, and interpretations were made of the meaning of this data. (W. Creswell. 2014).

The reconnaissance, in this case, is used to help to measure the effects of FA in IBL classes, if it has positive impacts on the students' inquiry skills, achievement, and understanding or not.

It is used to measure whether the FA is supportive tools in the learning and education procedure and if it guides the students in their inquiry and innovation journey.

The first part was about the teachers' instructions toward FA. How often they use it and how they felt regarding their effects on their students.

Section number two involved questions also for the teachers about the responses of the pupils against FA instruction, and it influences their skills, understanding, and behavior in the class

The last division possessed three open-ended questions to examine the viewpoints of teacher about FA effects on inquiry-based learning skills.

The selected sample were teachers of the different branches of science, included environmental science, chemistry, biology, and physics for middle and high school. The participants worked in three different private schools in Al-Ain city.

The schools' primary goal is to convey the learning and teaching method to entirely student-centered approach. Plus motivating the innovation and the inquiry skills in their students, hence FA is one of the tools they are using in their classes, and they are familiar with its different strategies; as a result, it eased the collecting data task and made it more applicable.

Dr.Sufian Forawi, a professor in BUID, faculty of education, checked the validity of the questionnaire and proposed some minor changes on it, which were fixed.

3 3.3 Comparing midterm exam result of grade 11 (real-life link)

This part may appear irrelevant to the study for as we are arguing the FA influence on inquiry skills, not on the summative assessment. Nevertheless, in my point of view as a teacher for almost 13 years, learning and teaching are complementary processes, means if FA has a positive impact on the inquiry skills; correspondingly, it has the same effect on the summative assessments, as an example of the summative evaluation is a midterm exam.

The reasons behind employing grade 11 midterm exam results' comparison as an instrument in this study are some issues I faced with the targeted sample when I started teaching Environmental Science at the beginning of the academic year, which facilitated and eased up the differentiation process, with the FA used as the testing variable.

Why did I decide to do so?

I thought of an opportunity to get some shreds of evidence of FA influence when applying it during the lesson, on motivating inquiry-learning skills and examine the level of the students' understanding.

These boys' classes - 11B1 & 11B2- in MIS, had behavioral issues at the beginning of semester one, which needed a direct interfering from the administration, teachers and their families to deal with their hard attitude. One of the problems concerning these pupils was refusing to do any cooperative learning. That is when I get the idea to consider them, as a sample for my study, what encouraged me further to proceed with it, was their behavioral improvement, as we were moving toward the end of the first term.

In the second term, they cooperated and began responding to the instructions, and behaved well, which made it possible to start teaching with the cooperative learning methods and encouraging inquiry-based- learning, excluding the first two weeks, at the beginning of the second semester, to conduct the quasi-experiment with grade 11B1.

3.4 Participants

The current investigation included two participant groups, teachers, and students.

The teachers who offered their lesson plans were 12 teachers from the two schools, who are teaching the different branches of science in middle and high school.

On the questionnaire part, twenty (20) science teachers were involved, also from the same schools, they are teaching middle and high school, for different science branches.

Regarding the students, the sample that was chosen for the first investigation (the grades' comparison), and because of particular reasons listed in section 3.2.2.3, was grade 11 boys in MIS, twenty-eight (28) students in the two classrooms, in the first semester, but they became twenty-six (26) students in semester two, since two students left the school.

The last tool used in the study was the quasi-experimental, in were twenty-four (24) students, in grade 11B1, were the experimental target, due to their high attendance record in the first semester against grade 11B2, which make the investigation more accurate and applicable.

3.5 Quasi-Experimental

The quasi-experimental is so called because they did exclude all the highlights of an actual examination, as a complete experiment, control is not generally possible, particularly concerning the randomization and use of mediation. (Dutra HS & Reis VN dos.2016). This type of field experiment basically, obtained prominence in social science research and is more over-applied to fulfill the needs of this research. Moreover, it progressively utilized to accomplish harmony among inward and outside legitimacy. (A. Handley et al. 2018)

(W Grabbe. 2015), listed some pros of experimental designs in their book, which made it the most suitable choice to run this investigation:

- 1) Better inside legitimacy.
- 2) Greater control of incidental variables.
- 3) Ability to characterize causality.
- 4) Replicability is simpler to produce.

The experiment was run for four weeks at the beginning of semester two, with grade 11B1-24 students with a high attendance record- as the investigation sample. The class was taught with the student-centered Approach, with no to least use of FA. A minimum intervention of the teacher

was in the first two weeks, the students were asked to search for solutions for any problems, and mostly no FA was given to the students.

Then in weeks three and four, FA was highly implemented in the class, such as class discussion, peer assessment, matching game, online APP, most notable the using of feedback after each task or activity.

Three main tools were used via the quasi-experiment duration:

3.5.1 Individual Track Sheet.

Figure 6 illustrates the track sheet used to follow students' achievement through the experiment's period.

One sheet was used per each environmental class; it was divided into ten columns;

The first column for the student's name, the next and the third ones was used to record the cooperative work attitude and the innovation ideas students come up with while there are working.

The following columns were filled with different criteria, starting with the ability of the students to raise questions, participation amount, classwork, independent learning, the ability to search for the answers and solving critical thinking problems respectively.

Note that, classwork is a short question at the end of the period, which solved individually, and used to check the students' understanding.

.....	Week :	Date:	Subject:
			Grade :

Period: -----

Groups	Follow instructions	Creativity	Timing	Behavior
G1				
G2				
G3				
G4				
G5				
G6				

Period: -----

Groups	Follow instructions	Creativity	Timing	Behavior
G1				
G2				
G3				
G4				
G5				
G6				

Figure 7, record students' attitude

The above picture shows that the sheet was divided into five columns

The first column for the group number, the second to records if it was easy for the students to follow the instructions.

The rest is for the students' creativity, their abiding by the assigned time, and the last one for their behavior.

3.5.3 Projects

The below figures (8 & 9) show two rubrics that were using the experiment and their rubric.

The first one was used in the first two weeks was about the causes and impacts of global warming, and the other one in weeks three and four was about how water and healthy diet affect human bodies health and daily activities.

The rubric was used to evaluate the students.

**Project Outlines
Science Department
Term 2**

Project Title:	Describe the causes and impacts of the global warming		
Teacher's Name	Wasan Mahdawi	Grade:	G11
Starting Date:		Number of allocated periods for project	2
Nature of Project:	<input checked="" type="checkbox"/> Individual	<input type="checkbox"/> Groups	<input type="checkbox"/> (Both)

Project title:	
Related standard/s:	HS-ESS3-1
Curriculum area covered	Non-renewable Energy Source
Learning Objectives of Project:	
<ul style="list-style-type: none"> - Explain the influence of fossil fuels using in increasing temperature and the formation of global warming. - Identify the impacts of fossil fuels burning on global warming. 	
Outcomes/products:	
<ul style="list-style-type: none"> - List and describe the effect of the released substances from the burning of fossil fuels on the climate change and global warming. 	
Used materials:	
<ul style="list-style-type: none"> - Posters, colors, colored papers, glue, clay, scissors, rulers, markers, pipes cleaners, I-Pads,... 	
Procedure	
<ul style="list-style-type: none"> - Surf the internet OR use your book to collect and summaries information about: (please prepare these information before the class) - The effect of using and burning fossil fuels on the Global Warming. - Make a poster or a model using these information to explain the Global Warming, depending on what you have been studying in the environmental science. - Explain the causes of the global warming as mentioned above, and its impacts on environment and human being. - List some solutions that is already been working on, or give some suggestions to decrease the Global Warming on earth depend on your knowledge and researches. 	

Figure 8, Project Outlines

Project Evaluation Rubrics
Science Department-(Environmental Science) Term 2

Teacher's Name	Wasan Mahdawi	Grade:	11
Starting Date:		Deadline Submission Date:	
Software Used	-----		
Nature of Project:	Pair work – Group work (poster)		
Student Name:			

Aspect of Project Work		Max Value	Student's Score
Part 1: Knowledge			
1	Student was able to identify the causes of the global warming	2	
2	Student was able to identify and describe the impacts of global warming on organisms and earth.	1	
Part 2: Application			
3	Student was able to write correct and accurate information about the importance of water and its effects as a part of healthy diet on the human bodies	2	
5	Student was able to display project properly (neatness, pictures, spelling, clear handwriting)	1	
Part 3: Pair work- Group work			
8	Student shared provided materials and their thoughts.	1	
9	Student was able to be an effective member	1	
10	Student was able to overcome any problem.	1	
Part 4: Date of submission			
11	Student submit the project on time	1	
Overall Total Mark		10	

Project Evaluation Rubrics
Science Department-(Environmental Science) Term 2

Teacher's Name	Wasan Mahdawi	Grade:	11
Starting Date:		Deadline Submission Date:	
Software Used	-----		
Nature of Project:	Pair work – Group work (poster)		
Student Name:			

Aspect of Project Work		Max Value	Student's Score
Part 1: Knowledge			
1	Student was able to identify the importance of water and its effects as a part of healthy diet on the human bodies	2	
2	Student was able to identify how many liters or cups of water should we drink in order to balance our healthy diet and how it affect our daily activities.	1	
Part 2: Application			
3	Student was able to write correct and accurate information about the importance of water and its effects as a part of healthy diet on the human bodies	2	
5	Student was able to display project properly (neatness, pictures, spelling, clear handwriting)	1	
Part 3: Pair work- Group work			
8	Student shared provided materials and their thoughts.	1	
9	Student was able to be an effective member	1	
10	Student was able to overcome any problem.	1	
Part 4: Date of submission			
11	Student submit the project on time	1	
Overall Total Mark		10	

Figure 9, Project Evaluation Rubrics

3.6 Ethical considerations

Formal permission from the school's administration (Appendix 3) was granted to conduct the quasi-experimental in the school campuses, to maintain research validity and integrity (Sura Sabri. 2015). In the addition of that, the participant teacher, who their names were mentioned, gave verbal approval for mentioning them in the study. In addition, the questionnaire aim was explained in it, the beginning of it to assure that all data will be used for study purposes only and will remain confidential, and anonymity was guaranteed, because the questionnaire did not require teachers to mention their names or spot, as no name category or school's name in it. As such, the investigator is not able to identify individual participants. (Sura Sabri 2015).

