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# Influencing Student Achievement: Teaching, Learning and Teachers' Attributes

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# INFLUENCING STUDENT ACHIEVEMENT: TEACHING, LEARNING AND TEACHERS' ATTRIBUTES

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# INFLUENCING STUDENT ACHIEVEMENT: TEACHING AND LEARNING AND TEACHERS ATTRIBUTES

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## Abstract

Student achievement has become a hot topic in education today, especially for classroom teachers whose responsibility is to employ effective teaching and learning strategies. This application thesis examines how crucial instructional strategies are related to cognitive student outcomes and higher order thinking, that in turn are necessary to increase students chances of academic success. It was hypothesized that effective teaching and learning strategies predicts student achievement. In this review we will discuss school accountability measured as compared to students achievement that are based on the Measures of Academic Performance MAP at Collegiate American School CAS, Dubai. This application thesis summarizes research findings on effective strategies in relation to how each impacts student achievement. We will mainly use Hattie's list of influences and the Cohen d to measure their effect size. Results of this review reveal a direct connection between applying effective teaching strategies that no matter how high is their effect size, they need to respond to students' needs. Also results revealed that there is a direct connection between a holistic approach of interrelated factors related to teaching and learning and their impact on students' achievement.

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# CHAPTER I: INTRODUCTION

## Context of Research and Application

Standardized testing, high stakes testing or any criterion based testing can place an incredible stress on everyone involved in the process. Pressure is increasing for teachers and school administrators as well as students to increase test results and demonstrate adequate progress every year. More emphasis is being put on schools' rating system and even more on teachers' appraisal system when it comes to measuring the quality of teaching and schools' credibility. Overloaded with unnecessary stress, it becomes tempting for teaching to emphasize to students how vital tests scores are, and this stress may adversely affect student performance on the tests. With the amount of emphasis being placed on computer based external tests, teachers cannot ignore or deny their presence, however it would be unfair to students to conduct assessment that they are not prepared for. On another note, teachers should not consecrate a specific time to teach for the test. In this application thesis we hypothesize that test preparation should not be overwhelming. Teachers do not have to entirely halt their teaching to tackle standardized tests. Integrating simple yet effective strategies, combined with solid teaching, can lead to positive results without sacrificing classroom time.

As a proponent of evidence-based quantitative research methodologies on the influence of student achievement, Hattie (2009) established a way of synthesizing a varied list of influences in different meta-analyses according to their effect size (Cohen's d). The latest groundbreaking study "Visible Learning" ranked 150 influences to the most recently 195 effects that are related to learning outcomes from very positive effects to

very negative effects. Hattie found that the average effect size of all the influences he studied was 0.40 as the average rate which he called 'hinge point'. As a result, he decided to judge the success of interventions relative to this 'hinge point' in order to find an answer to the question "What works best in education?" Originally, Hattie conducted studies around six areas that contribute to learning: the teacher, the home, the curricula, the school, the student, and teaching and learning approaches, with the most updated list that includes the classroom. In this literature review we will mainly focus on teaching and learning approaches and their impact on student achievement in addition to teachers' characteristics. The reason of our focus area is that many researchers put a strong emphasis on teachers' approaches to learning, the amount of time students spend at school and their relation with their teachers; they argue that no child should be disadvantaged by their parents social-cultural or economic background. In his research of nearly 1200 meta-analyses – up from the 800, Hattie (2009) enumerates many visible learning ideas ranging from inductive teaching also identified as inquiry based, to cooperative learning and feedback, yet the one that sits atop of his list are teacher estimates of achievements, prior ability and response to intervention.

The aim is to conclude with a statement that support the hypothesis, that is by developing higher order thinking and critical thinking opportunities in the classroom it would help boosting students' achievement in test scores as a result, without just sticking to traditional learning strategies such as rote learning and memorization to cover topics presented in the test and therefore teaching to the test. Instead it is a process of developing self-regulated learning. The question that lies here is the following: "Would

best teaching methods stated on Hattie's (2009) Cohen d spectrum of measurement such as metacognitive strategies, prior knowledge, assessment and other strategies on the spectrum of influences employed by the teachers in the classroom have a strong effect on students' academic performance and consequently on their adaptive test scores? It is important to note that there are many outcomes and strategies that influence student achievement according to Hattie, Marzano and other specialists, however the key reason of this literature review application is to show why and how some strategies work more effectively than others rather than identifying one method and adopting it in the classroom exclusively. Also, in this application, the focus will be on variable related to teaching and learning and teachers' attributes.

Teachers should not belong to the movement that is shifted towards teaching to the test nor to the one that ignores the test completely. Considering the emphasis put on the results, it would be unfair to leave students unexposed to the process. If school's aim is to raise their rating and accountability level, it becomes prominent for teachers to support their students in raising their academic performance by preparing them through a set of evidence based instructional strategies that in return develop a certain level of higher order thinking and rigor in learning necessary for the process of achievement.

## Guiding Questions

Critics of computer-based tests argue that the latter promotes rote learning and memorization in schools over more sophisticated cognitive skills, such as writing, critical reading, analytical thinking, problem solving, or creativity. In an era of high stakes and computerized testing, it is becoming mandatory for teachers to prepare students to

conduct these assessments without teaching to the test. A teacher plays a vital role within a few hours in the classroom by using effective instructional strategies. There are many educators, school influencers and researchers who have debated and conducted research describing variables related to teachers' approaches to learning which influence students' achievement in particular. There is a fine line between preparing students to take adaptive tests and teaching to the test. The big question is how can we balance the challenges of computer based testing and the role they play in accountability and credibility, without overthrowing or even dilapidating the best teaching and learning practices that play an immanent role in students' well being and achievement?

In order to investigate my two essential questions I began by examining research related to evidence based research about teaching, learning, and teachers' expectations. What I hope educators will gain from this research is to implement in their classroom strategies that raise their students achievement, strategies they find most helpful and catered towards their specific students needs.

## Rationale

The success of any educational system is crowned by the success of the students in their academic performance, which is likewise influenced by many factors. Researchers have determined many factors influencing students' achievement. In this review of research, we will focus on the most influential factors related to teachers' attributes, students' learning strategies and teaching strategies. In an era of accountability, teachers' responsibility is shifting towards ensuring that their students learn. To measure what students know and do not know, many countries administer computerized international assessments. Many teachers are clueless about how to best prepare their

students for these assessments without compromising teaching practices that correspond with their students' needs, yet experienced teachers and researchers argue that test preparation should be part of the day-to-day curriculum. Teachers should not teach to the test, they should focus instead on strategies that raise students' achievements.

The reason for the application of research is to enable teachers with a paradigm shift about how to prepare students effectively without compromising best teaching and learning practices and most importantly the well being of everyone involved. Curriculum content is packed with an amalgam of content and standards that teachers resort to telling students what they know and students simply commit facts to memory. The overloaded curriculum allows minimal time for students to develop a deeper understanding of the topic of study or to acquire long lasting skills such as critical thinking, problem solving, and communication. However, learning is not restricted to committing a set of facts to memory, but the ability to use resources, find, evaluate, and apply information, and transfer their learning to a different setting or context. This paper will provide a list of teaching and learning strategies that promote higher order thinking allowing students to use and transfer these skills into different settings. With a shift in focus from covering content to using content, teaching becomes less a matter of determining "what" to teach and more a matter of "how" to facilitate learning.

# CHAPTER II: LITERATURE REVIEW

## Research Strategies

With the increased shift towards accountability as a means of achieving specific goals in education, school accountability—the process of rating and judging schools overall performance on the basis of students' academic measures —is increasingly becoming prevalent around the world in order for the educational institutions to meet their responsibilities and reach their goals.

To answer the proposed research questions, observations and learning walks were conducted by teachers and school administrators in elementary classrooms at Collegiate American School. The sample consisted of 120 students between grade 1 and grade 5 classes aged between 6 to 11 years. The majority of students were bilingual and speak English as a second language. These observations are guided by teaching practices of what constitutes an outstanding lesson according to research. Based on the aforementioned theoretical frameworks in chapter 1, the purpose of this study is to test the validity of factors related to teaching and learning influencing students' achievement. To examine how each factor impacts students' outcomes, a comparison of students' results of MAP tests to the instructional strategies applied in their classroom to verify the effectiveness of best practices according to literature reviews related to student achievements (Hattie, 2009). This process will be able to uncover to what extend the teaching and learning practices stated in the literature review will impact student achievement (Bereiter, 2002; Hattie, 2008; Marzano, 2010). Observation of classrooms typically shows a direct correlation between students' achievement and the effectiveness of instructional strategies such as assessments for leaning, inquiry based approach,

feedback and explicit teaching. Other elements contributing to students' success are teachers' expectations and students' learning strategies such as background knowledge, cooperation and metacognitive strategies. In the United Arab Emirates, accountability is measured through the results of students' progress and academic achievement based on international accredited assessments conducted at various schools. At Collegiate American School Dubai, where all the observation and study were conducted, the main external source used to measure students academic achievement is Measures of Academic Performance MAP. This assessment is designed to target a student's academic performance in mathematics, reading language, and science. These tests are catered toward students' current level of achievement. This grants every student a fair opportunity to show what he or she knows and can do. Because the computer is able to tailor the level of difficulty of the questions as the test progresses, each student undertakes a unique test. MAP is solely exploited to measure students' progress and achievement in school in comparison to large scale age-based norms. The testing information is important to teachers and school inspectors because it indicates a student's performance measured as compared to the effectiveness of seven performance indicators in which we will only focus on the effectiveness of teaching and learning. Teachers can use the data to guide their instruction in the classroom. According to the MAP test results measured twice during fall and spring 2018- 2019, the vast majority of elementary students at Collegiate American School made a progress in Mathematics, Reading and Language throughout one academic year. During fall test results, only half of students' population reached high average score that is greater than 61% percentile, while the vast majority of students reached that same score in spring. The results imply that the

effective strategies employed in the classroom have had a positive impact on student scores. In this review, results are attributed to evidence based instructional strategies employed by the teachers, and proven to influence students' achievement based on their effect size.

In Hattie's (2008) meta-analyses compendium of list influencing learning, he describes the effect size Cohen "d" where the larger the effect size, the more effective the approach. Hattie (2008) presents a list of more than 250 variables, yet as much as we believe that students' success depends on a holistic approach including all variables, the focus of this paper is a review of research related to improving academic achievement in basic skills, we will solely focus on instructional strategies related to teaching and learning. One approach to reduce the number of variables is to consider the influences related to the classroom variables such as teaching using instructional strategies that have positive impact on students' learning. Another approach is to select only the ones that meet the cut-off criterion with an effect size higher than 0.40. The effect size essentially generates a standard deviation between the correlation of two variables. Hattie uses Cohen's (1988) method of calculation referred to as "d". As a result, 0.40 effect size is considered as the cut-off for selecting important variables that will be used in the research. Every influence at or above 0.4 is considered to be within the "Zone of Desired Effects" and by then teachers should focus their energy on improving skills using these approaches.

## Definition of Student Achievement

Student achievement is the basis of nearly every aspect of education. It gives direction to all educational improvement efforts and provides the foundation for

education accountability systems. The majority of empirical research dealing with the quality of education measures achievement in relation to students' performances in their studies and to test results – which are, of course, the most frequent indicators of the effectiveness and quality of the teachers and of the school.

## Influences Related to Teachers

Some believe that the primary focus of schools should be the academic preparation of students (Tienken & Wilson, 2001), that the main person responsible to deliver this academic success for student is teacher (Darling-Hammond, 2000), and schools should efficiently and effectively organize themselves towards that task (Engelmann & Carnine, 1991). One of the important categories contributing to students' achievement includes teacher characteristics. Hattie (2009) identified variables related to teacher characteristics that met his cut-off criteria including micro teaching (d = 0.88), and teacher expectations (Goddard, Hoy & Woolfolk-Hoy, 2000) with an effect d = 0.43. Moreover, Goddard (2000) provided an estimate of variables related to expectations for student achievement, and claimed that teacher efficacy to be especially important when aggregated amongst teachers within one school, creating a culture of positive work environment.

### Teachers' Expectations

Teachers are undoubtedly the most significant individual in the field of education and have the power to influence every aspect of their students' pathways. Much of the research findings point to the idea that there is a strong correlation between teacher expectations and their students' actual performance. These expectations are subconsciously reflected toward students and therefore, high expectations corresponds to

high academic performance for students, while low expectations would correspond with low academic performance.

**The Self-Fulfilling Prophecy.** Hattie noted, however, "The question is not 'Do teachers have expectations?' but 'Do they have false and misleading expectations that lead to decrements in learning or learning gains?" (2008, p. 121). To understand how teachers' expectations ranging from high versus low might influence student learning and students' expectations, it is helpful to be aware of the self-fulfilling prophecy. The self-fulfilling prophecy works on the principle that high expectations lead to enhanced performance. A self-fulfilling prophecy works the other way also and it occurs when teachers hold low expectations toward students. With low expectations, the result would be decreased performance. Teachers with low expectations produce behaviors that cause a decrease in student performance because students themselves produce negative behaviors. On the basis of different reviews and meta-analyses, the average effect of teacher expectations on subsequent student performance has been found to be moderate ( d = 0.43; Hattie, 2009 ). In particular, students with lower academic achievement seem to be more influenced by their teachers' perception of their performance. When teachers form inaccurate judgements it is always the lower achiever that are more severely affected because they rely entirely on teachers' support (Madonetal, 1997). High achievers can always fall back on their earlier results in the event of teacher being unsatisfied with their performance. In general, teacher expectations become inhabited in their behaviors and ultimately this behavior is projected intentionally or unintentionally toward students' subsequent performance (Ready & Wright, 2011; Rubie-Davies, 2007, 2008). The rationale behind this assumption is one can notice the expectations others

ascribe, which ultimately leads that person to behave in such a manner that conform with these expectation.