3.7 Limitations of the study

The limitations of this study have mostly been a short period to execute the quasi-experimental. I suggest to grantee better results and validity for any research or investigation; the time limit should exceed three months minimum, to collect more data, run more tests, and cover all the study aspects sufficiently.

Another issue is the schools' responses to this type of experiment, and the difficulties a researcher can face to get approval to apply them, therefore, awareness should be raised toward such studies and experiments, and about their contribution to education improvement for the sake of the children around schools, to be more open and welcoming toward them.

Chapter Four: (Data analysis and discussion)

Introduction

The main target of this study, as mentioned previously, is to test the effects of FA on IBL in science classes, in middle and high school.

FA intends to enable students to improve their learning. Practically speaking, FA is a self-reflective method that means to advance pupils accomplishment. (SUMANTRI & SATRIANI, 2016). On the same page, the Inquiry process can reinforce imagination and creativity. It has also shown positive effects on students' outcomes and enhanced their results. (Rodríguez et al. 2019).

4.1 What aspects of Formative Assessments exhibited in science Inquiry-Based Learning documents?

4.1.1 The Weight of FA Usage in Lesson Plans.

Lesson plans were one of the tools that used to collect evidence and data about FA, where different criteria were tested, such as how many times FA was used per class, and in what parts of the lesson it was applied.

The below map displays the percentage of FA utilized in the science classes in middle and high schools.

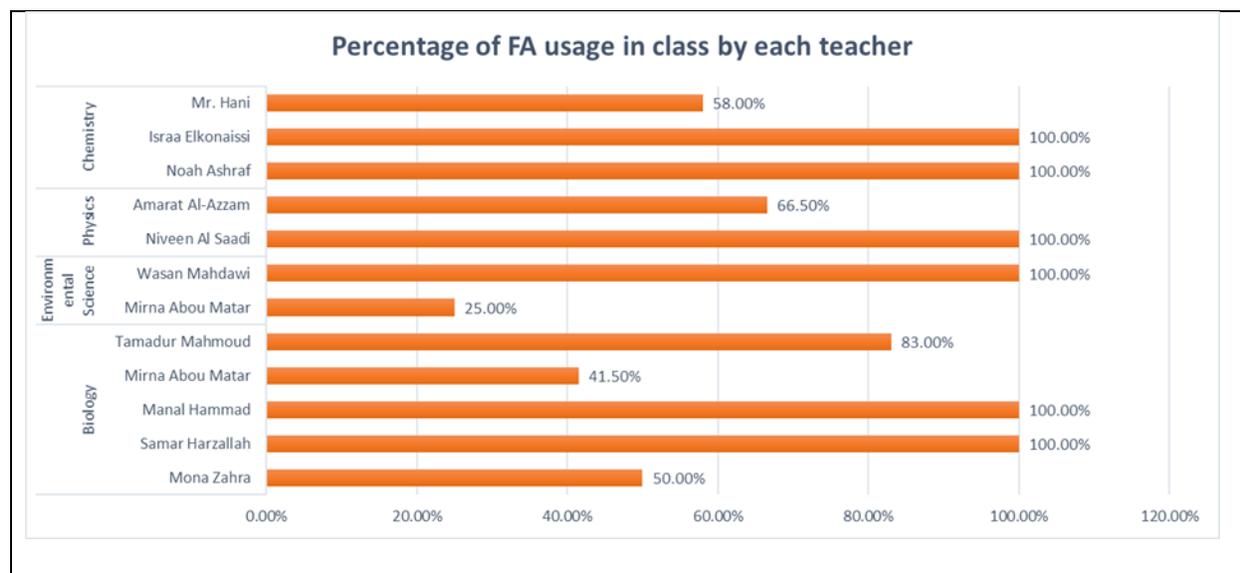


Figure 10, Percentage FA usage in class by each teacher

As I went across the plans that were provided by eleven different teachers, I noticed several types of FA, which were used in their classes. For examples:

1. Peer Assessment.
2. Feedback, which was highly used in the ranks.
3. Class Discussion.
4. Online Application, such as Plickers, kahoot.... etc.
5. Matching Activity
6. True or False Questions
7. Fill in the Blanks Activity.

Looking closely at the bar graph, we can notice that it displays the high amount of applying FA on IBL science classes, as six teachers out of eleven, use FA during the whole period by 100%, one teacher use it 83%, three teachers use it from 70% to 40%, and one teacher use it 25% among their classes.

4.1.2 Comparison between the Two Schools Regarding Using FA in Science Classes.

Twenty-four lesson plans were collected from two private sector schools in Al-Ain city for eleven teachers; each teacher provided two plans expect of one teacher who volunteered with four lesson plans, because he/she is teaching two different subjects; environmental science and biology.

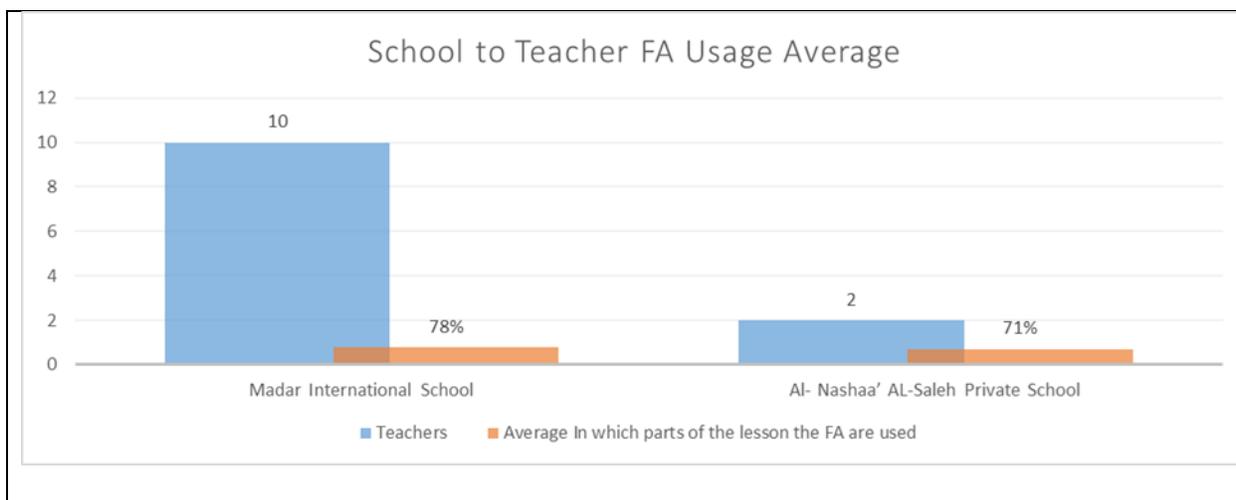


Figure 11, School to teacher FA usage Analysis

The comparison showed that the uses of FA on the IBL classes are nearly the same weight 78%: 71%, betwixt them, which indicates that the prevailing direction of teaching in schools currently is the active learning, in which FA and IBL play a significant role in it.

4.2 What perceptions do science teachers have about formative assessments on inquiry-based learning?

4.2.1 Teachers Experience and Gender

A questionnaire was used to collect the teachers' respective of the FA on IBL classes in schools; the below map 4.2.1 illustrates the general points the opinion poll asked about the participants.

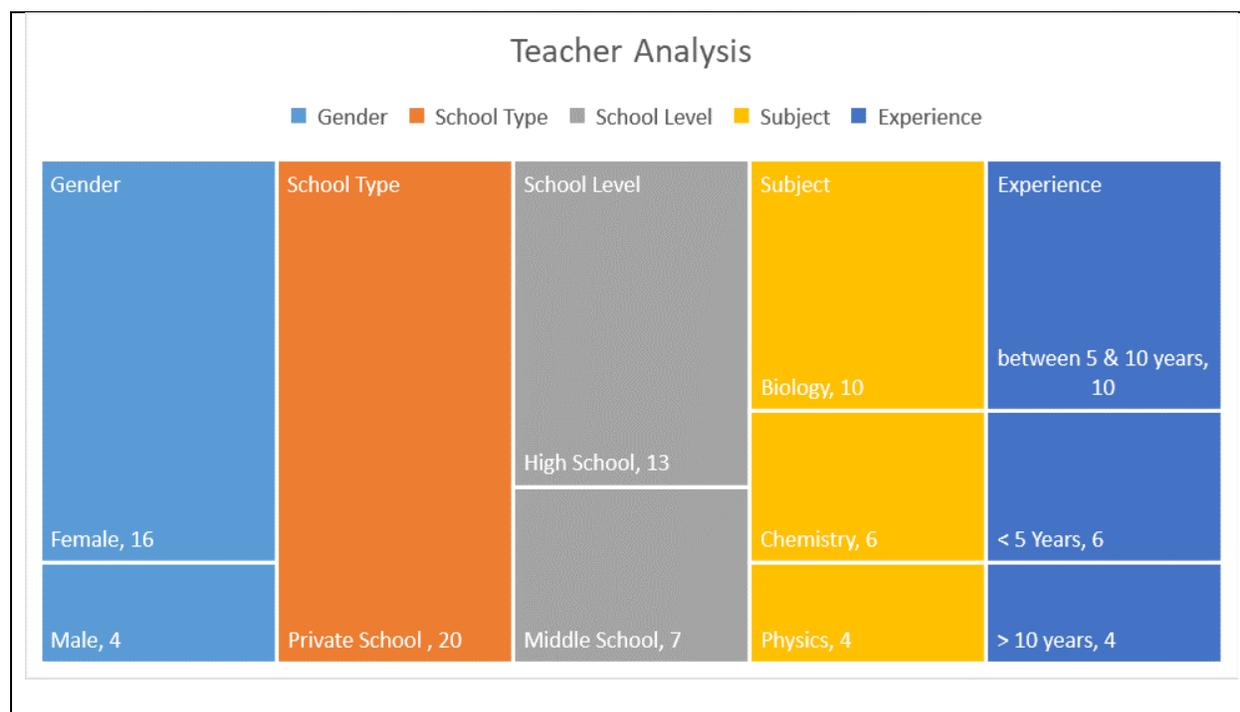


Figure 12, Teacher information Analysis

The tree-map exhibits that, the majority of the teachers who volunteered to take the questionnaire were female teachers (16 out of 20 teachers), and only four were males. Ten of the tested teachers have five to 10 years' experience, 6 has five or fewer years of experience, and only four has worked as a teacher for more than ten years. Moreover, thirteen teachers are teaching high school.

4.2.2 A Comparison of Using FA in Middle and High Schools

Middle school teachers use FA tactics more often than high school teachers do. (Anton Pav. 2018).

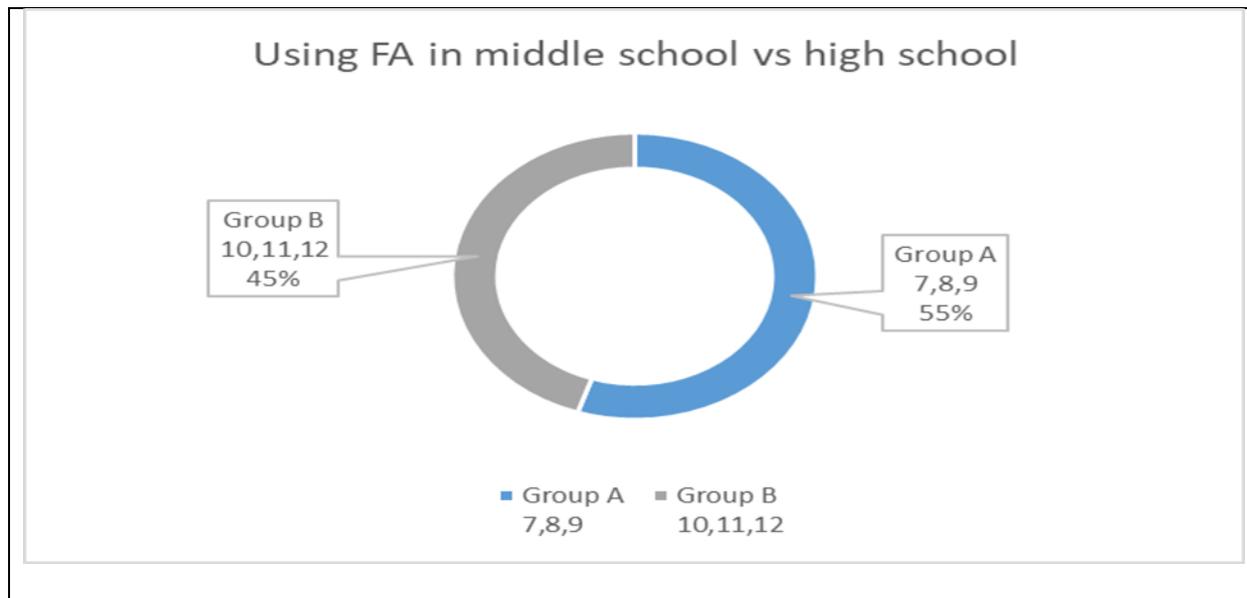


Figure 13, Using FA in middle school vs high school

The pie graph illustrates how the usage of the FA of IBL classes is commonly more in middle school than high schools by 55%: 45% respectively.

Age plays a role obviously in the formative assessment applying, as students grow older, their need for guidance to become less. And the teacher becomes facilitator more than an educator.

4.2.3 Teachers' Perspectives of FA

Teachers utilize FA procedures to lead day-to-day instruction. Proper FA forms give information to classroom instruction. (L. Paine. 2018)

The next map presents twenty teachers' responses to nine different questions about the implementation of FA on IBL classes.

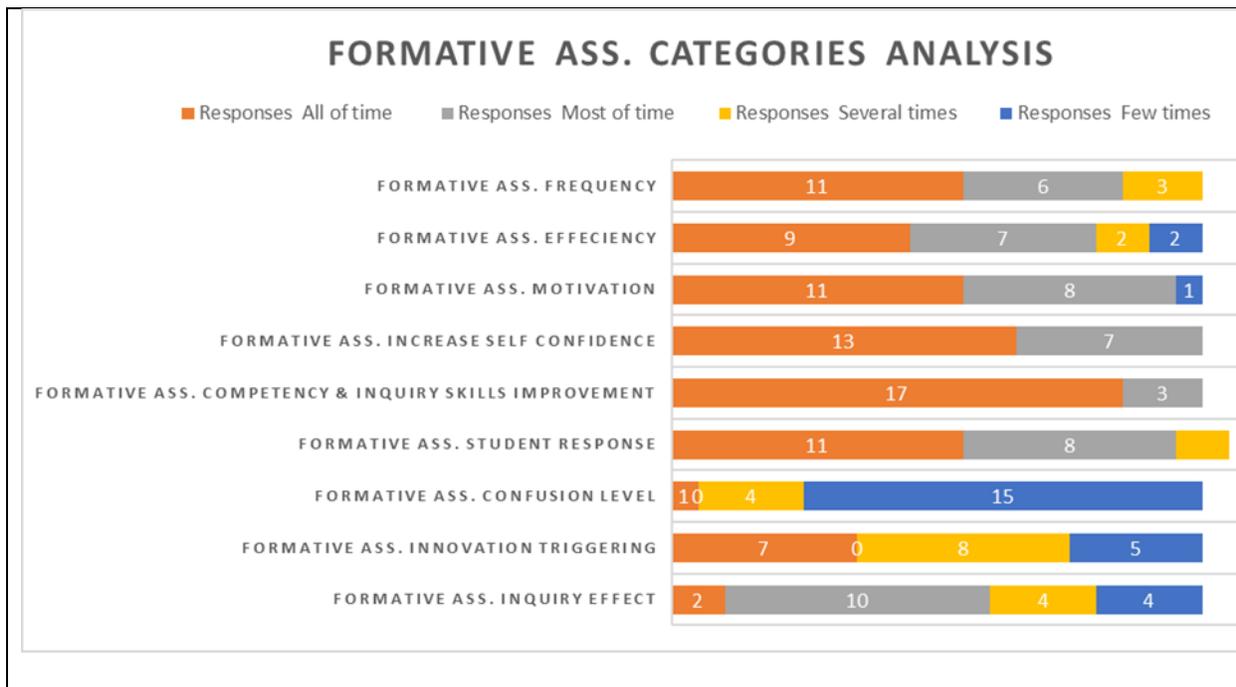


Figure 14, Formative Ass. Categories Analysis

The table below summarizes all the teachers' answers about how their classes and students influenced by the FA, which showed mostly positive impacts of FA on IBL classes,

Table 2, Aspect of the Questionnaire

The Aspect of the Questionnaire	Majority of Responses
1. I usually use formative assessments in my classes.	55% responded all the time.
2. Formative assessment helps you in delivering the information effectively.	45% responded all the time.
3. Formative assessment motivates my students.	55% responded all the time.
4. Formative assessment provides my students with self-confident.	65% responded all the time.
5. Formative assessment improves the student's competency and inquiry skills	85% responded all the time.
6. Students response efficiently and effectively to the formative assessments	55% responded all the time.
7. Students are confused and misled by formative assessment	75% responded a few times.

8. Formative assessments trigger the creativity of the students.	40% responded several times
9. Students show better inquiry behavior in lessons when formative assessments are provided.	50% responded most of the time.

4.2.4 Teachers' Responses to the Open-Ended Question of the Questionnaire.

Part C: Open-ended Questions

This section of the survey contains open-ended questions related to various aspects of the formative assessments on improving the inquiry skills. Kindly answer them with as much clarity as possible.

- In which part of the lesson do you usually choose to give the formative assessments? Why?

- Do the formative assessments lead the students to unexpected solutions of a question or to a problem they are facing? If it does, how often it happens in your classes.

- From your point of view, what is the impact of formative assessment on the inquiry skills of the students?

Figure 15, Open-ended questions

The open-ended questions of the questionnaire contain three different issues that discuss the teachers' perspectives toward the uses of the FA in the science classes.

The upcoming three subsections represent these questions and the teachers' responses.

4.2.4.1 In which part of the lesson do you usually choose to give the formative assessments? Why?

The majority of the teachers apply the FA, when it is needed, No specific part was chosen. Nevertheless, teachers have his/her point of view; some of them wrote they usually implement FA after the starter and before wrapping up the lesson. Moreover, some of the teachers utilize the

FA after a specific activity or a task. Another teacher said he/she usually use the FA after an objective is taught to make sure that most of the students understand before moving on to the next one.