**Teachers' Attributes**. This differential treatment of high and low expectation students may be the result of attributional perceptions one can develop based on general stereotypes such as ethnicity, gender, and socio-economic background. Teachers' expectations of student achievement might seem inaccurate sometimes, and these biased expectations are the product of student characteristics or previous academic results or informal information amongst staff (e.g., De Boer et al., 2010 ; Timmermans et al., 2015), or related to teacher variables and attributes, such as their background, motivation, and differential beliefs among teachers concerning instructional practices (e.g., Rubie-Davies, 2007; Weinstein, 2002 ). One case observed at Collegiate American school in which the teacher placed low expectations for most the students in the classroom with the arguments that what ever strategies implemented they always seem to fail due to students' cognitive abilities. The same group of students demonstrated better results on the MAP scores the year after. Based on conversations conducted with these students, they claimed to enjoy the classroom environment more often this year and particularly the connection they were able to build with their teacher on the basis of supporting them reaching their full potential . Psychologists use the term 'defensive pessimism' to explain the way most people lower expectations to cope with the anxiety arising from complex situations. School staff involved in defensive pessimism situations lower their expectations to mentally prepare themselves for failure and move along with challenging situations dealing and advancing the learning of hard to reach students. The point is, teachers need to avoid categorizing students based on inaccurate determinants. It is only

through keen observations and logical evaluations that teachers can potentially play an effective role in students' future academic success; the issue of teacher expectancy becomes all the more important.

**Teacher Self Efficacy**. The learning process is a personal journey for the student as much as it is for the teacher, both journeys contain remarkable commonalities. The act of learning is the act of transferring one's initial knowledge to a higher level of understanding they can use in a different context. The act of teaching entails purposeful intervention to ensure that there is a cognitive change in students' learning. The key component for this change is the awareness of the final learning outcome specific to all students' population within one classroom environment, knowing when a student is successfully attaining those outcomes, having sufficient understanding of students' mastery and providing meaningful and challenging progressive learning experiences. This process involves an expert teacher rather than just experienced teacher, who possess a myriad of learning strategies to support students as needed, to provide direction and re-direction in terms of the content being understood and thus maximize the power of feedback, and therefore prepare students to develop a self regulatory learning journey. Self regulation occurs when students learn to monitor and regulate their own learning. Regulation, or meta-cognition, refers to knowledge about one's own cognitive processes and the monitoring of these processes through acquired skills. "When students become their own teachers they exhibit the self-regulatory attributes that seem most desirable for learners, self-monitoring, self-evaluation, self-assessment, self-teaching" (Hattie, 2008, p. 43). To facilitate such an environment, to employ a variety of learning strategies, and to be cognitively aware of the pedagogical means, requires dedicated and passionate

professionals. Passion is not only constrained to joy and involvement (Neumann, 2006). Teachers need to be aware of which of their teaching strategies are efficient and which are not suitable, be prepared to understand and adapt to the learners' situations to attain understanding. Good teachers are aware of qualitative learning strategies, when to employ each strategy, what are the necessary requirements that facilitate learning, and how to encourage and support deep approaches to learning. The essence here is to change the process of teaching and learning according to the needs of the learner by creating an environment of divergent critical thinkers, and teaching to find out the missing links between theory and practice to fulfill the gap, which has always existed**.**

## Teaching Strategies

Hattie (2009) shared 14 teaching strategies that met his cut-off criteria. In this application research we will share the two with the largest effect sizes: engaging in reciprocal teaching (d = 0.74) and utilizing meta-cognitive strategies (d = 0.69). Strategies including teaching the steps in problem solving (sometimes recognized as inquiry-based approach) was also highly significant (d = 0.61). In general, teaching strategies were deemed quite important (d = 0.60). The teaching process is a learning process that becomes more efficient when teachers learn to innovate, seek new challenges and learn from these challenges, learn to monitor, seek and give feedback, and identify the right alternative learning strategies when others do not work. "What is most important is that teaching is visible to the student, and that the learning is visible to the teacher. The more the student becomes the teacher and the more the teacher becomes the learner, then the more successful are the outcomes" ( Hattie, 2008, p. 47).

**Surface, Deep, and Conceptual Understanding**

Hattie (2009) compares Popper's (1978) three world of understanding (the physical world, the subjective or mental world, and the world of ideas) to his theory of three level of understanding: surface, deep, and constructed understanding. It is important for teachers to be aware of these three levels of understanding due to their major impact on achievement, if we as teachers do not understand them before we start to teach, they can become the stumbling blocks for future learning. Hattie (2017) draws a simple distinction between surface and deep learning. Surface learning is very much about the idea, the content, the knowledge and the information while deep learning is when the learner relate or extend or transfer that knowledge

Teachers who apply a surface approach to learning tend to work according to the following general pattern such as concentrating strictly on assessment requirements, memorizing facts and procedures, routines, note taking, underlining, highlighting, summarizing and mnemonics necessary to help students master the surface knowledge. Nonetheless, the impact of some of these strategies is probably higher if taught within each content domain, as some of the skills can have reasonable effects of d =0.53. Some studies have found the proportion of surface thinking in the classrooms can be in the order of 80 percent or more (Airasian, 1991; Barnette, Walsh, Orletsky, & Sattes, 1995). For example, questioning strategy level can deviate between high and low depending on the quality and purpose of questions posed by the teachers. Teachers' questioning may not trigger higher order thinking and elicit deep knowledge, on the contrary they elicit so much of what is called "knowledge telling", and thus surface knowledge is sufficient. Hattie (2009) states that most teachers claim to prefer a deep view of learning, while at

the same time they emphasize surface approaches to teaching with the defense that this is what is required in order to prepare students for computerized assessment or qualifications.

Deep understanding or development of thinking skills involves learning strategies that develop skills through which the surface knowledge is durably established or well learned. This phase invokes the tendency to engage continuously in opportunities for effortful cognitive activities such as practice testing, rehearsal, maximizing effort, spaced versus mass practice, interleaved practice, help seeking, time on task, reviewing records, learning how to receive feedback and deliberate practice. Strategies that require sufficient metacognition and a calibrated sense of progress towards the desired learning outcomes. Acquiring deeper learning is the ability to organize and elaborate, monitor the uses of the learning strategies, and possess a variety of metacognitive strategies that are the critical determinants of success at this phase of learning. The major purpose is for students to deliberately activate their background knowledge and then connect and extend that knowledge beyond what they have learned at the surface phase. In another words, at this stage students learn to consolidate their initial understanding and transfer it to different learning situations.

Conceptual understanding or constructing defensible theories of knowing and reality constitutes a change in the quality of thinking that is cognitively more challenging than surface questions. In such cases, the learner is required to think beyond the shared knowledge and bring in related, prior, or new knowledge, information or ideas, in order to create a prediction, an answer, or a hypothesis that extends to a wider range of situations (Hattie & Brown, 2004).

Hattie and Donoghue (2016) focused on surface, deep and transfer learning. They conclude that students who are able to employ a repertoire of strategies they acquired through their learning process have high levels of awareness, control or strategic choice of multiple strategies, often referred to as self-regulated or having high levels of metacognition. Hattie (2009) described these self-regulated students as becoming like teachers since they possess a repertoire of strategies they can apply when their current strategy is not working. He adds that these students have clear conceptions of what success on the task looks like as they apply their knowledge to reach the targeted task. More technically, Pintrich (2000) described self-regulation as an active, constructive process whereby learners set goals for their learning and then attempt to reach their goal through higher order thinking skills such as regulating, monitoring, and controlling their behavior, cognition and motivation. Constrained by their goals, students who attained the conceptual level know the what, where, who, when and why of learning, and understand the reason behind each learning strategies. Self-regulation strategies include organization, elaboration, concept mapping, strategy monitoring, metacognitive skills, self-regulation and elaborative interrogation. In such cases, the learner is forced to think beyond the given knowledge and bring in related, prior, or new ideas in order to create a new answer, prediction, or hypothesis that stretches to a wider range of situations.

These three types of understanding, surface, deep, and constructed or conceptual understanding are built on the SOLO model of student learning that has proven most valuable both in developing models of teaching and learning and also in our understanding of assessment and achievement (Hattie & Purdie, 1998; Hattie & Brown, 2004). These three levels are simultaneously interconnected, and student must have

sufficient surface knowledge before moving to deep learning and then to the transfer of these understandings to conceptual understanding. It is necessary to note that the major revision of Bloom's Taxonomy (Anderson, Krathwohl, & Bloom, 2001) introduced four similar levels: factual knowledge (how to be acquainted with a discipline or solve problems in it); conceptual knowledge (interrelationships among elements within a large structure that enable them to function together); procedural knowledge (how to do something, methods of inquiry); and meta-cognitive knowledge (knowledge of cognition in general as well as awareness and knowledge of one's own cognition). This is a major advance of what is know as Bloom Taxonomy.

**Learning Objectives and Success Criteria**

Setting objectives is a prominent process of establishing regulated learning to guide instructions (Pintrich & Schunk, 2005). Students can make a clear connection and evaluate their performance in comparison to the expectation outcomes when teachers share and communicate learning objectives with student. For this perspective, teachers can gauge their students' starting point with relation to the learning objectives and determine what they need to pay attention to and where they might need help. This clarity helps students raise their intrinsic motivation and their confidence about their ability to succeed. The overall effect across 31 meta-analyses conducted by Hattie and Donoghue is 0.54, with the greatest effects relating to providing students with success criteria and having intentions to implement the learning goals. The process of transfer from surface to deep learning entails communicating learning intentions and success criteria, students can refer to accommodate learning gaps to their learning needs in order to reach the required performance. When students learn how to gain an overall picture of what is to be learned,

have an understanding of the success criteria for the lessons to come and are somewhat clear at the outset about what it means to master the lessons, then their subsequent learning is maximized (Hattie & Donoghue, 2016).

For success criteria to be effective, they have to be specific, differentiated but not restrictive, communicated to all students with all their ability levels, and unpacked in a way that is geared towards the specific targeted standard, and stated in a student friendly content, whereby the teacher uses the knowledge and skills identified through the unpacking process to plan lessons that focuses on student success. The results from McREL's 2010 study indicate that the strategies of setting objectives and providing feedback have positive impacts on student achievement.

**Subject Based Effective Strategies**

This section addresses instructional strategies considered to be more effective in one subject than the other. This model of teaching refers to "learning activities that are necessary and most adaptive for knowledge building in a domain specific activities" (Seidel & Shavelson, 2007, pp. 460–461). Seidel and Shavelson concluded that such domain specific activities consistently represented the most important influence of teaching on students' learning. For instance, reciprocal teaching is an instructional process to teach students cognitive strategies that might lead to improved learning outcomes specifically in reading comprehension, while inquiry method has always been studied in the area of science, even though the method can be used in any other context, while problem based teaching is mostly effective in Mathematics.

**Reciprocal Teaching**. Reciprocal teaching is an interactive set of verbal techniques where students and a teacher work in small guided practice groups, to develop

metacognitive higher order thinking such as predicting, inferencing, questioning, comparing, summarizing, classifying and clarifying. The aim is to develop reading comprehension skills by gradually delegating and empowering students to take on the role of the teacher. It is what we practically call guided reading. The emphasis is on teachers to enable their students to learn and develop cognitive strategies such as summarizing, questioning, clarifying and predicting. During a reciprocal teaching session, teacher and students use dialogic conversation and prior knowledge to construct a shared understanding of the text and to construct a background of reading comprehension skills. Teachers provide cognitive scaffolding and monitor the conversation and the process through a shared language related to the four aforementioned thinking strategies. Research on reciprocal teaching demonstrated that there are improved comprehension results and transfer of skills to other curriculum areas (Palincsar & Klenk, 1992; Westera, 2002). It is also noted that the dialogical approach is inclusive of students with different abilities (Soto, 1989, cited in Arbor, 2013). It aligns closely to developmental theories of learning described by Vygotsky (Kozulin, 1986).

Vygotsky (1978) linked metacognition and dialogue in providing an explanation of how individuals develop understanding of concepts. He believed that the process of learning involved moving into what he called the zone of proximal development, which is supported by another individual considered as expert able to guide the dialogue with the learner. Through dialogue the learner is able to shape current knowledge to construct new ideas and understanding. The process is supported by scaffolds, which provide accurate support based on the required needs of learners, allowing them to move from one level of understanding to another across the zone of proximal development (Kozulin, 1986).

According to meta-analyses conducted by Hattie (2009) the effect size is a very high d = 0.74, especially when associated with explicit teaching and scaffolding. An analysis of elementary students in the study school at Collegiate American School indicated performance at or above average of more than 71 percent of students in 2019-2020 as compared to the previous year's results where students scores during 2018-2019 in language and reading were concerning. When analyzing the results, it was noticed the impact of reciprocal teaching during guided reading sessions. The key factor in the success gain manifested through the results is due to the consistency in applying the reciprocal teaching approach to reading across all elementary classrooms and on a regular basis. While the inconsistency in incorporating this approach during the previous year has lead to drastic results in reading and language.

**Inquiry-Based Teaching**. Inquiry-based teaching is a process that permits students to explore and conduct investigation to reach the required understanding, rather than the teacher dictating to students what they need to know. Inquiry based instruction is considered a student centered approach to learning placing an emphasis on students' roles as an active participant in the learning and teachers as an activator facilitating learning. Throughout this process, students are encouraged to explore the material, ask questions, and share ideas to develop understanding. Inquiry methods have often been studied in the context of science. The concept of inquiry-based teaching began in the early 1960s with Bruner (1961). The teaching methods that Bruner recommended allow the learner to discover new information and ideas instead of merely memorizing teacher output. There are many terms used to describe this mode of instruction include inquiry-based teaching (Anderson, 2002; Furtak 2006; Jiang & McComas, 2015). Variation in opinion regarding

the effectiveness of inquiry-based teaching arises from ineffective (effect size = 0.08) to slightly effective (effect size = 0.71) depending on many variables such as the amount of scaffolding, student readiness and teachers' preparedness. Hattie (2009) used four meta-analyses (Bangert-Drowns & Bankert, 1990; Shymansky et al., 1990; Smith 1996; Sweitzer & Anderson, 1983) in his quest of inquiry-based teaching effect and from these meta analyses, he determined an effect size of 0.31. Furtak (2012) conducted a more recent meta-analysis of 37 experimental and quasi-experimental studies, and the latter revealed an effect size of 0.50 for inquiry-based teaching approaches. Instructions that emphasized content over process, were found to be particularly purposeless. On the other hand, instructions that emphasized teaching strategies that actively engaged students in the learning process such as hypothesizing, making prediction and drawing conclusions through scientific inquiry activities resulted in large learning gains and were more likely to increase conceptual understanding than passive strategies (Minner et al. 2010). Kirschner ( 2006) provide and explanation begging the low effect size that the inquiry based might hold in some situations, he discusses the issue of cognitive overload, in that the skills and knowledge required to carry out the inquiry activity are so challenging that the student is unable to grasp the key learning points of the activity. In this case learning frequently fails because it is presented in such a way that requires excessive use of cognitive resources that some students —especially those with low processing issues— find it almost impossible or challenging to cope. This is thought to occur because some students might not be able to process new information, unable to follow multi step directions or mentally reformulate new ideas due to their level of readiness and ability. In fact even though inquiry strategies are considered as being more student centered than

teacher directed traditional methods, they can produce higher learning gain if these were delivered via methods such as guided activities, scaffolded work or facilitated inquiry.

Furtak et al. (2012) carried out a meta analysis about the effect of inquiry based teaching when supported by a certain level of guidance ranging from teacher-led, traditional instruction to student-led inquiry, the results showed a positive effect. The study indicated that when students experienced traditional lessons or participated in unstructured student-led activities, they experienced less learning gains as compared to the groups that participated in guided inquiry. The key solution is by reducing the cognitive loads of skills not directly linked to the learning intentions that can be achieved by a greater level of teacher guidance (Hmelo-Silver 2006). Thus, when discussing the effectiveness of inquiry-based teaching it is imperative to discuss alongside one important factor that is the level of teacher guidance or scaffolding (Furtak et al. 2012). The key component is realizing that most effective classroom inquiry is usually guided and supported by the teacher, through inferential questioning and constructive feedback. Rather than leaving students to their own devices with the argument of preparing them to develop self regulated leaning, the teacher's obligation is to facilitate and guide each step of the inquiry process, ensuring that students are on the right track as they develop the higher-order skills of critical and creative thinking.

An observation related to the inquiry approach effect on two different groups of third grade students during two consecutive academic years. The same teacher implements the same inquiry approach with the first group in 2018-2019 and the second group in 2019 – 2020. Results based on MAP scores and classroom performance showed that the first group interacted more effectively than the second group. It is thought that

the reason is due to students' readiness and cognitive ability level. Students involved in this type of setting must have the capacity to embody the inquiry process and take ownership of their decisions. While this process does provide opportunities for students to voice their ideas, they may not function well in an unstructured environment if they are unprepared or unequipped for this shift. Teaching learners the skills of the inquiry process is a critical solution to this potential problem. Therefore, armed with the ability to ask significant questions and form judgements concerning the information they are researching during their investigation. When teachers design their classroom inquiry based on a structured inquiry process and teach students how to incorporate and use this process, they need to provide a scaffold for self-directed learning that enables all students to become self reliant and feel supported through the learning pathway. The key component is for the teacher to work from within the process, capturing evidence of learning and higher-order thinking as students are developing these skills. Another additional key component for the success of the inquiry based approach is ongoing, real-time formative assessment. Teachers will be able to collect a wealth of information about previous learning, experiences, perspective, ability and interest while listening to students voice through their responses , which lead all engaging learners in a conversation that raises the level of curiosity as a result.

**Feedback**

Results that emerged in studies of effective transfer of instructional strategies demonstrated that methods such as modeling practice, providing feedback and the use of cooperative learning groups have stronger effect than others (Mikulecky & Peers, 1994). Hattie (2002) reported a synthesis of over 800 meta analysis involving studies

representing a large number of students on various influences on student achievement. Those studies provided a benchmark figure from which to judge the various influences on achievement, it became clear that feedback was among the most powerful influences on achievement. It is important to mention that for feedback to be effective it should provide cues and reinforcement, tackling more challenging tasks and appreciating higher quality experiences rather than just doing "more." Additionally, it is also worth noting that the key component here is the feedback that requires a response, acted and reflected upon by students. The issue is even though many teachers claim to provide ample amounts of feedback yet not every situations demands students to respond and interpret the information in the feedback. What is required is that each student should receive moments of feedback in a single day (Nuthall, 2005). Punishment, negative reinforcements, praise, and extrinsic rewards were the least effective forms of feedback for enhancing achievement.

Hattie (2017) states in his latest research on the Visible Learning theory, that pupil self-assessment is one of the most effective tools teachers can use in order to accelerate their pupils' learning. His theory was further supported by research from the Educational Endowment Foundation, which validates the efficacious impact of constructive feedback in improving learning outcomes for children. Whether the feedback provided to pupils is verbal or written, the outcome is integral to effective teaching. Equally important, collecting feedback on how well pupils have learned something is necessary in order to enable teachers clearing up any misconception or misunderstanding and provide the right level of challenge as a next learning step.

**DIRT Feedback.** To strengthen the impact of next step marking and feedback in accelerating the children's progress in learning, the elementary school at Collegiate American School introduced the Dedicated Improvement and Reflection Time DIRT feedback strategy. DIRT is an effective way for children to act upon the feedback given by their teacher. Teachers spend a significant amount of time each day marking their students journals and adding comments. The purpose of DIRT process is to ensure the time teachers have invested in providing feedback is maximized as the children have to actively engage with the corrections or interventions. DIRT Making should become a thinking routine in the classroom. The purpose of this routine is to help pupils to focus their mind on improvement and enable it to be a meaningful component of their learning journey. This strategy encourages children to find ways in which they can improve on their first attempt in learning. Making mistakes is proof that children are learning, if they are not making mistakes they are not trying hard enough. Moreover, it encourages the children to take risks in their learning, build their resilience and dismantle their fear of failure. As Thomas Edison once said, 'I haven't failed. I've just found 10,000 ways that won't work.' A recent monitoring of this technique during learning walk by the senior leadership team involved an observation and conference with pupils about their learning process and what would be their next step to improve their learning, children were able to understand the purpose of DIRT and could explain the learning process they followed throughout their assignment. Students articulated their learning in a meaningful way allowing them to revise and reflect on the task at hand considered to be a prominent strategy to improve their learning.

**Explicit Teaching**

The model of explicit teaching is directed towards students' attention to reach a specific learning outcome in a highly structured environment. It involves direct instructions of topics and contents that are broken down into small chunks or even taught individually with the focus on producing specific learning outcomes. Children are provided with specific directions and structured frameworks such as demonstrations, explanations, modeling and practice, in addition topics are taught in a logical sequential order beginning from the simplest to the hardest yet all guided by the teacher. Another characteristic of explicit teaching involves modeling skills, behaviors and thinking. The key component making this process successful is that teachers demonstrate thinking to students when working through problems and modeling processes for students. Various reviews and meta-analyses have studied and reported the effectiveness of explicit instruction. For instance, in a meta-analysis conducted by Swanson (1999) about intervention plans incorporating explicit strategies for students with learning disabilities LD, results demonstrated large effect sizes of 0.80, even higher effects were noted when direct instruction was involved. Furthermore, higher effect size of 1.06 were noted for reading comprehension and word recognition when explicit instruction was coupled with strategy-based instruction. Explicit instruction is used mainly to support learning for students with learning disabilities in the core subjects of reading, writing and mathematics. After completing a meta-analysis of the research literature on effective teaching strategies, Swanson (2001) reported that the best model for instructing students with learning disabilities is strictly interconnected to the explicit teaching model. The largest effect size was observed with explicit strategy instruction such as strategy cues,

think aloud models, explicit practice, independent practice elaboration and explanations. Gersten, Vaughn, and Chard (2000) noted in a review of research funded by the Office of Special Education Programs and the National Center for Learning Disabilities, that "making instruction visible and explicit is an essential feature of effective interventions for students with LD" (p. 108). Further, these authors noted that "teachers need to plan and reflect on their instruction to ensure that it is explicit and intensive so that students with learning difficulties are faced with valuable learning time" (p. 111). According to Gauthier, Richard and Bissonnette (2013), explicit instruction can be divided into three consecutive steps: modeling, guided or directed practice, and independent practice. In this perspective, it is important to take into consideration the understanding by design model through which the educators prepare their lessons in advance and reflect on the anticipated learning outcomes and how the anticipated learning outcomes will be evaluated. Ultimately, the teacher must specify the learning objectives they will pursue with their students, which drives planning activities in reverse (Tomlinson & McTighe, 2010). Bissonnette et al. (2010) identified strategies aimed to support students who are at risk for failure through intervention instructions. These interventions were explicit instructions aimed to promote reading, writing and math skills for students with learning disabilities. It was concluded that explicit instructions is more efficient if utilized alongside the reciprocal teaching method. It is therefore interesting because students with learning difficulties requires additional time for practice in order to consolidate their learning where they can apply what they have understood from the modeling and guided practice steps and transfer to their independent practice. Before reaching a stage of some expertise, students who are novices require much more direct instruction in order to reach

a more advanced self regulated learning catered toward student centered activities such as assessment for learning strategies, or constructivist methods. These methods can be integrated into our teaching methods with success (Muijs & Reynolds, 2000; Rowe, 2006).

Critics of explicit instruction basically argue that this model is a deficit that positions students as passive learners sitting in rows all day engaging in rote learning. This is a misconceiving perception about explicit instruction. “Sometimes deeper concepts need more specific and direct teaching, and sometimes the more surface concepts can be learned via inquiry or problem solving” (Hattie, 2008, p. 53).

**Ways to Prepare for Standardized Tests Without Sacrificing Best Practices**

In this era of accountability, a lot of teachers claim feeling compelled to abandon best teaching practices in exchange for a test preparation curriculum designed to raise students’ scores. Many educators find themselves judged by the test scores of their students test results that are determined by factors beyond their control: students’ academic background, students’ cognitive abilities, school curriculum and programs, transience of the population, socioeconomic class, and so on. With the accountability assessments raised by requirements for annual student progress and achievement connected strictly to teachers’ appraisals, there is an increasing concern that teachers will teach to the test and thereby narrowing the curriculum and compromising the quality of daily lessons. Researchers suggest that teachers can prepare students to conduct standardized assessments without sacrificing best practices. Proham ( 2001) describes it as “teaching the test” instead of “teaching to the test” in which a teacher directs instructions towards a body of language represented in a test.

Some researchers administered studies about testing effect within classroom settings (Carpenter, 2009; Anderson, 2012; Roediger, 2013). Experiments have revealed that low- stakes multiple-choice quizzes with immediate correct-answer feedback can indeed enhance student learning for core course content. Carpenter (2009) proposed a suggestion concerning direct effects of practice testing. His suggestion revealed that testing can enhance retention by triggering elaborative retrieval processes. In return these processes enhance long-term memory that activates prior related information forming an elaborated trace that triggers multiple pathways to facilitate later access to that information. To benefit the most out of practice tests, it is suggested to make them low-stakes, which can help decrease test anxiety. We extend the notion of practice test to massed and spaced practice. Most students tend to forget the materials or strategies being taught. According to a model developed by Nuthall (2000) of how students acquire the knowledge embedded in their classroom curriculum experiences, it requires three to four experiences involving interaction with relevant information for a new knowledge construct to be created in working memory and then transferred to long-term memory. From this perspective providing opportunities to go over these materials at a later stage of their learning will allow students to sustain their cognitive engagement. Amongst the strategies related to instructional effectiveness, Hattie (2017) mentioned the effect of spaced practice to have high impact on students' achievement. Spaced practice includes aligned materials from previous years. In this case, if we as educators aim to optimize students' success we need to reconsider the elements we cover in our assessment and the frequency of our testing.

Timing also matters: to identify false impression about their level of understanding of any topic of study being introduced, it is helpful to give a practice test right after a lesson and continue to give them throughout the school year to reinforce the materials. Since students may not realize what questions they got wrong or why teachers must give feedback to allow students time to reflect on that feedback and act upon it. Finally, simple preparation strategies such as flash cards, exit ticket or multiple choice or any other low stake example can dramatically improve a student's performance. It is important to note that practice tests is always beneficial to learning regardless of the format of the practice test, even if it does not match the format of the criterion test.

**Assessment for Learning**

Formative assessment methods are considered as important techniques in raising the overall level of student achievement. Research conducted on formative assessments has claimed that it is perhaps one of the most important interventions for promoting high-performance. In their influential 1998 review of the English-language literature on formative assessment, Black and Wiliam (1998, p. 61) concluded that:

> ... formative assessment does improve learning. The gains in achievement appear to be quite considerable, and as noted earlier, among the largest ever reported for educational interventions.

As an illustration of just how big these gains are, the effect size is 0.7. For assessments to be more effective, they need to be an extension and a reflection of the learning skills content constructed in the classroom and aligned with the instructional activities and should not be a surprise. Critics of the alignment between content and assessments sometimes argue that this approach is nothing but "teaching to the test," but

of the desired learning goals are the foundation of any instructional experiences, then assessment of student learning are simply an extension of the desired learning goals to be assessed and therefore teachers are testing what they taught instead. Since the aim of any teaching practice is to support students' learning to reach their potential, it is therefore impeccable to identify learning needs and adjust teaching appropriately. In classrooms, formative assessment refers to frequent, interactive assessments of student progress and understanding. Teachers use formative assessment techniques to better respond to their diverse students' needs. It is widely recognized by educators that today's classrooms are characterized by academic diversity among students (Tomlinson et al., 2003). Among the learners in regular classrooms are students with identified learning problems, ELLs, highly advanced learners, underachievers, students from broadly diverse cultures and economic backgrounds and students who may fit into more than one of these categories (Tomlinson et al). Approaches like differentiation, scaffolding, modifications, accommodations of learning and adaptation of teaching are put in place to raise the level of student engagement and achievement, and within the same fashion we are providing a greater equity of student outcomes. Analyzing assessment results, provide information for both students and teachers. By reviewing the results, teachers must consider the quality of their teaching, in other terms, what Hattie (2009) calls "Formative Evaluation of Programs" (p. 181). The major message is for teachers to pay attention to the formative effects of their teaching, as it is these attributes of seeking formative evaluation of the effects of their programs that makes for excellence in teaching and mastery learning (d=0.90). When followed by corrective measurements and feedback assessment can be

vital component in our effort as teachers to improve students' learning. Improved learning leads to the process underlying mastery learning.

**Mastery Learning**. Mastery learning refers to students' ability to master the material being taught, in that all children can learn when provided with clear explanations of the task at hand. Mastery learning include other features to facilitate the appropriate learning conditions in the classrooms. These features involve high levels of cooperation between classmates; myriad amount of constructive teacher feedback that is both frequent and specific by using diagnostic formative tests; and the regular correction of mistakes students make as they travel along their learning path. Using classroom assessment to improve student learning and ultimately achievement goes to Bloom (1968, 1971). He defined mastery in terms of behavioral objectives, with class instruction supplemented by feedback or correction mechanisms. It is important for teachers to understand the most efficient use of assessment and establish a culture of evaluation where students and teacher set goals for their learning, and prepare success criteria to reach these goals, assess their performance as compared to the intended learning goals, reflect on their performance and finally incorporate multiple strategies until they reach the final outcome.