4.2.4.2 Do the Formative Assessments lead the students to unexpected solutions of a question or a problem, they are facing? If it does, how often it happens in your classes.

All the replies to the first part of the question were yes.

Most of the responses of the second part where most of the time, some of them answered sometime, and few answered a few times.

4.2.4.3 From your point of view, what is the impact of Formative Assessment on the inquiry skills of the students?

Most of the answer stressed on how often FA motivates students, and increase their inquiry skill level. Some of the teachers elaborated more and emphasized the vital role of FA in leading the students to solve the critical thinking issue through the inquiry skills they possess.

After scrutinizing this part of the questionnaire, all the responses came in favor of FA usage; and how significant it is on the students' inquiry skills.

**Note: check appendix2 for some examples of teachers' questionnaires.*

4.3 What, if any, differences of demographic variables related to teachers and student Formative Assessments of IBL

4.3.1 Midterm Results' Comparison between Semester 1 and 2 for G11B1 and G11B2.

FA is used to improve the achievement of the pupils and their skills, in IBL classes in term 1; a minimum amount of FA was used due to behavioral problems as mentioned in chapter 3, against significant increases in using FA in term2.

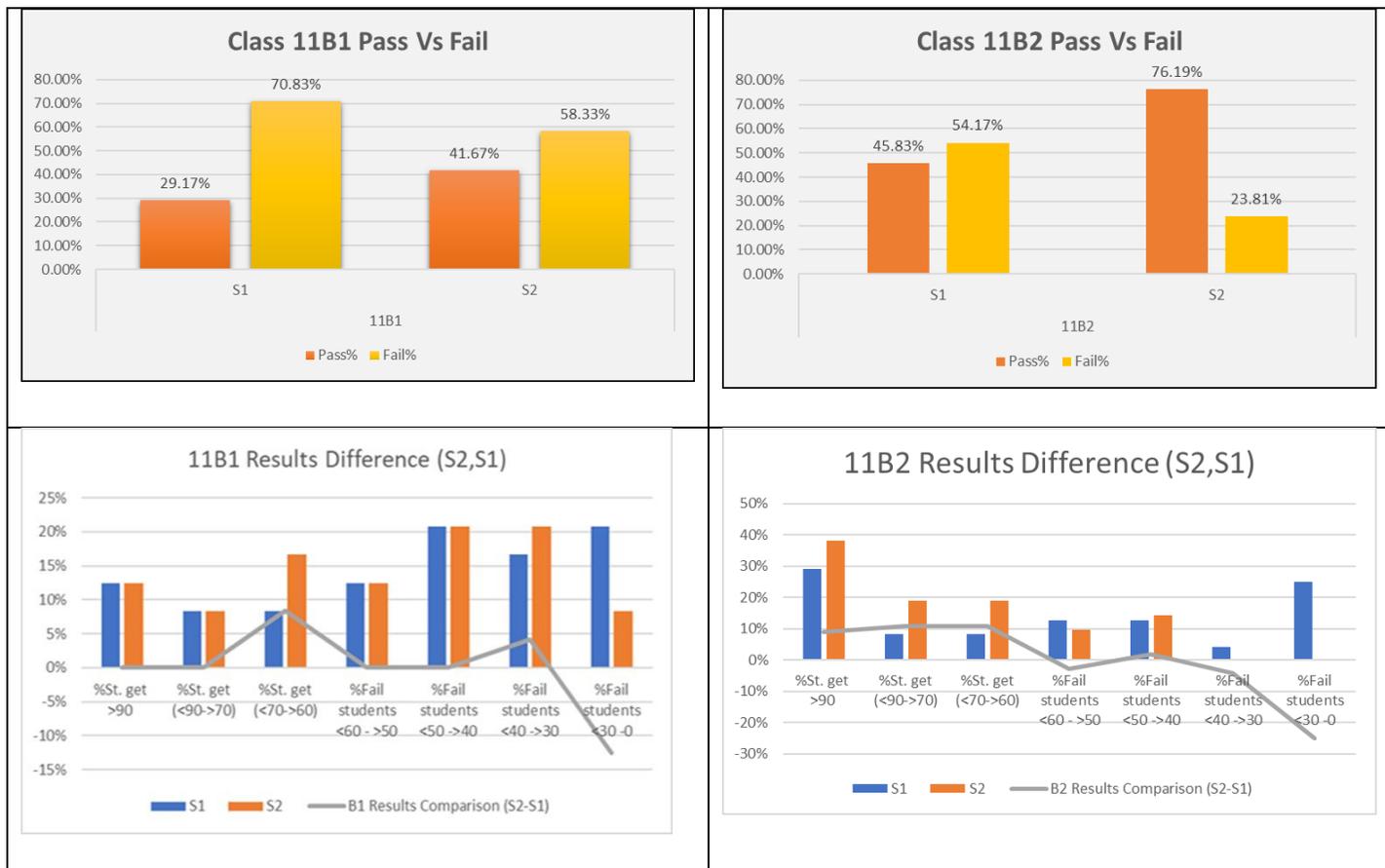


Figure 16, Midterm Results' Comparison

Figure 16 illustrates the influence of using FA on IBL classes and the results of the students' midterm exam in semester one and two.

It is having a positive impact on their results, as it shows an increase in the results in semester two since FA were used more in it.

4.3.2 Classwork Results Comparison for G11B1

Class work is a technique used to measure the understanding of students at the end of each lesson, in a private school in Al-Ain city.

This strategy is about a small question or an activity that test how much the learners comprehend the taught concept in a class.

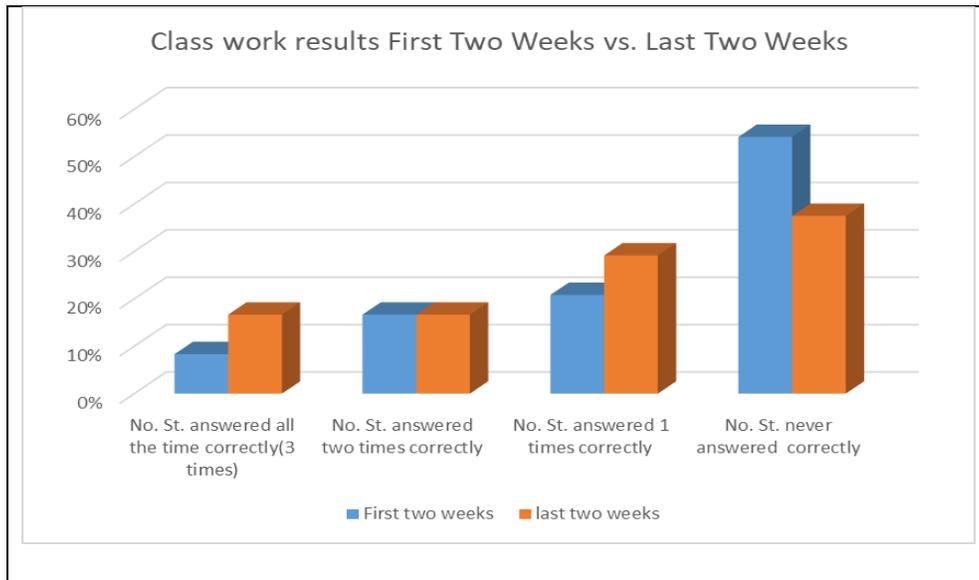


Figure 17, Class work Results

The bar graph (figure 17), emphasizes on the previous result that showed in figure 16, as it exhibits a notable increase in classwork outcomes once FA usage raised in week 3 and 4.

4.3.3 Performance Comparison in IBL Classes for G11B1

IBL classes motivate students to search, ask questions, express their personality in the learning process through different types of activities, integration of technology, and apply assessments, including the FA.

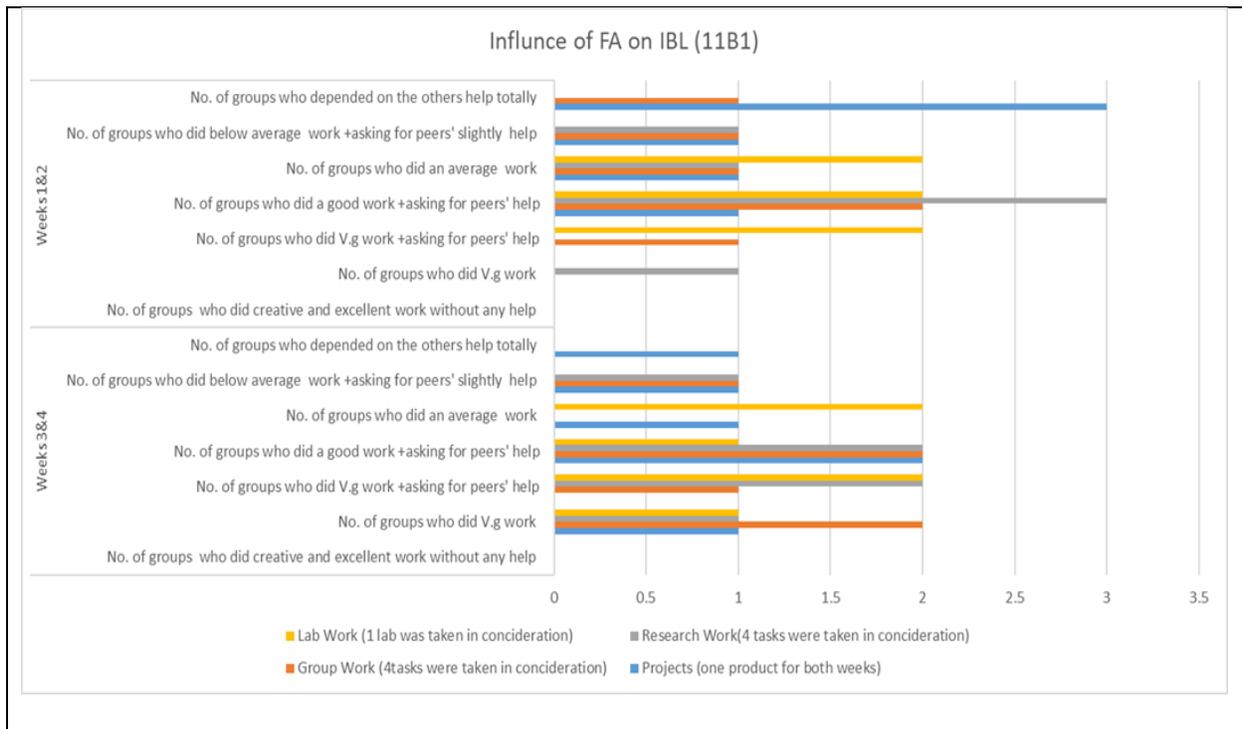


Figure 18, Influence of FA on IBL

Several criteria were tested in 11B1 to examine how efficient it is to use FA in IBL science classes.

Refer to figure 4.3.3, an essential increase of students' performance is shown because of the FA implication during the class by contrasting the first two weeks result with the next two weeks.

4.3.4 Projects

First two weeks of the quasi-experiment, the students' task was to do a project about global warming under the title "Describe the causes and impacts of global warming."

It was followed by another project in the last two weeks of the experiment with the title "How water and healthy diet affect human bodies' health and daily activities."

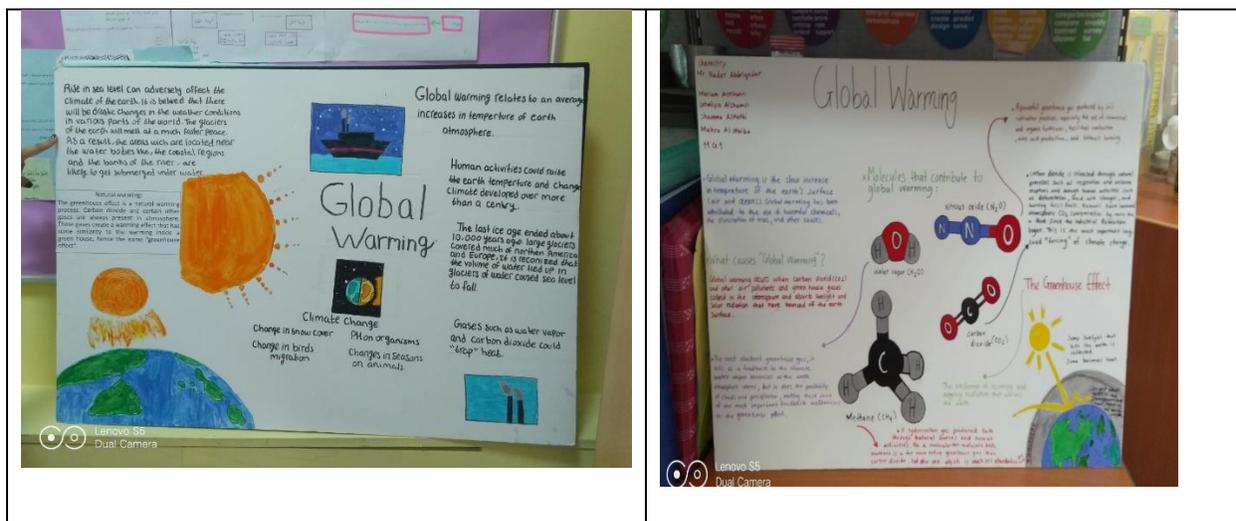


Figure 19, First project



Figure 20, Second project

Students showed more creativity and came up with innovated ideas in the second project after giving them pre feedback on them. The students even went beyond their task, and besides making a poster and a power point presentation, some of them built a model that shows a way to harvest the rain and use the water later on in houses and maybe farms.

4.4 Summary

This study exposes some evidence of the positive influence of FA on IBL science classes, as argued in the previous three sections. FA provides guidance, supportive instructions, and clarifies the misconception students may have during their learning process.

Moreover, programmatic assessment, like FA, enable the students to become active participants in their learning. (Heeneman. et al. 2015).

Furthermore, classes that lack the FA during the learning journey is accountable for misrepresentation of learners because FA can upgrade the degree of control of particular learning by point out deficiencies. (TRIDANE et al. 2015).

Chapter Five (Discussion and Conclusion)

Introduction

The previous section specifies several findings. This chapter discusses and interprets the outcomes, provides a conclusion, studies limitations, and presents recommendations for more research to close the gaps in this area.

5.1 Discussion

The study displays that teachers are growingly using FA in their lessons, as their lesson plans revealed. The lesson plan breakdown showed that among the 11 volunteered teachers, six use FA during the whole period by 100%, one teacher uses it 83%, three teachers use FA between 70% to 40%, and one teacher uses it 25% among their classes.

When FA focuses on the progress of learning, it is plainly most powerful (H. McMillan et al. 2013) as learners are instructed and process feedback. Via many studies, FA with its different types and activities had, most of the time, a positive impact on the students' achievements and performance.

(SUMANTRI & SATRIANI. 2016) Noted that FA aims to decide how much the learners are "shaped" in the wake of taking an interest in the learning procedure for a specific timeframe. That was clear when this study compared the competences of the students through the four weeks quasi-experiment, as in the second two weeks, they showed a slight improvement because of the FA implementation in contrast with the first two weeks, which lack the FA integration.

Using the assessment for learning during the learning process contributes to the growth of it in a persistent way. (Placklé. et al. 2014), the results of grades 11B1 and 11B2 uncovered a significant rise in term two, after using the FA increasingly during lessons, as 12.5% increase in passing students vs. 12.5% reduced in failing students of grade 11B1. Against 25.36% increase in passing students and 30.36% decrease in failing students of grade 11B2.

Students' testing their ideas, making mistakes, and learning from the mistakes is what active learning in PBL (Problem-Based Learning) is all about. Teachers can support and facilitate this process in PBL by giving opportunities for FA, as well as iterative usage of feedback and revising during the inquiry and product formation. (C. English & Kitsantas. 2013).

Inquiry and FA are natural copartners as inquiry supplies new and different chances and imperatives for students in learning, feedback, and assessment. For their next investigation steps to be informed and strategic, students should monitor their progress towards their objectives. Teachers need to control where learners are in relation to learning goals to give useful guidance. (Gavin T. et al. p. 337, 2016) for example, the students came up with more creative ideas for their projects when pre-feedback was given to them to assist and guide them during their work in the last two week of the quasi-experiment.

Through FA methodology, the instructors had the option to discover which inquiry skills learners can perform admirably, and which they had issues with. They were then ready to utilize this evaluation information to framework the following stage in learning for their students. (Harrison. 2014) and as the questionnaire analysis discloses in chapter four, 85% of instructors think that FA improves the student's competency and inquiry skills, and 50% of the teachers' perceptions expose that students show better inquiry behavior in lessons when formative assessments are provided.

K. FRY highlights how FA can support learning; teachers should assess their students during the learning processes to adjust instruction so that it is successful in assist students achieve learning objectives, point out that there is convincing proof that FA can progress standards of achievement, this being an essential educational priority. (2011)

Eliciting questions used to start a sequence of responses have the potential for giving data on the developing status of student originations and comprehension about scientific inquiry skills and habits of mind. (Ruiz-Primo & Furtak. 2007) add to that; several studies found that formative assessment helps low achievers students more than the others. (N Falchikov. 2013) The questionnaire that was conducted in this investigation revealed 45% of teachers of the participant sample believe that FA helps them in delivering their lesson effectively. 55% of the teachers convinced that this type of assessment motivates their student. Thus, they use it all the time in their classes.

Depending on all what was discussed in this section, it is evident that FA has vast potential to support pupils' conceptual learning of science. (Bulunuz & Bulunuz. 2013)

5.2 Limitations

The time was an obstacle during the quasi-experiment, which only was conducted for four weeks and which was insufficient to collect enough data and record students' behavior as well as a response toward the FA accurately.

The school administration would not allow the experiment to last more for the sake of the students and their education. Therefore, it would be much better if the government plan such research to test how much influence FA has on IBL.

Another challenge appeared while writing this dissertation, the shortage of resources that link the FA to inquiry-based learning.

5.3 Recommendation

5.3.1 FA and Summative Assessments.

One of the analyzed data of this research study is the results of the midterm exam, which is considered a type of summative assessment. (I. Ali and H. Iqbal. 2013). Stated in their study's results that FA inserted with teaching is of extreme value as the learners to whom the instructor taught by applying this strategy showed an increase in the academic achievement than the other group, who were taught without using FA method. In order to ensure and analyze the effect of FA on students' performance, it will be helpful if a study is planned to examine the influence of FA on the summative assessment and how it may help the students improve their grades.

5.3.2 FA and Teacher's Gender

Anton Pav revealed in his study, 2018, that female educators harness FA strategies 10 percent more frequently than the male teachers do.

Accordingly, to specify the role of the teachers more, it would be beneficial and more precise to broadly examine which teachers' gender use the FA more in their classes and explain their perspective toward such dilemma.

That may help the government to fill the gap between the two genders, and it may help it to set a law to guide and monitor the usage of FA in the schools, in a way that helps both teachers and students.