## Students' Learning Strategies

When we refer to change in knowledge, behaviors, beliefs and attitude in one's initial acquisition we are talking about learning. This acquisition unfolds over time, contributing to a change that is not fleeting but rather evolving to undergo a long lasting impact on students' thinking and behaviors. Learning is something students do by themselves, rather than something done to them. It is the result of how students interpret situations and respond to their experiences. Vygotsky (1986) defines learning as the

process of engaging and manipulating objects, experiences, and conversations in order to build mental models of the world. The process of learning entails steps that learners would follow naturally as they build knowledge. Whenever they explore and investigate the world around them, connect new ideas with prior understandings, interact and observe with phenomena, and engage in conversations with others, learners are building their knowledge. This process involves building, consolidating, enriching, and modifying existing understanding, where "one's knowledge base becomes a scaffold that supports the construction of other future learning" (Alexander, 1996, p. 89). Learning provides learners with the opportunity to engage with specific ideas and concepts on a need-to-know or want-to-know basis (Kolodner, 2006; Greeno, 2006). In this review, we define learning as a process predicated on a set of principles that lead to change, where change occurs and unfolds as a result of ones' experiences and increases the potential for improved performance and future learning. The set of strategies that follow are connected with the definition stated above.

**Creating an Environment for Learning: Cooperative Learning**

The use of cooperative learning in instructional strategies is based on the constructivist approaches to learning, with particular attention to the contribution that social interaction can produce. In essence, interactive learning is at the heart of the constructivist approach, and it is formed on the principles of the social component where individuals build their own knowledge through interactive approaches, connecting new ideas and experiences to existing knowledge and experiences to form new or enhanced understanding (Bransford et al., 2000). The idea of the social interdependence theory is the origin behind the consideration of the prominent role that groups play in the process

of cooperative work. Vygotsky expanded the notion of social interdependence by examining the relationship between social activities and cognitive processes, developing the sociocultural theory. The theory of sociocultural development considers the social aspect as the main component in constructing knowledge, supported by positive group interdependence, which is the base of cooperative learning. Vygotsky refers to this idea as the zone of proximal development. He suggests that learning takes place when students solve problems beyond their current developmental level with the support of their instructor or their peers.

In a meta-analysis of several studies comparing cooperative learning to competitive learning and individualistic learning in college students (Johnson et al., 2006), researchers found that cooperative learning produced greater academic achievement than both competitive learning and individualistic learning, exhibiting a moderate to high effect size of 0.54 when comparing cooperation and competition and 0.51 when comparing cooperation and individualistic learning.

Cooperative learning situations play an imminent role in learning as it involves two or more students working together to improve their understanding of a performance task. Cooperative learning takes different form in the classroom. Strategies Like Think Pair Share, peer instructions, jigsaw puzzle are all examples of what constitutes an cooperative learning. Settings such as placing students in homogeneous and heterogeneous grouping are also examples of cooperative learning. Several literacy studies have indicated that learning in pairs and heterogeneous or homogeneous groups can provoke positive interactions that facilitates transfer of learning. O'Donnell (1989) and Larson, Hythecker, Dansereau and Rocklin (1985) performed a study outlining a

pattern of situations consisted of reading strategies such as note taking and summarizing important ideas, listening and correcting summary mistakes. The purpose of the patterns was to observe how cooperative learning facilitated the transfer of reading abilities through these patterns. It would appear from these studies that transfer occurs when there is sufficient time to practice these strategies and when the cooperative activity calls for the learner to internalize what has been learned. Students' readiness and maturity play an imminent role in the effectiveness of cooperative learning. The earlier cooperative learning is implemented the better students academic performance appears to be. For instance, students in kindergarten who learned the norms of collaborative learning can take more responsibility when it comes to their classroom performance than third grade students who are socially not ready to collaborate with each other to assume responsibility. Additionally, in a classroom where there is an increased number of students with learning difficulties, cooperative learning (specifically peer learning) is the only solution that leads to active student engagement and overcoming learning challenges (Johnson teacher al., 2014). Cooperative learning strategy is heavily implemented and used in the elementary department at Collegiate American School as a strategy to support English Language Learners ELL and students with learning difficulties. Observation of student performance and results indicated improvement in their reading and math scores according to MAP scores. In some occasions, students with higher ability were able to support students with lower ability and in other occasions students with the same ability felt more confident working with groups with the same ability which allow them to share their thoughts and idea with ease.

**Students' Prior Knowledge**

Psychologists (Thompson & Zamboanga, 2003) stated that prior knowledge is one of the most important factors in learning. Researchers used several explanations to describe the term prior knowledge. Some simply define it as what a person already knows about the content (Marzano, 2004) while others use more complex definitions such as Biemans and Simons (1996), "all knowledge learners have when entering a learning environment that is potentially relevant for acquiring knowledge" (p. 6). Dodgy and Alexander (1995) go further by stating that prior knowledge is the whole of a person's knowledge, including explicit and tacit knowledge, metacognition and conceptual knowledge. It is what we initially possess in our brain before we add new learning materials. In any cases teachers often make assumptions that students come to class possessing the skills and information necessary for new knowledge. When preparing instruction, the focus is always geared towards students' expected outcome instead of thinking initially of what they already know. In fact, in some cases, students lack prior knowledge to extract meaningful learning or further more their prior knowledge is not always compatible with the learning target that teachers intend to achieve, or simply is inappropriately associated with an inaccurate content. Our prior knowledge is an amalgamation of concepts, facts, perceptions, beliefs, experiences, and attitudes. This amalgam makes it hard to discern between what consists an accurate, complete, and appropriate knowledge for the context, and what consisted an inaccurate, insufficient or simply inappropriate for the learning requirements. As students bring this knowledge to classrooms, it influences how they interpret this knowledge, in other way it accelerates their learning or impedes it. Understanding what students know or tend to know will help

teachers leverage their knowledge accurately and ultimately plan instructional strategies that fill any preexisting gaps, actively work to correct any misconceptions and consequently promote students' academic achievement. Students connect and add their recent learning outcomes to their previous knowledge, interpreting incoming information through the lens of their existing knowledge, beliefs, and assumptions (Vygotsky, 1978; National Research Council, 2000).

In literature the term background knowledge is interchangeably used to refer to prior knowledge. Here, the terms are used synonymously since they both mean essentially the same. Hattie and Hansford (1982) reported an effect size of d = 1.19 between measures of intelligence and achievement. The overall effect size is among the highest effect sizes in the meta-analyses, "This high relationship accounts for what many researchers call the "Matthew effect," which is based on the biblical notion that the rich get richer and the poorer get poorer or do not gain as much" (Hattie, 2009, p. 68). Children's prior knowledge they brings to the classroom each year is strictly interconnected with their achievement in previous years. Hattie and Marzano go beyond student academic achievement at school, to talk about one's success after school. Marzano (2010) states that academic background knowledge affects more than just "school learning." Prior achievement is related to success stories emerging from the first years of schooling including preschool (Duncan et al., 2007; La Paro & Pianta, 2000), to high school and college or university grades (Kuncel, Hezlett, & Ones, 2001), and between grades in school and later job performance (Roth, BeVier, Switzer, & Schippmann, 1996).

In fact, there is widespread agreement among researchers that students must connect new knowledge to previous knowledge in order to learn (Bransford & Johnson, 1972; Resnick, 1983 ), yet the effect role might be sometimes erroneous when students' background knowledge is influenced by misconceptions that can impede learning. Strongman and Hall (2004) reports several studies that demonstrates how students harbor misperceptions. Prior knowledge activation could impede learning if it is erroneous and if it passes unnoticed, results are consequently negative on students' academic achievement. In which case intervention becomes a necessity, otherwise students can fare poorly on tests. Teachers can not disregard such ideas, on the contrary, they need to create an intervention plan that helps students discover thoughtful ways to correct them. Of course, establishing the conditions that enables students' thinking to be revealed is not a small task. Background knowledge is the raw material that triggers learning. It acts as a mental hook that interconnects prior learning to new materials. Examples of tapping on prior knowledge could be direct instruction, introducing new vocabulary, questioning and inquiring into a topic.

Strangman and Hall (2004) claim that direct instruction strategies combined with prior knowledge have much promise with diverse elementary students. Examples of such techniques includes vocabulary instruction, introducing difficult concepts in a reading text or a reader has content or even in a math problem solving task. Patches (2005) also talks about diversifying classroom groups to encourage participation among all students and to pose questions related to the topic of study. A positive inquiry based classroom environment is a prerequisite for students to share what they think they know through a set of visible thinking routines. These routines will help students to develop a better

understanding of the content to be taught while at the same time uncovering students' prior knowledge.

**Transfer Strategies and Meta-Cognitive Strategies**

According to Edutech Wiki, transfer of learning refers to learning in one context and applying it to another, for example the capacity to apply acquired knowledge and skills to upcoming situations. In the context of education, transfer of learning can be referred to as transfer of meta-cognitive strategies, that is the effective application by learners of the cognitive skills gained as a result of new learning. Stated in another way, transfer of learning occurs when learning in one context impacts an existing performance in another context. Hattie and Donoghue (2017) focus on students acquiring deep level, and suggest teaching strategies such as organization, concept mapping, strategy monitoring and meta-cognitive strategies. As stated previously, deep learning can be consolidated by using meta- cognitive strategies like questioning, comparing and contrasting, self monitoring, explanation of thinking, self verbalizing, peer tutoring, collaborating to reach final goals and any other critical thinking techniques. From a practical point of view, transfer of learning can have several contexts. It can transfer learning from one level of Bloom's Taxonomy to a deeper level, and across content areas. The question that rises is "How can learning transfer be facilitated?".

**Questioning and Cues.** Teacher questions, are classified as instructional cues and stimuli in the classroom setting that convey to students the content to be learned and guidance for outcome expectations and the process of their execution. Some researchers have conducted general investigations of the role of classroom questioning and have drawn the following conclusions: instruction which include posing questions during

lessons is more effective in producing achievement success than instruction conveyed without questioning students. Schroeder, Scott, Tolson, Huang, and Lee (2007) found an effect size of 0.74 for questioning in science, and Sencibaugh (2007) reported an effect size of 1.18 for questioning in reading comprehension. One of the studies related to cues and questions (Hay et al., 2007) illustrated the effects of questioning on students with language difficulties. This study investigated teachers' use of four levels of questions, developed by Blank, Rose, and Berlin (2003), to enhance students' language development. The first level requires students to name objects, events, topics, or concepts, a practice that increases their vocabulary. The second level of questions focus on the organization and classification of the vocabulary, which helps students store and retrieve the information from memory. Level 3 questions require higher-order reasoning, helping students reorganize and elaborate on the information and link the new information to what they already know. The fourth and last level of questions move to the abstract level and ask students to reflect on, restructure, and advance their perceptions about concepts. In another word moving from surface learning to deep learning through a progressive scale of questions that helps students deepen their understanding in a step by step way going from the simple concept to the more complex. In this case teachers avoid any confusion and devoid of understanding students may encounters dues to the complexity of the questioning provided to initiate learning.

Marzano (2010) found a strong correlation between the cognitive level of teachers' questions and the achievement of their students, and results on that matters has proved frustrating to many in the field of education due to the quality of questions used in the classroom. For instance, McREL researchers calculated effect sizes for cues and

questions (0.20). Researchers found higher cognitive questions used with low ability students may have opposite effect due to the lack of understanding, the process of higher cognitive thinking should be done gradually. The same correlation is true of research examining the relationship between the cognitive level of teachers' questions and the cognitive level of students' responses. The conventional wisdom that says, "ask a higher level question, get a higher level answer," does not seem to hold. The results indicate that systematic and progressive use of tiered questioning enhances students' ability to organize information in verbal memory, and their ability to engage in critical reasoning . Such an approach can initiate and boost students' motivation by tapping into their curiosity and interest about the topic. In addition, using higher-order questions can help students deepen their knowledge by requiring the use of critical-thinking skills.

**Summarizing and Note Taking**. The process of summarizing required distilling the most important aspects of information or text in order to support the process of understanding, ease the process of memorizing, and facilitate the process of learning the relevant material. Similarly, the process of note taking involves capturing key ideas, through varied strategies such as writing, drawing, or audio recording for later access. Summarizing and note taking are part of the same category of transfer strategies because they both require students to analyze and distill information. The purpose of summarizing and note taking is to help students deepen their understanding of information and ultimately facilitate learning, since these strategies provide opportunities that involve higher-order thinking skills. For examples these opportunities should involve the act of capturing, organizing, and reflecting on important facts, concepts, ideas, and processes they will need to access at a later time (Olive, Piolat, & Kellogg, 2005). Cognitive

psychologists (Kintsch, 1979; vanDijk, 1980) have found that summarizing involves at least two highly critical thinking strategies: filling the missing parts through analysis and inferences and translating information into a synthesized form. Additionally, note taking, like summarizing, involves higher order thinking strategies: identifying essential information, sorting and coding information, which can help them memorize information and conceptualize new ideas. Numbers of studies have been conducted on the effect of note taking on student achievement. Findings from McREL's (2010) study indicate that summarizing and note taking have positive effects across content areas and grade levels, with note taking having a significantly higher impact on learning than summarizing — The effect size for note taking (0.90) is similar to the overall combined effect size (1.00). Teachers might achieve better results if they teach students to use summarizing in conjunction with other cognitive strategies. For example, Hattie and Timperley (2007) report an effect size of 0.86 for reciprocal teaching, which includes summarizing, questioning, clarifying, and predicting.

**Similarities and Differences**. Other patterns consisted of identifying similarities and differences through four main components: comparing, classifying, creating metaphors and creating analogies. For instance, metaphors can be used in all content areas to help students make sense of information. Teachers should intentionally plan to use metaphors when they want students to focus on how items are similar on an abstract level (Harrison & De Jong, 2005)

Seeing similarities and differences is a fundamental cognitive process (Gentner & Markman, 1994; Goldstone, & Markman, 1995). Equally important, other cognitive strategies promote higher order thinking such as making connections related to patterns

amongst different learning elements, classifying groups based on specific characteristics, creating metaphors to make sense of information and creating analogies to see similarities between things that seem dissimilar on the surface. Students benefit by having similarities and differences pointed out by the teacher in an explicit manner. This might include amazing discussions and inquisitive situations, and it allows students to focus on the relationship or bridge to the new ideas (Chen, Yanowitz & Daehler, 1996; Gholson, Smither, Buhrman, & Duncan, 1997; Solomon, 1995). This instruction should include providing students with steps in the process and modeling the process in order to promote higher-order thinking. As students become more familiar with each process, teachers should provide opportunities for them to do so independently, gradually removing the scaffolding provided by teacher-directed tasks. Teachers can use student-directed tasks to stimulate divergence in students' thinking. Each of these components consist of processes that offer students opportunities to think and learn at deep level that promotes higher order thinking.

**Generating and Testing Hypotheses**. The process of generating and testing hypotheses involves consolidating knowledge by using two higher order thinking skills that can be interdependent or interconnected with one another. Deduction is the first skill when we refer to generating and hypothesizing. This process entails using general rules to make a prediction about a future event or action. Deductive thinking, involves applying a generalization or rule that is known or provided to the student. Induction, the second thinking process involves making inferences that are based on knowledge that students already have or information that is presented to them. Induction involves drawing new conclusions or identifying rules based on observations or patterns in information.

Generally speaking, deductive approaches produce better results than inductive approaches. The inductive approach provides students with opportunities to discover principles and generalizations on their own, but it also provides opportunities for students to stray from the main questions and primary learning tasks. Misconceptions can easily form as students, investigating on their own, create an incomplete or incorrect understanding. In this way teachers must have a solid understanding of the content, debrief inductive learning experiences with students, and provide formative assessment opportunities to ensure that students have not developed or reinforced misconceptions as they constructed their own learning.

Across grade levels and content areas, inquiry in the classroom turns curiosity to the learner's advantage. Creative teachers create opportunities to guide students through the process of asking quality questions, generating hypotheses and predictions, investigating through testing or research, making observations, and finally analyzing and communicating results. A variety of tasks helps provide a context for students to generate and test hypotheses. These tasks include processes such as systems analysis, problem solving, experimental inquiry, and investigation. Through active learning experiences, students deepen their understanding of key concepts. Researchers have found that methods and techniques used during science inquiry lessons help students gain a better understanding of fundamental concepts, in comparison to traditional methods like lectures and textbook-based instruction (White, 1998). For example, Ward and Lee (2004) find that students who are involved in problem-based learning which involves students generating and testing possible solutions to real-life problems, have a better

understanding of the connections among the content, their own personal lives, and the work world than students taught using a lecture-based approach.

Inquiry extends far beyond the science classroom. Inquiry methods can be used in any other subject area. For instance, in math, students begin their target with a question where they have to solve a problem make predictions and analyze the questions based on their understanding of the data presented to them. In history, students search for evidence to support their main idea and theory about why certain historical events unfolded. In language arts, students predict what comes next in a story based on events that have already transpired. In every context, teachers can make inquiry more effective by initiating learning with a question that triggers their curiosity and by scaffolding their experience as their learning unfolds progressively.

Generating and testing hypotheses deepens students' knowledge because it requires the use of critical thinking skills such as analysis and evaluation – the two highest levels of thinking in the Bloom's Taxonomy. Much of the literature suggests that it is possible to teach successfully for transfer through generating and testing hypotheses. The overall effect size for the 15 studies analyzed in the 2010 study is of 0.61 that was reported in the first edition of *Classroom Instruction That Works* (Marzano, 2000).

**Concept mapping.** Concept mapping involves the development of graphical representations of the conceptual structure of the content to be learned. In other words, concept mapping refers to focusing on the essential aspects of the content to be learned, thus the representation entails a pictorial-like representation to familiarize students with the surface knowledge of the deeper concept to be mapped. The importance of concept mapping is to scaffold students throughout the process of brainstorming the main idea of

a specific outcome using a pictorial spectrum. Concept mapping can assist in simplifying higher order thinking strategies, particularly for the learners who do not possess these skills. Kim, Vaughn, Wanzek, and Wei (2004) argued that the visual displays of information such as synthesizing, comparing, summarizing, identifying the main ideas and interrelationships provided by concept mapping enhance the reading comprehension of students with learning difficulties, possibly by helping these students represent their verbal information by graphical representation and thereby improving their recall. Hattie (2009) found that the average effect of concept mapping is 0.57**.**

# CHAPTER III: APPLICATION MATERIALS

Lessons were written for a group of elementary students in heterogeneous classrooms at Collegiate American School Dubai, United Arab Emirates. Students in the class are very diverse. There is no major population of one ethnicity or nationality, but the majority of students are from Asia, Europe, Middle East and The United States. A vast majority of students speak English as a second language. Thirty students in the elementary school have Individualized Education Programs (IEPs) outlining their special services and needs. The design of these lessons includes a description of strategies mentioned in the literature.

## Lesson Plans

**Grades:** 1-5

The lessons below are purposeful and apply the research related to influences affecting student achievement. The purpose of these lesson plans is to help elementary teachers prepare lessons that responds to Dubai Schools Inspection Bureau DSIB framework of what constitutes an outstanding lesson. The UAE School Inspection Framework is based on comprehensive performance standards that define the essential aspects of a quality education (see appendix). Each standard is broken down into specific indicators and elements, and detailed descriptors and illustrations guide inspection judgements and school improvement. The judgment is based on performance standards and indicators measured through evidence based research and reflection of previous years of inspection and the vision of the years to come. School inspections are structured around six performance standards and conclude with an overall performance judgment. Performance standards are as follows:

1. Students' achievement
2. Students' personal and social development, and their innovation skills
3. Teaching and assessment
4. Curriculum
5. The protection, care, guidance and support of students
6. Leadership and management

Below is an explanation providing guidelines for effective lesson planning related to key elements of the research-based best practices recommended in Chapter II. Each lesson provides a clear link between evidence-based teaching strategies and classroom practices. Teachers can use and adjust their practices in response to their students' needs and monitor the impact on students' learning outcomes. There are seven lesson components that reliably increase student learning whenever they are applied. They emerge from the findings of tens of thousands of studies of what has worked in classrooms (Hattie, 2017; Marzano 2010; Tomlinson, 2014; Shaddock, Packer, & Roy, 2015)

All units are aligned with the Common Core State Standards CCSS introduced through curriculum that covers the content. Every unit represents the relationships between concepts that can help students to improve their meaningful learning and the lessons to be introduced. All lessons and activities within the lessons are centered around integrated topics with the exception of stand alone topics that can not be embedded in other subjects. The school is using Eureka for Math, Engage NY for English Language Art and Next Generation Science Standards NGSS for Science.

**Part 1**: Essential Question. The first part of the lesson (see appendix) consists of the big ideas under the form of a question that is strictly connected to learning standards. Standards are formulated in a question format to trigger students' attention, curiosity and prior knowledge. Schroeder et al. (2007) found an effect size of 0.74 for questioning. When teachers begin their lessons with questions, they require students to make inferences and draw upon what they already know and think more deeply and critically about the standard or information presented. Since the goal is to help students achieve learning objectives, then it is critical for the questions to address the big idea and what is important to learn about a topic.

**Part 2**: Learning Objectives and Success Criteria. The second part of the lesson (see appendix) consists of success criteria and learning outcomes. Setting objectives is the process of establishing a direction to guide learning (Pintrich & Schunk, 2002). Hattie and Timperley (2007) found an effect size of 0.54 when objectives and feedback work in tandem. Teachers need to identify success criteria for learning objectives so students know when they have achieved those objectives (Hattie & Timperley, 2007). At a minimum, setting objectives involves clearly communicating what students are to learn. The classroom practices presented in the lessons emphasize that learning objectives should be differentiated to allow the diverse students abilities reaching their full potential and their highest expectations possible (Zone of proximal development, Vygotsky, 1976) regardless of their grade level, to maximize this strategy's potential for improving student achievement.

The process of setting learning objectives begins with knowing the specific standards. Often, standards are written at a fairly general level, so teachers must "unpack"

the statements of knowledge in their standards document to drill down to more specific statements of knowledge and skills that can serve as the focus for instructional design and delivery. For example, as a 3rd grade teacher prepares to design and deliver writing instruction, he or she might encounter the following 3rd grade standard and expectation: Standard: RL.3.9. Compare and contrast the settings of stories written by the same author about the same or similar characters

In this example, the standard is written at a very general level. While success criteria should be more clear, specific and student friendly (Marzano 2010). Teachers may use the unpacking process to determine students' learning outcome under the "I Can Statement" such as:

- D: I can list the 5 senses I heard to describe setting in a story
- S: I can give examples of what senses an author used to describe the setting of a story
- A: I can use a Venn Diagram to identify similarities and differences of setting in two texts by the same author

C: I can debate which setting was described better to the reader using success criteria.

**Part 3**: Prior Knowledge. The third part of the lesson refers to students' background knowledge. The beginning of a great lesson should engage student interest. A brief "activator" activity (lasting no more than five minutes) should "hook" students' desire to learn lesson content. Through an engaging and experience based activator task, students can explore the purpose of the lesson. They can also activate prior learning and demonstrate their readiness for learning new content. The "activator" task can also provide the teacher with clear formative assessment data about what students know—or may be lacking—about requisite lesson skills and content.

As educators, we are fortunate to have meta-analyses and other research available on effective strategies. Much of the research on background knowledge has focused on basic skills acquisition (Donovan & Bransford, 2005; Marzano, 2004; Strangman & Hall, 2004). For culturally diverse students, previewing can be especially vital in achieving academic success.

Vocabulary plays a fundamental role in any student's knowledge base. The lesson identifies essential vocabulary from the curriculum guide. This includes all words and terms that are to be introduced in the lesson. In fact, some research suggests that teaching vocabulary is synonymous with building background knowledge (Marzano, 2004). There are a lot of visible thinking routines practices that teachers can use to tap on students' prior knowledge. The most common examples are the K for things I know W things I want to know and L for the things I learned, visual sequencing or cause and effect, concept mapping, vocabulary sorting, find the rule question cues and problem solving, or it could be a simple prompt like "What did you notice?" or "What did you find interesting?"

**Part 4**: Cooperative or Collaborative Learning. The fourth part of the lesson refers to students' collaboration and collaborative learning. The evidence for the success of cooperative learning as a pedagogical practice that promotes both socialization and learning is overwhelmingly supported with meta-analyses by Johnson et al. (2014). In fact, Johnson et al. (2014) suggest that organisations that wish to maximize the motivation and achievement of their members would be well advised to structure positive interdependence among members while minimizing negative or no independence. In schools, opportunities for students to work in situations where they experience positive

interdependence would seem to be a better choice than situations based on negative or no independence. This strategy is grounded in the theory that learning can be maximized through a well-designed, intentional social interaction with others (Vygotsky, 1978) where the adult or teachers in this case play a prominent role in organizing it. The recommended practices in the lessons include elements of positive interdependence and individual accountability, grouping students into heterogeneous or homogeneous groups depending on the difficulty of the materials presented or the outcome to reach. Another element present in the lessons offers the use of cooperative learning consistently and systematically where students can work in small groups to ensure every member participates and takes ownership of a task that would not be completed if the pieces of puzzle are not assembled to achieve the final outcome. Size of group is a key element; students are grouped in maximum groups of four and in most cases specially in reading groups of two or pairs is preferred. Dialogic conversation would take place in this case to support students who feels uncertain to share their ideas in larger groups. In reading, strong readers would support emergent readers to develop their reading skills. In math, students would learn and collaborate together to solve a problem displaying each a different strategy. In science, students would collaborate together to take notes on a specific topic, brainstorm important information and present them collaboratively to the other groups. Examples of collaborative learning are Think-Pair-Share, debate, Carousel of learning, Jigsaw Puzzle, etc.

Part 5: Metacognitive and Transfer Strategies. Metacognition and learning transfer have been studied for decades, generally as by a large number of investigators (Lodge & Smith, 2017). An effective lesson ensures that students move from initial

acquisition of new knowledge and skills toward growing levels of independent use and transfer.

Part five relates to the process of helping students develop understanding, extend their learning and apply their knowledge. This part is the largest section taking up the most time, and employing a wide range of instructional strategies. The teacher anticipates the needs of students and provides options during the delivery of content, process, and product. In addition, the teacher uses previous student learning data to differentiate instruction. Specific resources used to differentiate for students' needs are included: digital media, websites, manipulatives, trade books, etc. Hattie and Donoghue (2016) focus on acquiring and consolidating the different levels of learning. When teachers work with students on acquiring surface level learning, they are teaching students to use strategies like highlighting, note taking, mnemonics, underlining, and imagery. When students go to the next level of consolidating surface level learning, they are using strategies like test taking, rehearsal, and learning how to receive feedback. Hattie and Donoghue go on to focus on acquiring deep level, and suggest strategies such as organization, strategy monitoring, concept mapping, and metacognitive strategies. The next step is to consolidate that deep learning by using strategies like self-questioning, self-monitoring, self-explanation, self-verbalizing, peer tutoring, collaboration, and critical thinking techniques (Hattie & Donoghue, 2016). Other instructional strategies include reciprocal teaching in Reading, Modeling in writing, Inquiry questions in Science, and problem-based strategies in Math. In addition, based on the New Bloom's Taxonomy, the lesson describes what students must be able to do with what they know. The lesson should facilitate students' use of higher level thinking skills through a multi-

tiered scale framework to express the level of expertise required to achieve each measurable student outcome. This framework is represented in a form progressive set of questions and skills that begin with the simplest – remember, understand, apply- to the hardest – analyze, evaluate, create (Bloom, 1956). It provides opportunities for students to practice and actively process and then consolidate their learning. Lastly, Swanson (2001) reported that the best model for instructing students with learning disabilities is strictly interconnected to explicit teaching model. Explicit teaching strategies considered to be foundational to effective teaching such as teacher modeling, "I do, You do, We do." Guided practice and independent practice are constantly and regularly implemented to consolidate students' understanding of a particular concept.