5.4 Implication

The result of this study suggests, that assessment for learning like the FA, possess valuable effects on the learning process and should be used widely in different aspects of education.

5.4.1 Training Teachers in UAE

UAE teachers in both sectors, the government and the private, should be trained more on using FA, to gain the needed knowledge and skills to implement such approach in their classes, so they may get more confidence while conveying this tactic to their students, so they themselves could gain this confidence as well. Thus, the learning and teaching process may reach a point at which the students could think as their teachers in solving any issue that may face them, whether in their education or their life.

5.4.2 FA and EmSAT Exam.

According to the ministry of education site, The EmSAT is a national framework of standardized computer-based exams, based on United Arab Emirates federal standards.

Its objective is to ensure that pupils are equipped with the necessary skills and knowledge to participate in the modern experience based global society effectively.

FA could help and lead students while preparing for this test, as it became a needed qualification to apply to universities in the UAE. Moreover, it has other essential areas, on both sides nationally and internationally, for example, it:

1. Specifies the performance level of the students, locally and globally.
2. Supports the Ministry of Education in assessing the private and the government.
3. Assesses schools' performance.
4. Substitutes for other higher education entry exams.
5. Measures learners' performance development over time.
6. Helps students to select for themselves suitable education track.
7. Helps the higher administration to make resolutions to improve the educational.
8. Assists the government and the private sectors in developing improvements plans for students' present performance.

Because of what has argued above, FA could draw a well-planned and more facilitated track to our students to plan their future and be more prepared before attending the EmSAT test

5.5 Conclusion

Since the last century, many steps and studies have been taken to improve and transform students' learning from passive to active, to engage them more in the learning process and to motivate their hidden skills to rise to the surface and refine them.

This study indicates on the positive impact FA has on the IBL, and how it helps the students and guide them during their learning journey, It shows how the students improved and developed when FA was implemented in the IBL lessons, unlike the classrooms that lack the FA integration in their lessons.

To sum up, utilizing FA procedures to assess inquiry learning in science classrooms would empower instructors to gather valid evidence in regards to students' comprehension of the scientific concepts; it would also evoke students' inquiry skills and improve them, and lead them during their learning process, which mostly affects their performance and achievement positively.

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Appendices

Appendix 1 (Lesson Plans)

Lesson Plan 1

Lesson Information							
Teacher: Hani			Grade Level: 9				
Term :3	Date:9/04/2019	Week:1	Period:4	Class	Number of students		
				B	19/18B		
Strand/Domain:Physical Science		Lesson Title:Periodic table and periodic law		Required Resources: White board, data show, speakers, white boxes			
Key/ New Vocabulary:Periodic Law		Homework or Out-of-School Learning Search to write short notes about the scientists participating in developing the periodic table Date due:12/04/2018					
Learning Attributes							
Value of the Month:Honesty		Math: Rows and columns//NaCl salt//Find out the common elements in the UAE Application and relevance of this lesson to: OTHER SUBJECTS/ REAL WORLD/ UAE					
Competence(s): <ul style="list-style-type: none"> ○ collaboration/teamwork ○ communication ○ critical thinking ○ creativity ○ cultural awareness/citizenship ○ digital competence 		My Identity Themes: <ul style="list-style-type: none"> ○ UAE Culture ○ Emirati Community ○ UAE Values ○ Arabic Language ○ Citizenship ○ UAE History 		Assessment Menu			
				Diagnostic	Formative		
					Pre-test	√	Class work
				√	KWL	√	Homework
					Graphic Organizer		Practice Quiz
					Concept Map	√	Self-Evaluation
	Performance		Peer-Evaluation				

<ul style="list-style-type: none"> ○ entrepreneurship ○ global and environmental awareness ○ independent learning ○ initiative/self-direction ○ leadership and responsibility ○ problem solving ○ self-confidence 			Other:		Other: Investigation
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Expectation(s) – Use of Prior Data

Standard(s): HS-PS1-1	
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Learning Objective(s): To explain how was the periodic table developed?	Learning Outcomes: <ul style="list-style-type: none"> • All students will be able to: Investigate the four scientists participate for developing the periodic table. • Most students will be able to: Classify the scientists according to their participation • The more able students will be able to: Summarize the steps of developing the periodic table
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STUDENTS’ PRIOR LEARNING: What relevant skills do they already know?	<input type="checkbox"/> Special Needs <input type="checkbox"/> Visual <input type="checkbox"/> Auditory <input checked="" type="checkbox"/> Kinetic Explain:
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OTHER DATA ABOUT STUDENTS TO BE TAKEN INTO CONSIDERATION	
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Students’ Performance Results (Based on the Most Recent Assessment Data)

Class	80%-100%	60%-79%	Below 60%
	Number of Sts:	Number of Sts:	Number of Sts:t

PLANNING SHEET

Lesson Development	Time	
Starter	5 min	Pic.of periodic table, asking
Instruction (“I do”-teacher models)	10 min	-Define periodic law -Explain the components of periodic table
Guided Practice (“We do”-shared practice-teacher and students)	10 – 15 min	Table of the contributions to the classification of elements -Students correlate between the four scientists to conclude the developing of periodic table. -Discuss -Writing a summary
Independent Practice (“You do”-practice collaboratively and/or independently)	10 – 15 min	-explore the structure of each square in the periodic table Discuss + Write conclusion
Plenary/ Parking Lot	5 min	Writing 3 sentences Parking lot

Differentiation Checklist

Grouping	Worksheet	Reading Ability	Gender	English Language Level
Time	Homework	Learning New Vocabulary	Question	Student choice

Outcome	Resources	Learning Style including student movement	Task	Other :
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Lesson Reflection Checklist
What would I do differently / better next time? To be completed AFTER the lesson.

Better resources	More student activity	Differentiate in more ways
Better starter	More student choice	Use more differentiation methods
Better plenary	Use Clearer objectives	Use different groupings
Talk less	Use peer assessment	Make students move more
More questions	Use self-assessment	Use technology
	Use time better	Other :

All students attained the learning outcomes
Some students attained the learning outcomes
Few students attained the learning outcomes

Lesson Plan 2

DAILY LESSON PLAN 2018-2019

Subject:	Biology	Teacher's Name	Ms. Samar	Week	5	Term	[] First [<input checked="" type="checkbox"/>] Second [] Third
Name of Lesson	Chapter (10): Cell Growth and Division Lesson (1): Cell Growth, Division, and Reproduction	Grade level	10	Date: From 3 /2/2019 to 7/2/2019		Period number:	1-3

Standard	HS-LS1-1 From Molecules to Organisms: Structures and Processes
Relevance to UAE culture and everyday life: (My Identity standard)	Modern (UAE): The urban growth is increasing as a result of population growth. Slide no. 21
Implementation of STEM and HOTS	Applying: students use mathematical equations related to mass and volume to solve different questions
Student competency Framework standard/Theme	Critical thinking: students are challenged to answer a question in slide no. 5 (starter)
Moral education Standard	Care and respect to all efforts in The UAE to expand the area of new buildings to prevent any population crises.
Perquisite and Prior Knowledge required	Homeostasis

<p>Lesson Objectives</p> <p>(in bullet points)</p> <p>Use Bloom taxonomy</p>	<p>By the end of the Lesson students would be able to :</p> <ul style="list-style-type: none"> • All students Identify some of the difficulties a cell faces as it increases in size. • Most students explain the ratio of surface area to volume. • Some students create a table to list the limits to cell size difficulties. 	<p>Key Words and terminologies</p> <ul style="list-style-type: none"> - Growth - Division - Reproduction
<p>Resources required</p> <p>(to accomplish your Objectives)</p>	<p><u>Pearson Textbook</u>, copy book, smart board, pens.</p>	
<p>STARTER</p> <p>Max 10 min.</p>	<p>- I will bring my students to my Lesson by: Students are challenged to answer the question in slide no. 5 (critical thinking) (differentiation by outcomes) (independent learning).</p>	
<p>Development of lesson</p> <p>[Steps taken for teaching & learning process]</p> <p>including:</p> <ul style="list-style-type: none"> - Cooperative learning - Activities 	<p style="text-align: center;"><u>Teacher Role</u></p> <p>2. Teacher collects the students’ findings and write them on the board, and uses the slides (7-12) to explain the difficulties a cell faces as it increases in size. (differentiation by teaching styles)</p> <p>4. Teacher follows up and supports the struggling students, teacher may re-explain for weak/SEN students (differentiation by teaching styles).</p> <p>5. Teacher explains the Ratio of Surface Area to Volume by using slide no. 16</p> <p>7. Teacher follows up.</p> <p>9. Teacher follows up and gives a feedback (relate it to everyday life and UAE culture).</p>	<p style="text-align: center;"><u>Student Role</u></p> <p>1. Reading task (Round Robin): students read from page 274, and then share their findings within the group to answer the question in slide no. 6. (English reading connection) (Independent learning).</p> <p>3. (Solo Work): students Observe the picture in slides no. 13, & 14 and explore the relation between the traffic clogs and a cell that continues to grow. (Real life application)</p> <p>6. Pair work: students use the table in slid no. 17 to practice solving some questions by using the equations. (math connection)</p> <p>8. (Individual work): students use their copy books to summarize the difficulties a cell faces as it increases in size. (Plenary) (English writing connection)</p>