Part 6: Feedback. Part six refers to providing feedback throughout the learning process. It works alongside with part five. Feedback and reflection are provided by the teacher during and after the lesson. This is an opportunity to reflect on what worked or did not work, whether all material for the lesson was covered, and which students are struggling with the concepts taught. Hattie (2012) considers feedback amongst the most important features of successful teaching and learning. He builds a model of feedback that aims to reduce the gap between prior or current achievement and the success criteria. In other words, to maximize the effect of the feedback teachers need to initiate the three feedback questions: "Where am I going?", "How am I going there?" and "Where to next?" Feedback can be provided in many ways: verbal or written, increased effort, motivation, or engagement, restructuring understandings, confirming to the student that he or she is correct or incorrect, indicating that more information is available or needed, pointing to directions that the students might pursue, and indicating alternative strategies

with which to understand particular information. The most common feedback used in the lessons is the DIRT feedback, where teachers highlight in green students' areas of success, and then pushing their learning further by highlighting in pink what would be the next step as an area of improvement to close the learning gap. A key consideration is that feedback typically comes after instruction and during the learning process.

Part 7: Assessment. Black and Wiliam (1998) argue that assessment, properly employed in the classroom, will help students learn what is being taught to a substantially better degree. They support this argument with evidence from their research review (1998), a meta-analysis in which they conclude that student gains in learning triggered by formative assessment are "amongst the largest ever reported for educational interventions" (p. 61). Formative assessment is more diagnostic than evaluative. It is used to monitor pupil learning style and ability, to provide ongoing feedback and allow educators to improve and adjust their teaching methods and for students to improve their learning. Examples included in the lessons involve exit ticket, polls, quiz, checklist, rubric, and progress check. Summative assessment aims to evaluate students learning and academic achievement. Examples include project based rubric or performance-based assessment, end of unit tests and standardized tests.

## Students Achievement Instrument

Since Dubai Schools Inspection Bureau DSIB places a strong emphasis on students' achievement, school accountability and rating depends on the results of external assessments and their alignment with the school internal reports. Results were measured by Measures of Academic Performance (MAP). MAP is a norm-referenced measure of student growth and achievement over time. MAP assessments provide detailed data

supported by individual instructional plans related to each child's unique learning path, tracking student progress throughout a year and across school years. Being linked to the learning skills and standards, results can assist teachers and administrators in planning instruction. MAP assessments are used to measure a student's growth in Mathematics, Reading, Language and Science. Map assessment may takes place three times a year: fall assessment gathers baseline, winter assessment measures progress and spring assessment measures the students' growth and achievement at that point. The Rasch Unit (RIT) scale is used as a unit of measurement form to measure and track students' progress. Also, the RIT Scale is a curriculum scale that uses individual item difficulty values to estimate student achievement. Most importantly is that MAP assessments are aligned with the Common Core State Standards CCSS adapted at school.

With the new lesson plans and strategies implemented at school in order to upraise the rating —an important component of school success in the United Arab Emirates, the results were promising between MAP fall term and winter where the vast majority of elementary students demonstrated a major improvement and an increase in their achievement level, where at least 68% of students met their projected targets in all subjects (Math, Reading, Language and Science).

## Connection to Research

Lesson plans are interconnected with the evidence based strategies listed in this research and leading to studens' achievement. They emerge from the findings of studies of what has worked in classrooms. International experts such as Hattie (2017) and Marzano (2010) have synthesised these studies and ranked hundreds of teaching strategies by the contribution they make to student learning.

The first part of the lesson is related to checking for previous understanding and sharing learning targets through a set of differentiated success criteria catered toward the varied students' needs. Ultimately, the teacher must specify and anticipate the learning objectives they will pursue, which drives planning activities in reverse (Tomlinson & McTighe, 2010). Research shows goals are important for enhancing performance. It is important to set challenging goals, rather than 'do your best' goals relative to student starting places (Hattie, 2009). By setting challenging goals, the teacher develops and maintains a culture of high expectations. The importance of teacher expectations in facilitating students' learning has long been recognized (Rubie-Davies, 2008). On the basis of different reviews and meta-analyses, the average effect of teacher expectations on subsequent student performance has been found to be relatively moderate ($d = 0.43$; Hattie, 2009). In general, teacher expectations influence teacher behavior and the subsequent performance of students (Rubie-Davies, 2007, 2008).

Strangman and Hall (2004) claim that direct instruction strategies combined with prior knowledge have much promise with diverse elementary students. Examples of such techniques include vocabulary instruction, introducing difficult concepts in a reading text or a reader has content or even in a math problem solving task. Every lesson begins with an essential question to intrigue students' curiosity and engage them in meaningful conversation where new vocabulary will be introduced to support all students and specifically English Language Learners whose numbers are large at school. Questioning by teachers of students is one of the most widely studied aspects of teaching. Effective questions have varied levels as they focus on both product and process (Kyriakides et al., 2013; Muijs et al., 2014). Effective teachers deploy it regularly to engage students,

stimulate interest and curiosity in learning, and make links to students' lives. It unfolds opportunities for students to talk together, discuss, argue, and express opinions and alternative views. Used effectively, questioning yields immediate feedback on student understanding, supports informal and formative assessment, and captures feedback on the impact of teaching strategies (Hattie, 2009). Schroeder, Scott, Tolson, Huang, and Lee (2007) found an effect size of 0.74 for questioning in science, and Sencibaugh (2007) reported an effect size of 1.18 for questioning in reading comprehension.

The second component launches the mini lesson after evaluating students' prior knowledge and placing them according to that knowledge. This particular model places the emphasis on moving students forward from surface learning to deeper learning to conceptual understanding using Bloom Taxonomy of progressive processes ranging from the simple to the complex, under the concept of 'develop', 'secure', 'apply'.

**Develop.** Develop is the most basic level of Bloom's Taxonomy requiring the least amount of cognitive rigor. This is about students recalling key information and understanding of the facts remembered. At this phase, teachers use explicit teaching methods to provide instruction, demonstrate concepts and build student knowledge and skills. The teacher decides on learning intentions and success criteria, makes them transparent to students, and demonstrates them by modeling. and creating opportunities in lessons for students to demonstrate understanding and apply the learning. Hattie (2009) found an effect size of 0.59 for direct instruction. The results of the various meta-analyses showed that explicit instruction should be utilized as the basis for teaching reading, writing and math, which could also include steps for reciprocal teaching (Bissonnette et al., 2010). Explicit instruction involves using highly structured and sequenced steps to

teach specifically students with learning disabilities (Gauthier, Bissonnette & Richard, 2013).

**Secure**. Secure is concerned with how students can take their knowledge and understanding, and apply it to different situations. Evidence shows teaching metacognitive strategies can substantially improve student learning. Hattie (2008) measured the average effect size of metacognitive strategies at 0.69. At this stage, teachers used metacognitive strategies to help students develop awareness of their own learning, to self-regulate, and to drive and sustain their motivation to learn (Hattie & Donoghue 2016). Hattie and Donoghue focus on acquiring and consolidating the different levels of learning. When teachers work with students on acquiring surface level learning, they are teaching students to use strategies like highlighting, note taking, mnemonics, underlining, and imagery (Olive, Piolat, & Kellogg, 2005). When students go to the next level of consolidating surface level learning, they are using strategies like test taking, rehearsal, and learning how to receive feedback. Hattie and Donoghue (2016) go on to focus on acquiring deep level of learning, and suggest strategies such as organization, strategy monitoring, concept mapping *(*Kim, Vaughn, Wanzek, & Wei, 2004) and metacognitive strategies. The next step is to consolidate that deep learning by using strategies like self-questioning *(*Schroeder, Scott, Tolson, Huang, & Lee 2007), self-monitoring, self-explanation, self-verbalizing, self-regulating (Pintrich, 2003), collaboration, and critical thinking techniques. Teaching students these strategies, and how to use them, will all help lead to transfer of their learning.

**Apply.** Apply is about students being able to draw connections between ideas, think critically, and break down information into the sum of its parts. The challenge level

is the ultimate aim of students' learning journey. At this final level of Bloom's taxonomy, students demonstrate what they have learned by creating something new, either tangible or conceptual. Students reach this level through a progress check or self-assessment (Hattie, 2017), feedback (Hattie, 2009) and assessment for learning (Black & William, 1998) to evaluate their initial starting point as compared to the intended learning outcome. They progressed ultimately to reach their projected growth. The higher up in levels students can reach , the more complex are the cognitive processes involved and, as such, they engage in more challenging cognitive work connected to their lesson's content. In some occasions, we do not seek to scale multiple levels of the taxonomy in a single lesson, instead choosing to do this over the course of a few lessons, due to the nature of the content (Gershon, 2015, p. 103). Feedback informs a student and teacher about the student's performance relative to learning goals. Its purpose is to improve the student's learning. Feedback redirects or refocuses the actions of the teacher and student so the student can align effort and activity with a clear outcome that leads to achieving a learning goal. Both teachers and peers can provide formal or informal feedback. It can be oral or written, formative or summative. Whatever its form, it always comprises specific advice a student can use to improve their performance. Studies with the highest effect sizes involved students receiving feedback about a task and how to do it more effectively. Feedback in the form of praise, punishment and rewards have lower effect sizes (Hattie & Timperley, 2007). Therefore, students should receive feedback under a form of two areas: one area of success in students work and one area of improvement to reach the intended projected goal. One point to make clear is that not all students are required to reach the apply level, but all students should move at least one level up throughout one lesson.

The last part of the lessons is related to scaffolding students based on their needs. Differentiated teaching refers to methods teachers use to extend the knowledge and skills of every student in every class, regardless of their starting point. The objective is to lift the performance of all students, including those who are falling behind and those ahead of year level expectations (Tomlinson, 2014). Differentiated teaching involves teachers supporting students to achieve success as they move through the learning process. It recognizes all students have different abilities. It acknowledges and values the effort each student puts into improving his or her work. Teachers who differentiate effectively call on information that pinpoints what students know now, and what they are ready to learn next. They use formative assessment to monitor learning, and to guide selection of targeted interventions corresponding with individual needs. Teachers implement interventions to address students' current needs. Research shows a remarkable effect size of 1.07 for RTI (Hattie, 2009).

To be effective, the lesson plan does not have to be an exhaustive document that describes each and every possible classroom scenario. Nor does it have to anticipate each and every student's response or question. Instead, it should provide a general outline of the teaching goals, learning objectives, and means to accomplishing them. It is a reminder of what teachers want to do and how they want to do it. A productive lesson is not one in which everything goes exactly as planned, but one in which both students and the instructor learn from each other. It takes "three or four experiences involving interaction with relevant information for a new knowledge construct to be created in working memory and then transferred to long-term memory" (Nuthall, 2000, p.93). Multiple exposures provide students with multiple opportunities to encounter, engage with, and

elaborate on new knowledge and skills. It is not simple repetition or drill work. Research demonstrates that deep learning is developed over time via multiple and spaced interactions with new knowledge and concepts. Collaboration is involved in all the phases of learning. Hattie (2009) found an effect size of 0.59 for cooperative learning with a focus on meaningful learning. The teacher uses strategies such as cooperative learning strategies and strategic selection of groups to establish an atmosphere of cooperation and collaboration (Johnson et al., 2006). Collaborative learning is supported by designing meaningful tasks and inviting group responses to questions. It occurs when students work together in small groups and everyone participates in a learning task. Collaborative learning relies on students actively participating in negotiating roles, responsibilities and outcomes. Their collaboration may involve an inquiry approach for projects (Minner et al. 2010), problem solving, questioning or any activity involving dialogic engagement. Through dialogue the learner is able to shape current knowledge to construct new ideas and understanding (Vygotsky, 1978).

## Reflection

Over the course of this research, I have been able to distinguish between what constitutes best teaching and learning practices and how to implement them effectively in the classroom with reference to their effect size. By developing background knowledge related to the list of influences affecting students achievement, we will be able to incorporate efficiently the ones that impact their learning. This notion is fundamentally necessary if we as educators strive for quality education to our students. In my mind, I have always thought that an inquiry based approach is the only strategy that I should bear

in mind when planning, and that explicit teaching is a traditional strategy that should be excluded completely from the teaching strategies list. Throughout the process of my application thesis research I have come to a realization that no strategy is a one size fit for all. On the contrary, teachers need to collect the effect sizes within their classrooms and then ask "What is working best?", "Why is it working best?", and "Who is it not working for?" (Schagen & Elliot, 2004). There are thousands of studies promulgating claims that this paradigm shift in teachers thinking and background works. What is concerning is that even with the myriad of educational research related to best practices put at the disposition of all teachers, they are rarely used or even sometimes ineffectively employed in the classroom. That raises the following questions: How can we support teachers in implementing these strategies frequently and effectively? How can we ensure that teachers are pedagogically aware of the latest research about teaching and learning practices?

One explanation may be that when research is presented to teachers, it is done in a manner that fails to acknowledge that teachers come to research with strong theories of their own about what works for them. For example, one of the factors relates to students achievement is correlated with increasing the amount of feedback. However, one should not immediately start providing more feedback and then await the magical increases in achievement. Increasing the amount of feedback in order to have a positive effect on student achievement requires a change in the conception of what it means to provide effective feedback. Another explanation might be related to teachers' inability to translate the research and make it actionable in the classroom. Even with a paradigm shift, teachers

might not know exactly why some strategies are more efficient than others, and how to harness on them in their most optimal way.

The aim is to provide more than a litany of "what works", as too often such a long lists of best practices provide yet another set of recommendations devoid of taking into account any moderators of the "busy bustling business" of classrooms, and often they appeal to have little impact on students' learning. The point is to assist teachers when other approaches fail, when challenging situations abound, when supporting students becomes impossible.

When interpreting the results of the MAP results, attention should be focused on meeting individual students needs within their classroom community and ultimately focusing on learning. The point is not to teach every student different content. Conversely, it is creating a system in the classroom where students' learning is self regulated, and where autonomous students can reflect on their work and their targets, through a set of resources they can refer to check for learning. Resources are not only restricted to considering teachers as the only means they can refer to, it is creating a learning environment where students' mistakes are considered an integral part of their academic growth. It is also seeing students taking ownership of their own learning. Reaching self regulated learning requires expert teachers, able to discern amongst the set of strategies available at their disposition, and employ suitable methods that match the most with the situations, ultimately to help students reach their full potential. Self-regulated learning is an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the

environment.” (Pintrich, 2000, p. 453). The ultimate goal for students reaching self regulated learning is their ability to pursue their own learning goals and take control of their learning and consequently the process of their academic achievement. In order to reach these goals, learners would benefit from being exposed to all strategies that lead to their success and it is the role of the teacher and all educational stakeholders to support them in their achievement.

# CHAPTER IV: DISCUSSION AND CONCLUSION

## Summary of Literature

*"If he [the teacher] is indeed wise, he does not bid you enter the house of his wisdom, but rather leads you to the threshold of your mind" (p. 56).*

The Prophet , Kahlil Gibran (1923/1989)

Thinking skills must be placed high on the educational agenda as one of the most essential skills needed today. The available research provides already fairly good support for the view that effective learning from instruction that aims at fostering adaptive competence in students, is a constructive (Bruner, 1961), conceptual (Minner et al., 2010), self- regulated, and collaborative (Johnson et al., 2014) process of knowledge building and skill acquisition. Since the curriculum is overloaded with content, teaching to the test is not an option to raise students' achievement because it misrepresents how much students really have learned about a topic. Instead developing higher order thinking or critical thinking skills (Hattie & Donoghue, 2016) through metacognitive strategies and transfer of learning (Lodge & Smith 2017) embedded in the aforementioned instructional strategies in chapter 2, is a better approach to raise student's performance. They are prepared to tackle challenges they have not faced previously, yet they are equipped with a repertoire of strategies they have gained throughout their learning process that they can apply in any other situations.

Fisher, 2005 confirmed that when thinking skills become an integral part of the curriculum and instructional practice, test scores in academic areas increase. According to Bransford et al. (2000), the goal of teaching is to help learners develop the kind of thinking, problem solving, and fluency used by "experts" (Vygotsky, 1978) and develop

the skills and habits of a lifelong learner. To accomplish this goal, it is necessary to equip students with cognitive tools that they can apply beyond the initial learning situation where students learn to think beyond the mere replication of information through a constructivist approach (Bereiter, 2002). The ultimate goal for students reaching self regulated learning is their ability to pursue their own learning goals and take control of their learning and consequently the process of their academic achievement. In order to measure the effectiveness of instructional strategies that aim to develop higher order thinking rather than mere memorization and therefore leading to higher academic performance, a comparison is conducted between two classrooms within the same grade level. Results revealed that the progress and attainment of one classroom as compared to the other is remarkably higher.

The interpretation of such results, is the teacher's ability to employ these strategies effectively in the classroom, transferring learning from surface to a deeper level. One can argue that many internal causal factors leading to such an effect such as teachers' or students' motivation and effort, yet it is necessary to remember the prominent role a teacher plays in students' lives. Ranking as the greatest influence impacting student achievement (Hattie, 2016) is no doubt related to the productive teaching behaviors and types of learning environments that are positively associated with teacher efficacy. When teachers expect their students to perform at high levels, students perform at the highest level possible so they should provide opportunities for mastery learning (Goddard, Hoy & Woolfolk-Hoy, 2000).

A central implication for educators is that teaching and learning is an integrated entity, optimally supported by many evidence based approaches to learning that are

mainly efficient when all aspects of the educational environment support the dimensions of children's needs (Heacox, 2017). Moreover, teachers' input is more effective when they monitor the impact of the instructional strategies they implement, when they use assessment to inform instruction and intervention to reject instructional practices that harm learning (Black & Williams, 1998). And best of all, "what teachers do matters when they make learning visible to their students, so students can become their own teachers" (Hattie, Fisher & Frey, 2017, p. 167). A strategy that works with one group of students might not work with another group of students. Take the case of one third grade classroom at Collegiate American School that interacted actively with the inquiry approach and through which they were able to develop higher order thinking that prepared them to tackle learning challenges including conducting computerized adapted assessments. While the second year, the same inquiry approach was implemented with the same age group and its impact on students was not as strong as it is expected to be. Students' results due to explicit teaching strategies such as I do, We do, You do were staggering. As instructional methods evolve along with the needs and expectations of our students (Tomlinson et al., 2003) we always seem to come back to trial-and-error practices. There is a simple reason for this: it is a surefire pathway to students owning their learning, and thus developing a lifelong self-regulated learning (Pintrich, 2000) .

The methods that work best, as identified from the research presented in this application paper lead to active, direct involvement, and high sense of agency in the learning and teaching process. Such teaching leads to higher levels of learning, autonomy, and self-regulation on behalf of the learner. There is no perfect one-size-fits-all teaching approach that will connect with the interests and abilities of every single

student out there, and teachers know this intimately. For each lesson there is an appropriate strategy. For every scheme of learning there is an amalgam of methods required. The most effective teachers have a strong grasp of a range of teaching methods and they have the agility to pick between different strategies for different groups and individuals. The big idea in this application of research is that it is not as simple as looking at the list and learning the top 10 effect size strategies and just using them repeatedly (Hattie, 2008). Instead some strategies are most helpful with specific lessons or learning goals, while other strategies might be less efficient with the same lessons.

Where students are in the stage of what they are learning should determine what approaches teachers use (Hattie, Fisher & Frey, 2017). Further, researchers (Hattie, Fisher & Frey, 2017) argue that some strategies whose effect size is below 0.4 in the core research may actually be much more effective when used in a different sequence or stage of learning. They make this case, for example, for inquiry-based learning (0.4 overall) and learning simulations (0.33). They argue that when these strategies follow the process of surface learning first then consolidation, they can become powerful deep learning approaches.

## Research Limitations

The majority of empirical research dealing with the quality of education measures student performance in their assessment or test results in relation to their overall achievement. Assessment results correlated with achievement is considered as the most accurate indicator of the effectiveness and quality of the teaching and learning. Currently, the most frequent method for measuring students' progress and achievement is MAP assessments. This study utilizes the datasets provided by MAP assessment to investigate

the effectiveness of teaching and learning strategies to students' achievement. However, measuring the effectiveness of teaching and learning is a complicated endeavor, and it is one that cannot be adequately determined based on any single factor, such as one test. Effective teaching is determined by several factors. While student performance is part of the measure of classroom success and positive learning gains, it should not be the only determining or predominant factor. Just as our obligation is to look at the child with a holistic pedagogical approach, we must also look at the whole teacher. Moreover, by just admitting that one exam is not the end goal, nor the be-all measure of students' learning, we must also admit that results —even though defined by an accurate resource— it should not be the main criterion of teachers' effectiveness and appraisal system. Information from multiple sources, including students' dispositions, teachers' attributes, school curriculum, peer observations, and many other factors should all be considered in building a comprehensive evaluation portfolio.

One limitation of the research is that MAP assessment can not be the only means to measure academic performance. A second limitation is that the computer based format means that children are working independently on a computer and not being assessed with an adult in a one to one setting. This format limits the MAP's ability to critically assess students' ability to use effective strategies because the results are only taken based on the final response. Also since the test is based on multiple choice answers there is a risk that students might guess the answers. Another limitation of the test is that it does not take into consideration students' social and emotional statues at the moment of the test, or students' ability to sit for a long time to answer about 42 to 50 questions that have no interest to them. Research conducted by the Northwest Evaluation Association (NWEA)

have been extensively studying the impact of students' effort on MAP results and found that as students get older, the effort also decreases. The decreased compliance of students is also confined to other areas of students' life such as their age, level of motivations and engagement. For English Language Learners MAP assessment reveals a lot of challenges in term of understanding the instructions even though some accommodation were made to them. Since all assessments including reading, language, science and math are heavy on reading, it becomes difficult for them to overcome these challenges independently without adult support. In the case of our school where the number of Students of Determination and English Language Learners is considerably high, the results might not accurately reflect teaching effectiveness and students' learning ability.

The findings of this research highlighted some factors which influence the academic achievement of students in the elementary school. These factors were related to teaching strategies, learning strategies and teachers' attributes. The academic achievement of students is not only impacted by these factors as other factors such as classroom management, school curriculum, students' disposition, etc.

One of the most obvious limitations of this research lies in its relatively small sample (100 students) as this research might not be completely representational of the situation in the UAE. Another limitation lies in the issue that the effectiveness of teaching and learning are only measured based on students' external assessment results, which means that other variables such as learning walks and formal observations for lessons were not included to determine the effectiveness of teaching and learning, and there should be discrepancies in the factors which influence the academic achievement of students.

**Implications for Future Research.** Future research should be conducted on a larger sample to ensure better representation and consider more than one criterion to judge students' level of achievement throughout the academic year.

Despite the amount of evidence-based teaching studies available for teachers and students to use to improve learning and achievement, teachers must be aware of them. The question that lies here: What if students were instead adopting ineffective learning techniques that undermined their achievement? What if teachers are aware of these techniques but are not able to implement them ineffectively? Techniques shown to be effectively beneficial are underutilized by teachers or simply teachers do not learn about them. Hence students miss the opportunity to use them, despite evidence suggesting that theses strategies could benefit their achievement with little added effort. On the contrary, some learning and teaching strategies proven to be relatively ineffective are very popular amongst teachers and therefore their impact on students' academic gain is low or negative in some cases. One potential reason for the disconnect between research on the efficacy of strategies influencing students' achievement and their use in educational practice is that because "so many strategies are available, it would be challenging for educators to sift through the relevant research to decide which ones show promise of efficacy and could feasibly be implemented by students" (Fleet, Goodchild, Zajchowski, Pressley & Evans, 1989, p. 301-342). Another potential reason, is teacher mindedness and preparedness. If teachers do not completely understand or embrace a teaching

concept, they are unprepared and unable to engage with their students on a deeper level. This creates a disconnect, which in turn leaves the students unprepared and at risk. Teachers must have a clear understanding of the value of every teaching practice and a practical view of how to implement effectively in the classroom. We should consider developing a graduate program that prepares teachers practically address real life educational situations and grounded in theoretical approaches. As necessary as they seem to be, theoretical approaches are insufficient if they are not complemented by practical approaches that are correlated with situations teachers will face in the future. Supporting teachers ultimately helps students in gaining better results.

## Conclusion

Many instructional strategies popular amongst the teachers communities turned out to be ineeficient if not combined with other strategies or if these strategies do not respond to students' needs, yet other instructional strategies that remain as equally effective as others are not very popular. Teachers must constantly seek quality instructional approaches to prepare their students to reach their full cognitive potential.

The aim of this application thesis is to support teachers in creating a culture of thinking through strategies that nurture students' cognitive thinking. By narrowing down the list of instructional effectiveness to content that is more teacher friendly, and by providing resources, evidence, and examples of how to transfer theses strategies practically into the classroom life, we hope to be able to tackle teachers' challenges and needs. The ultimate goal is to deploy a repertoire of instructional strategies and best practices teachers can use and select to reflect on their students' learning processes, self-assess and acknowledge the impact of their instructional strategies on achievement in

order to prepare students who are capable of self-regulation and proactively take control of their own learning.

## References

Abrami, P. C., Bernard, R. M., Borokhovski, E., Wade, A., Surkes, M. A., Tamim, R., & Zhang, D. (2008). Instructional interventions affecting critical thinking skills and dispositions: A stage 1 meta-analysis. *Review of Educational Research*, 78(4), 1102-1134. Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ896709&site=ehost-live&scope=site http://dx.doi.org/10.3102/0034654308326084

Alkharusi, H. (2008). Effects of classroom assessment practices on students' achievement goals. *Educational Assessment,* 13(4), 243-266. doi:10.1080/10627190802602509

Bransford, J. D., Brown, A. L., & Cocking, R. (Eds.) (2000). How people learn: Brain, mind, experience, and school . Washington, DC: National Research Council, National Academies Press.

Clanet, J. (2010). The relationship between teaching practices and student achievement in first year classes. *European Journal of Psychology of Education,* 25(2), 192-206. doi:10.1007/s10212-010-0012-y

De Boer, H., Donker, A. S., & van, d. W. (2014). Effects of the attributes of educational interventions on students' academic performance: A meta-analysis. *Review of Educational Research*, 84(4), 509-545. Retrieved from http://www.jstor.org.ezproxy.bethel.edu/stable/24434248

Dean, C. B., & Marzano, R. J. (2012). *Classroom instruction that works research-based strategies for increasing student achievement / ceri B. dean ... et al.]* (2nd ed. ed.). Alexandria, Va.: Alexandria, Va. : ASCD.

Desautel, D. (2009). Becoming a thinking thinker: Metacognition, self-reflection, and classroom practice. *Teachers College Record*, 111(8), 1997-2020. Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=44030096&site=ehost-live&scope=site

Fogarty, R. (1999). *How to raise test scores. K-college* Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED434951&site=ehost-live&scope=site

Fuchs, L. S., Fuchs, D., & National Center on Student, Progress Monitoring. (2011). Using CBM for progress monitoring in written expression and spelling. *National Center on Student Progress Monitoring*, Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED519251&site=ehost-live&scope=site

Guirguis, R., & Pankowski, J. (2017). Potential effects of teaching strategies on students' academic performance under a trump administration. *Journal of Education and Training Studies*, 5(4), 103-110. Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?diret=true&db=eric&AN=EJ1133888&site=ehost-live&scope=site

Hattie, J., Donoghue, G. Learning strategies: a synthesis and conceptual model. *npj Science Learn* **1,** 16013 (2016). https://doi.org/10.1038/npjscilearn.2016.13

Heacox, D. (2017). *Making differentiation a habit : How to ensure success in academically diverse classrooms / Diane Heacox, ed.D; foreword by Rick Wormeli* (Updated edition. ed.). Minneapolis, MN: Minneapolis, MN : Free Spirit Publishing.

Jerald, C. D. (2006). "Teach to the test"? just say no. issue brief. *Center for Comprehensive School Reform and Improvement*, Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED494086&site=ehost-live&scope=site

John, A. C. H., & Gregory, M. D. (2016). Learning strategies: A synthesis and conceptual model. *Npj Science of Learning*, 1 doi:10.1038/npjscilearn.2016.13

Hattie, J. A., & Donoghue, G. M. (2016). Learning strategies: A synthesis and conceptual model. *Npj Science of Learning, 1*(1). doi:10.1038/npjscilearn.2016.13

Kuncel, N. R. (2005a). *The validity of self-reported grade point averages, class ranks, and test scores: A meta-analysis and review of the literature.* Washington, D.C. :

Kuncel, N. R. (2005b). *The validity of self-reported grade point averages, class ranks, and test scores: A meta-analysis and review of the literature.* Washington, D.C.