Plenary [Formative Feedback] Max 10 mins.	<input type="checkbox"/> kagan activity <input type="checkbox"/> Quiz <input type="checkbox"/> Writing main points <input type="checkbox"/> T or F <input type="checkbox"/> MCQ <input type="checkbox"/> Drawing <input type="checkbox"/> Writing Key words <input type="checkbox"/> Labeling <input checked="" type="checkbox"/> other (specify) .. (Individual work):.....					
Differentiation in Teaching & Learning	<u>For High Achievers Students</u>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="949 932 1577 980" style="text-align: center;"><u>For Average Students</u></td> <td data-bbox="1577 932 2051 980" style="text-align: center;"><u>For Intervention Students</u></td> </tr> <tr> <td colspan="2" data-bbox="949 980 2051 1253" style="text-align: center;"> See the lesson starter and development 1, 2, 3 4, 6 & 8 - Differentiation by outcomes and the starter. - Differentiation by learning style. - Independent learning. - Differentiation by task (critical thinking) </td> </tr> </table>	<u>For Average Students</u>	<u>For Intervention Students</u>	See the lesson starter and development 1, 2, 3 4, 6 & 8 - Differentiation by outcomes and the starter. - Differentiation by learning style. - Independent learning. - Differentiation by task (critical thinking)	
<u>For Average Students</u>	<u>For Intervention Students</u>					
See the lesson starter and development 1, 2, 3 4, 6 & 8 - Differentiation by outcomes and the starter. - Differentiation by learning style. - Independent learning. - Differentiation by task (critical thinking)						
SEN students including G&T	<u>Names:</u> NA	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="949 1256 1577 1401" style="text-align: center;"><u>Accommodations :</u></td> <td data-bbox="1577 1256 2051 1401" style="text-align: center;"><u>Notes</u></td> </tr> </table>	<u>Accommodations :</u>	<u>Notes</u>		
<u>Accommodations :</u>	<u>Notes</u>					

Independent learning	Refer back to the starter and lesson development 1		
21st Century Skills Practiced:	Cooperative learning and cooperation, Use of technology , learning to learn , communication , student centered learning		
Methods of Assessment of Learning	<u>Self- Assessment</u> Thumbs assessment 	<u>Formative Assessment</u> Class work – Pair work – cooperative work – discussion and plenary.	<u>Summative Assessment</u>
Integration of subjects	Integration with English Listening, writing, and comprehension in English Math: solving different questions related area and volume		
Real life application related to lesson	Refer back to the starter		
Use of Technology	<input checked="" type="checkbox"/> Yes PowerPoint Presentation <input type="checkbox"/> No Mechanism: (smart board and animation)		

Home Assignment / Research work	
Comments and carry over if needed:	

HOD's / Academic Advisor Remarks:	
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Lesson Plan 3

DAILY LESSON PLAN 2018-2019

Subject:	Biology	Teacher's Name	Ms. Samar	Week	4	Term	[] First [<input checked="" type="checkbox"/>] Second [] Third
Name of Lesson	Chapter (10): Cell Growth and Division Lesson (1): Cell Growth, Division, and Reproduction	Grade level	10	Date: From 27 /1/2019 to 31/1/2019		Period number:	2-3

Standard	HS-LS1-1 From Molecules to Organisms: Structures and Processes
Relevance to UAE culture and everyday life: (My Identity standard)	Old and Modern (UAE): Desert salamander heals its wounds, the body cells are dividing to repair the damage, similar to <u>asexual reproduction</u> . (Slide no. 22)
Implementation of STEM and HOTS	Creating: students create a table to compare between both types of reproduction.
Student competency Framework standard/Theme	Critical thinking: students are challenged to answer a question in slide no. 5 (starter), and slide no. 6
Moral education Standard	Care for all living things that reproduce asexual and sexually.
Perquisite and Prior Knowledge required	Homeostasis

<p>Lesson Objectives</p> <p>(in bullet points)</p> <p>Use Bloom taxonomy</p>	<p>By the end of the Lesson students would be able to :</p> <ul style="list-style-type: none"> • All students define the term cell division • Most students explain the process of reproduction and relate it to the cell division. • Some students compare between asexual and sexual reproduction. 	<p>Key Words and terminologies</p> <ul style="list-style-type: none"> - Cell Division - Asexual Reproduction - Sexual Reproduction
<p>Resources required</p> <p>(to accomplish your Objectives)</p>	<p><u>Pearson Textbook</u>, copy book, smart board, pens.</p>	
<p>STARTER</p> <p>Max 10 min.</p>	<p>- I will bring my students to my Lesson by: (Time-Pair-Share): students answer the question When a living thing grows, what happens to its cells? (critical thinking) (differentiation by outcomes) (independent learning).</p>	
<p>Development of lesson</p> <p>[Steps taken for teaching & learning process]</p> <p>including:</p> <ul style="list-style-type: none"> - Cooperative learning - Activities 		<p style="text-align: center;"><u>Student Role</u></p> <ol style="list-style-type: none"> 1. (Critical thinking): students are asked to observe the picture in slide no. 6 and then write their comments in their copy books. (English writing connection) (Independent learning). 3. (writing task): students use their copybooks to define the term cell division. 4. (Reading task): (Round Robin): students read from the text book to answer the questions in slide no. 10. 7. (Group work): students work with their group to compare between both types of reproduction. (Plenary)

Plenary [Formative Feedback] Max 10 mins.	<input type="checkbox"/> kagan activity <input type="checkbox"/> Quiz <input type="checkbox"/> Writing main points <input type="checkbox"/> T or F <input type="checkbox"/> MCQ <input type="checkbox"/> Drawing <input type="checkbox"/> Writing Key words <input type="checkbox"/> Labeling <input type="checkbox"/> other (specify) .. (group work):	
Differentiation in Teaching & Learning	<u>For High Achievers Students</u>	<u>For Average Students</u>
	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>See the lesson starter and development 1, 2, 3 4 & 5</p> <ul style="list-style-type: none"> - Differentiation by outcomes and the starter. - Differentiation by learning style. - Independent learning. - Differentiation by task (critical thinking) </div>	
SEN students including G&T	<u>Names:</u> NA	<u>Accommodations :</u>
	<u>Notes</u>	
Independent learning	Refer back to the starter and lesson development 1	
21st Century Skills Practiced:	Cooperative learning and cooperation, Use of technology , learning to learn , communication , student centered learning	

Methods of Assessment of Learning	<u>Self- Assessment</u> Thumbs assessment 	<u>Formative Assessment</u> Class work – Pair work – cooperative work – discussion and plenary.	<u>Summative Assessment</u>
Integration of subjects	Integration with English writing, and comprehension in English		
Real life application related to lesson	Refer back to the starter		
Use of Technology	<input type="checkbox"/> Yes PowerPoint Presentation <input type="checkbox"/> No Mechanism: (smart board and animation)		
Home Assignment / Research work			
Comments and carry over if needed:			

HOD's / Academic Advisor Remarks:	
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Lesson Plan 4

DAILY LESSON PLAN 2018-2019

Subject:	Chemistry	Teacher's	Noha Ashraf		Week	1 2 3 4 5	Term	<input checked="" type="checkbox"/> First <input type="checkbox"/> Second <input type="checkbox"/> Third
Name of Lesson	Chapter 6 – Lesson 1: Solids, Liquids, and gases.		Grade level	8	Date: From 9-Sep-18 to 13-Sep-18		Period number:	1 out of 3

Standard	MS-PS1-1: Develop models to describe the atomic composition of simple molecules and extended structures. MS-PS1-4: Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
Relevance to UAE culture and everyday life: (My Identity standard)	3.3: Good citizenship and Loyalty : The first Emirati female nuclear scientist graduated from Khalifa University.

Implementation of STEM and HOTS	Modeling, Analyzing: The attractive forces between the particles.	
Student competency Framework standard/Theme	Communication, Collaboration: (During different planned activities)	
Moral education Standard	Respect, Care	
Perquisite and Prior Knowledge required	Students share their previous knowledge about the physical states of matter.	
Lesson Objectives (in bullet points) Use Bloom taxonomy	By the end of the Lesson students would be able to : <ul style="list-style-type: none"> • All students will identify the meaning of matter. • Most students will explain the factors that determine the state of matter. • Some students will compare the forces between particles in solids, liquids and gases. 	Key Words and terminologies <ul style="list-style-type: none"> - Matter - Forces - Physical states
Resources required (to accomplish your Objectives)	Text book, Copybook, Styrofoam balls, video, PPT.	

<p>STARTER</p> <p>Max 10 min.</p>	<p>I will bring my students to my Lesson by:</p> <ul style="list-style-type: none"> • Prior Knowledge: Group-Work (Discussion): In groups students will list what they know about the key-words, then they will share what they wrote and discuss it. • Introducing the main idea: Attract student’s interest to the new lesson by showing them a video about matters. Then encourage them to define the term matter by their own words and write any information about it. 	
<p>Development of lesson</p> <p>[Steps taken for teaching & learning process]</p> <p>including:</p> <p>-Cooperative learning</p> <p>-Activities</p>	<p style="text-align: center;"><u>Teacher Role</u></p> <p>2. Reinforce the meaning of matter, the 4 states of matter and how we could describe it (Using measurements or senses). By showing them different examples.</p> <p>3. Show students different uses for the plasma (Real life & UAE connection)</p> <p>5. Show students a real examples of matters at different states. (Real life connection)(Differentiation by learning styles)</p>	<p style="text-align: center;"><u>Student Role</u></p> <p>1- Pair Work (Timed-Pair-Share): Students in pairs will write a scientific meaning of matter. (Differentiation by outcomes)(Independent Learning)</p> <p>4. Group Work (Speed competition): Ask students to list different matters - as many examples as they can think of within the time frame (3 min.).</p> <p>6. Pair work (Timed-Pair-Share): challenge students to think about factors that determine the state of matter. By using the iPad to play an interactive game and conclude the answer by their own. (Independent Learning)</p>

	<p>7. Encourage students to compare the forces between solid, liquids, and gases particle by showing them different diagrams, then explain that particles (Atoms) moves in any matter randomly. (Independent Learning)</p> <p>10. Teacher follows up and supports the struggling students, teacher may re-explain for weak/SEN students (differentiation by teaching styles).</p>	<p>8. Group Work (Class Activity): students will demonstrate the forces between the particles by their hands or modeling it. The teacher will say a certain state of matter and each group will demonstrate it. (Differentiation by learning styles)</p> <p>9. Pair work (Timed-Pair-Share): Students will think about ways to increase or decrease the attractive forces between particles. (Critical Thinking)</p>	
<p>Plenary</p> <p>[Formative Feedback]</p> <p>Max 10 mins.</p>	<p><input type="checkbox"/> kagan activity <input type="checkbox"/> Quiz <input type="checkbox"/> Writing main points <input type="checkbox"/> T or F</p> <p><input type="checkbox"/> MCQ <input type="checkbox"/> Drawing <input type="checkbox"/> Writing Key words <input type="checkbox"/> Labeling <input type="checkbox"/> other</p> <p>(specify)</p> <p>Think-Write-Round Robin: In groups students will be solving those differentiated questions and they will discuss the answers with each other's. (Students center, differentiation by outcomes, differentiated questions)</p> <ol style="list-style-type: none"> 1- Define the term Matter 2- State the factors that determine the state of matter. 3- Compare the forces between particles in solids, liquids and gases. 		
<p>Differentiation in Teaching & Learning</p>	<p><u>For High Achievers Students</u></p>	<p><u>For Average Students</u></p>	<p><u>For Intervention Students</u></p>
<p>Refer back to the lesson starter and lesson development no. 1,5,9,10</p>			

SEN students including G&T	Names:	Accommodations :	Notes
	See the attached IEPs		
Independent learning	Refer to lesson development no. 1, 6 & 7		
21st Century Skills Practiced:	Cooperative learning and cooperation, Use of technology , learning to learn , communication , student centered learning		
Methods of Assessment of Learning	<u>Self- Assessment</u>  <u>Thumbs assessment</u>	<u>Formative Assessment</u> Class work – Pair work – cooperative work – discussion.	<u>Summative Assessment</u>
Integration of subjects	<u>History connection:</u> Plasma was first identified by Sir William Crookes in <u>1879</u> (he called it "radiant matter")		
Real life application related to lesson	Refer to lesson development no. 3 & 5		
Use of Technology	<input checked="" type="checkbox"/> Yes		

	<p>[] No</p> <p>Mechanism: Power-Point presentation & Video: https://www.youtube.com/watch?v=ELchwUIIWa8, https://www.youtube.com/watch?v=94tReSbyPYc</p> <p>I-Pad: Interactive game. https://phet.colorado.edu/sims/html/states-of-matter-basics/latest/states-of-matter-basics_en.html</p>
<p>Home Assignment / Research work</p>	
<p>Comments and carry over if needed:</p>	

<p>HOD's / Academic Advisor Remarks:</p>	
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Appendix 2

FA Inquiry Questionnaire

Formative Assessment and Inquiry Questionnaire 1

This is a brief questionnaire to elicit teachers' perceptions of the aspects of the formative assessments on improving the inquiry skills of the middle and high school students. Please, answer to your best knowledge. The data and result will be presented with confidentiality and that your participation is voluntary. Thanking you in advance.

Part A- Background Information (kindly place (x) on the appropriate response)

1. Gender: _____ Male ___x___ Female

2. Type of School you Currently Work in:

_____ Public School ___x___ Private School

3. Level:

_____ Kindergarten _____ Primary School

___x___ Middle School _____ High school

4. Subject taught:

___x___ General _____ Biology _____ Chemistry

_____ Physics Other (please specify.....)

5. Teaching Experience:

_____ Less than 5 years ___x___ 5 – 10 years _____ More than 10 years

B- Please place (x) in one appropriate box

First table is a questionnaire about teacher FA instruction

No	Statement	Responses			
		All the times	Most of the Times	Several times	Few times
1.	I usually use formative assessments in in my classes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Formative assessment helps you in delivering the information effectively.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3.	Formative assessment motivates my students.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Formative assessment provides my students with self-confident.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Formative assessment improves the student's competency and inquiry skills	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The second part: Teacher perceptions of how students with the formative assessment.

No.	Statement	Responses			
		All of them	Most of them	Some of them	Few of them
1.	Students response easily and effectively to the formative assessments	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Students are confused and misled by formative assessment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.	The creativity of the students is triggered by formative assessments.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4.	Students show better inquiry behavior in lessons when formative assessments are provided.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Part C: Open-ended Questions

This section of the survey contains open-ended questions related to various aspects of the formative assessments on improving the inquiry skills. Kindly answer them with as much clarity as possible.

1. In which part of the lesson do you usually choose to give the formative assessments? Why?
After finishing each objective and as plenary, some times if objectives are too long I can give students assesment before finishing the objective.
2. Do the formative assessments lead the students to unexpected solutions of a question or to a problem they are facing? If it does, how often it happens in your classes.
Yes definetaly, when we are checking their answers specially on the board, students explore different answers and check what could be correct or wrong and how to take their answers to the next level.
3. From your point of view, what is the impact of formative assessment on the inquiry skills of the students?
If we proposed a good quality questions then could for sure improve the inquiry skills of students and making it as a habit can give students more abilities for creativity and solving problems.

Formative Assessment and Inquiry Questionnaire 2

This is a brief questionnaire to elicit teachers' perceptions of the aspects of the formative assessments on improving the inquiry skills of the middle and high school students. Please, answer to your best knowledge. The data and result will be presented with confidentiality and that your participation is voluntary. Thanking you in advance.

Part A- Background Information (kindly place (x) on the appropriate response)

1. Gender: Male Female
2. Type of School you Currently Work in:
 Public School Private School
3. Level:
 Kindergarten Primary School
 Middle School High school
4. Subject taught:
 General Biology Chemistry
 Physics Other (please specify.....)
5. Teaching Experience:
 Less than 5 years 5 – 10 years More than 10 years

B- Please place (x) in one appropriate box

First table is a questionnaire about teacher FA instruction

No	Statement	Responses			
		All the times	Most of the Times	Several times	Few times
6.	I usually use formative assessments in my classes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Formative assessment helps you in delivering the information effectively.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Formative assessment motivates my students.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Formative assessment provides my students with self-confident.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Formative assessment improves the student's competency and inquiry skills	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The second part: Teacher perceptions of how students with the formative assessment.

	Responses

No.	Statement	All of them	Most of them	Some of them	Few of them
5.	Students response easily and effectively to the formative assessments	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Students are confused and misled by formative assessment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	The creativity of the students is triggered by formative assessments.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8.	Students show better inquiry behavior in lessons when formative assessments are provided.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Part C: Open-ended Questions

This section of the survey contains open-ended questions related to various aspects of the formative assessments on improving the inquiry skills. Kindly answer them with as much clarity as possible.

4. In which part of the lesson do you usually choose to give the formative assessments? Why?
After each objective to make sure that the students achived each objective.

5. Do the formative assessments lead the students to unexpected solutions of a question or to a problem they are facing? If it does, how often it happens in your classes.
Yes .. Rarely

6. From your point of view, what is the impact of formative assessment on the inquiry skills of the students?
It increases the students level of thinking and the use of higher-level inquiry skills

Formative Assessment and Inquiry Questionnaire 3

This is a brief questionnaire to elicit teachers' perceptions of the aspects of the formative assessments on improving the inquiry skills of the middle and high school students. Please, answer to your best knowledge. The data and result will be presented with confidentiality and that your participation is voluntary. Thanking you in advance.

Part A- Background Information (kindly place (x) on the appropriate response)

1. Gender: Male Female
2. Type of School you Currently Work in:
 Public School Private School
3. Level:
 Kindergarten Primary School
 Middle School High school
4. Subject taught:
 General Biology Chemistry
 Physics Other (please specify.....Math.....)
5. Teaching Experience:
 Less than 5 years 5 – 10 years More than 10 years

B- Please place (x) in one appropriate box

First table is a questionnaire about teacher FA instruction

No	Statement	Responses			
		All the times	Most of the Times	Several times	Few times
11.	I usually use formative assessments in in my classes	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
12.	Formative assessment helps you in delivering the information effectively.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
13.	Formative assessment motivates my students.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
14.	Formative assessment provides my students with self-confident.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Formative assessment improves the student's competency and inquiry skills	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The second part: Teacher perceptions of how students with the formative assessment.

	Responses

No.	Statement	All of them	Most of them	Some of them	Few of them
9.	Students response easily and effectively to the formative assessments	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Students are confused and misled by formative assessment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11.	The creativity of the students is triggered by formative assessments.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
12.	Students show better inquiry behavior in lessons when formative assessments are provided.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Part C: Open-ended Questions

This section of the survey contains open-ended questions related to various aspects of the formative assessments on improving the inquiry skills. Kindly answer them with as much clarity as possible.

7. In which part of the lesson do you usually choose to give the formative assessments? Why?

At the closer (15 Min) of the lesson, so the assessment will take 10 Min and 5 min for students to ask questions and explain the assessment

8. Do the formative assessments lead the students to unexpected solutions of a question or to a problem, they are facing? If it does, how often it happens in your classes.

Yes, sometimes, students can be creative sometimes when answering assessment questions

9. From your point of view, what is the impact of formative assessment on the inquiry skills of the students?

It motivate the students and develop their curiosity to understand the answer of assessment questions.

Appendix 3

Authorization Letter