Marzano, R. J., Gaddy, B. B., Dean, C., & Mid-Continent Research for Education, and Learning. (2000). *What works in classroom instruction* Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED468434&site=ehost-live&scope=site

Mehrens, W. A. (1991). *Defensible/indefensible instructional preparation for high stakes achievement tests: An exploratory trialogue* Retrieved from

http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED334202&site=ehost-live&scope=site

Neimeier, C. K. (2012). *Factors influencing student achievement at a high-performing title I elementary school*

Nuthall, G. (2000). The role of memory in the acquisition and retention of knowledge in science and social studies units. *Cognition and Instruction, 18*(1), 83-139. doi:10.1207/S1532690XCI1801_04

Pressley, M., Gaskins, I. W., Solic, K., & Collins, S. (2006). A portrait of benchmark school: How a school produces high achievement in students who previously failed. *Journal of Educational Psychology*, 98(2), 282-306. Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ742174&site=ehost-live&scope=site http://content.apa.org/journals/edu/98/2

Pressley, M., Goodchild, F., Fleet, J., Zajchowski, R., & Evans, E. D. (1989). The challenges of classroom strategy instruction. *The Elementary School Journal, 89*(3), 301-342. doi:10.1086/461578

Richard, M., Gauthier, C., Bissonnette, S., & Castonguay, M. (2016). *L'enseignement explicite: Fondements et pratiques - volet enseignement et volet accompagnement:* Québec: Télé-Université. Retrieved from https://scp-pbis.com/2017/07/25/effective-behaviour-management-for-students-with-lds-and-behavioural-disorders-ldschool/

Rubie-Davies, C., Hattie, J., & Hamilton, R. (2006). Expecting the best for students: Teacher expectations and academic outcomes. *British Journal of Educational Psychology*, 76(3), 429-444. Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ750346&site=ehost-live&scope=site http://dx.doi.org/10.1348/000709905X53589

Rutten, N., Van Joolingen, W. R., Haverkamp-Hermans, G., Bogner, F. X., Kretschmer, T., Stracke, C. M., Lameras, P., Chioccariello, A., Doran, R., Tiemann, R., Kastrinogiannis, T., Maravic, J., Crotty, Y., Kelly, C., Markaki, V., Lazoudis, A., Koivula, J., & Polymatidis, D. (2015). A narrative approach to studying the diversification of inquiry learning across instructional settings. *International Journal of Education and Development using Information and Communication Technology*, 11(2), 184-228. Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1074141&site=ehost-live&scope=site

Scharff, L., Draeger, J., Verpoorten, D., Devlin, M., Dvorakova, L. S., Lodge, J. M., & Smith, S. (2017). Exploring metacognition as support for learning transfer. Teaching & Learning Inquiry, 5(1). http://dx.doi.org/10.20343/teachlearninqu.5.1.7

Schunk, D. H. (2005). Self-regulated learning: The educational legacy of Paul R. Pintrich. *Educational Psychologist, 40*, 85-94.

Shaddock, A. (2014). *Using data to improve learning : A practical guide for busy teachers / A. Shaddock; foreword by J. Hattie*. Camberwell, Victoria, Australia: Camberwell, Victoria, Australia : Acer Press.

Sotiriou, S., Bybee, R. W., & Bogner, F. X. (2017). Pathways--A case of large-scale implementation of evidence-based practice in scientific inquiry-based science education. *International Journal of Higher Education*, 6(2), 8-19. Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1134457&site=ehost-live&scope=site

Stecker, P. M., Fuchs, L. S., & Fuchs, D. (2005). *Using curriculum-based measurement to improve student achievement: Review of research*. Brandon, Vt.] : doi:10.1002/pits.20113

Stobaugh, R. (2019). *50 strategies to boost cognitive engagement: Creating a thinking culture in the classroom* Solution Tree. Retrieved from https://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED594948&site=ehost-live&scope=site https://www.solutiontree.com/products/books/fifty-strategies-to-boost-cognitive-engagement.html

Strangman, N., Hall, T., & Meyer, A. (2004). *Background knowledge instruction and the implications for UDL implementation*. Wakefield, MA: National Center on Accessing the General Curriculum. (Links updated 2009). Retrieved from http://aem.cast.org/about/publications/2004/ncac-background-knowledge-udl.html

Stronge, J. H. (2010). *Effective teachers -- student achievement what the research says / J. H.* Stronge. Larchmont, NY: Larchmont, NY : Eye on Education.

Sudkamp, A., Kaiser, J., & Moller, J. (2012). Accuracy of teachers' judgments of students' academic achievement: A meta-analysis. *Journal of Educational Psychology,* 104(3), 743-762. Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ993888&site=ehost-live&scope=site http://dx.doi.org/10.1037/a0027627

Thompson, R. A., & Zamboanga, B. L. (2003). Prior knowledge and its relevance to student achievement in introduction to psychology. *Teaching of Psychology, 30*(2), 96-101. doi:10.1207/S15328023TOP3002_02

Tomlinson, C. A. (2006). In McTighe J. (Ed.), *Integrating differentiated instruction & understanding by design : Connecting content and kids / C. Tomlinson and J. McTighe.* Alexandria, Va.: Alexandria, Va. : Association for Supervision and Curriculum Development.

Tomlinson, C. A. (2014). *The differentiated classroom : Responding to the needs of all learners, 2nd edition*. Alexandria: Alexandria: Association for Supervision & Curriculum Development.

Ustun, U., & Eryilmaz, A. (2018a). Analysis of finnish education system to question the reasons behind finnish success in PISA. *Online Submission*, , 2. Retrieved from http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED591431&site=ehost-live&scope=site

Ustun, U., & Eryilmaz, A. (2018b). Analysis of finnish education system to question the reasons behind finnish success in PISA. *Online Submission*, , 2. Retrieved from

http://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED591431&site=ehost-live&scope=site

Walberg, H. J. (2010). *Advancing student achievement*. Stanford: Stanford : Hoover Institution Press.

Weinstein, R. S. (2002). *Reaching higher the power of expectations in schooling* /. Cambridge, MA

Wiliam, D. (2010). *Standardized testing and school accountability. Educational Psychologist,* 45(2), 107-122. doi:10.1080/00461521003703060

Yeh, S. S. (2011). *The cost-effectiveness of 22 approaches for raising student achievement / S. Yeh*. Charlotte, N.C.: Charlotte, N.C. : Information Age Pub.

# Appendix

## Appendix A: Grade 2 English Language Arts lesson

| | G&T | SoD | ELL | Emirati |
|---|---|---|---|---|
| Name(s) | | | | |

| | | |
|---|---|---|
| Part 1: What will be visible at the front of the classroom? | | |
| Teacher Question:<br>What are the most important points presented in two texts for the same topic?<br>STD.RI.2.9 Compare and contrast the most important points presented by two texts on the same topic. | | |
| Part 2: What will be visible in the classroom? (Front of class, at tables, on wall) | | |
| Success Criteria/Learning Outcomes:<br>D: I can read a text about a specific topic<br>S: I can highlight important information about the features of a civilization from a text<br>A: I can use a Venn Diagram to show the same and different facts that two texts on the same topic give the reader<br>C: I can evaluate which text gives the most information to the reader | | |
| Part 3: Starter: How will students reflect back on prior knowledge? | I used to think, but now I know...<br>-Students will fold page in half in workbooks<br>-Students will be given an ancient civilization they are going to read about<br>-Students will write what they know about the civilization right now under I used to think...<br>-Start/end of each lesson this week students will write new information they learned to show progress of knowledge | |
| Part 4: Learning Skills: What and how will students use learning skills?<br><br>Highlight and explain. | Responsibility: Students will read independently and highlight facts<br>Collaboration: Students will work in pairs and plan an argument<br>Communication: Debate about which text as more information<br>Interdisciplinary Skills:<br>Innovation & Technological Skills:<br>Enterprise:<br>Inquiry:<br>Research:<br>Critical Thinking: Compare and Contrast Text and Evaluating | |
| Vocabulary: How will students be introduced to lesson vocabulary? | -Focus on text vocabulary part of guided reading station<br>-Word work is a reading station students will be rotating through | |
| Part 5: Develop: What will students be doing to develop understanding? | Reading<br>-Class will read with the teacher an example text<br>-Students will then go into their groups to read their text about same civilization<br>-Students will write new facts they learn into their visible thinking chart | What critical questions do I plan on asking? Remember: What facts do you |

| | | |
|---|---|---|
| Part 5: Secure: What will students be doing to secure understanding? | Text Detectives<br>-Class will review key features of a civilization – Groups of students will be put in charge of listening for a feature<br>-As a class we will read model text – students will clap when they hear their feature<br>-Students/teacher will underline fact on model text<br>-Students will go to read their group text and underline facts about each feature they read | remember from the text?<br>Understand:<br>Apply: Can you identify the most important facts?<br>Analyze: How can you compare these facts?<br>Evaluate: Can you defend your argument about which text gives the most information?<br>Create: ? |
| Part 6: Progress Check (Mini Plenary | Thumbs Up Thumbs Down<br>Teacher will ask to see thumbs up/thumbs down before working with guided reading groups to identify any students needing immediate support | |
| Part 5: Apply: What will students be doing to apply understanding to real-world context? | Venn Diagram<br>-Teacher will model how to use Venn diagram<br>-Students will be completing a Venn Diagram to show the same and different facts that two texts on the same topic give the reader.<br>-Students will come back to circle to discuss important points presented in text<br>-What are some facts that both texts had?<br>-What are some different facts in the texts?<br>-Why might the two texts not have the same facts if they are about the same civilization?<br>-Which text would you recommend first for someone who wants to learn about __? | |
| Challenge: | Two Start and a Wish<br>-Students will evaluate which text gives the most information.<br>-Students will be given a success criteria to do this<br>-Students will share two stars and a wish with another classmate | |
| Part 7: Plenary: How will students reflect back on learning/progress made in the lesson? | Exit Ticket-visible Thinking<br>-End of each lesson students will continue to add new information they learn about the civilization to show progress of knowledge | |
| Daily 5 (Students rotate through one or two activities per day) | Students will independently be working on daily 5 activities related to the outcome.<br><u>Guided Reading:</u> Students will read with the teacher on their level and practice comparing and contrasting.<br><u>Read to Self:</u> Students will read two texts on the same topic at their level and complete a Venn Diagram to compare and contrast.<br><u>Read with a Partner:</u> Students will read story from the grade level reader and complete comprehension questions<br><u>Word Work:</u> Synonyms and antonyms Tic Tac Toc Board<br><u>Writing:</u> Students write a paragraph to summarize the Venn Diagram<br><u>Edmentum:</u> Student complete 30min reading on Edmentum | |

## Appendix B: Grade 2 Math Lesson

| | G&T | SoD | ELL | Emirati |
|---|---|---|---|---|
| Name(s) | | | | |

| What will be visible at the front of the classroom? |
|---|
| Teacher Question:<br>How can we use math drawings to represent subtraction with decomposition and relate it to a written method?<br>CCSS.MATH.CONTENT.2.NBT.B.5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. |
| **What will be visible in the classroom? (Front of class, at tables, on wall)** |
| Success Criteria/Learning Outcomes:<br>D: I can recall how to use manipulatives to subtract<br>S: I can show how to use the vertical method to subtract<br>A: I can use manipulative and the vertical method to solve word problems involving subtraction<br>C: I can model how to use manipulatives and the vertical method using SeeSaw |

| | | |
|---|---|---|
| Starter: How will students reflect back on prior knowledge? | With a partner solve the subtraction problem. Explain to another pair how you solved the problem. 25-11= (vertically) | |
| Learning Skills: What and how will students use learning skills?<br><br>Highlight and explain. | Responsibility: Completing work independently and using the answer key to check work<br>Collaboration: Solving subtraction problem together<br>Communication: Explaining their work<br>Interdisciplinary Skills:<br>Innovation & Technological Skills: Seesaw<br>Enterprise:<br>Inquiry:<br>Research:<br>Critical Thinking: Solving word problems | |
| Vocabulary: How will students be introduced to lesson vocabulary? | Subtraction, difference, decompose, algorithm<br>Use the vocab words to label each part of your problem. | |
| Develop: What will students be doing to develop understanding? | Students will use the place value chart and drawings to solve the subtraction problems on the board. | What critical questions do I plan on asking?<br>Remember: What does it mean to subtract?<br>Understand: How can we use place value to subtract?<br>Apply: Can you explain how to decompose a ten?<br>Analyze: What works better, |
| Secure: What will students be doing to secure understanding? | Students will solve subtraction problems with decomposition on their own and use an answer key to check their work. If they have more than 3 mistakes, they will look at a video or example on the table to help them. Then try 2 more problems. | |
| Progress Check (Mini Plenary | 1, 2, 3 or 4/red, yellow, green<br>If you are not sure how to use drawings to decompose a subtraction problem you are a 1/red<br>If you can use a drawing to decompose a subtraction problem but still have some mistakes you are a 2/yellow | |

| | | |
|---|---|---|
| | If you can show a partner how to use a drawing to decompose a subtraction problem you are a 3/green | using a drawing or written method to solve a problem?<br>Evaluate: Can you correct a mistake in someone else's work?<br>Create: How would you explain how to solve a word problem using decomposition? |
| Apply: What will students be doing to apply understanding to real-world context? | Students will solve subtraction word problems using decomposition; RDW (Read, Draw, Write) | |
| Challenge: | If time allows, students will model how to solve a word problem using decomposition on Seesaw. | |
| Plenary: How will students reflect back on learning/progress made in the lesson? | Exit ticket: Eureka page 75 – Finding the mistake of the subtraction problem. | |

## Appendix C: Grade 2 Math Lesson

| | G&T | SoD | ELL | Emirati |
|---|---|---|---|---|
| Name(s) | | | | |

| | | |
|---|---|---|
| What will be visible at the front of the classroom? | | |
| Teacher Question:<br>How can we represent subtraction with and without decomposition when there is a three-digit minuend?<br>CCSS.MATH.CONTENT.2.NBT.B.5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. | | |
| What will be visible in the classroom? (Front of class, at tables, on wall) | | |
| Success Criteria/Learning Outcomes:<br>D: I can recall how to use manipulatives to subtract<br>S: I can show how to use the vertical method to subtract<br>A: I can use manipulative and the vertical method to solve word problems involving subtraction<br>C: I can model how to use manipulatives and the vertical method using SeeSaw | | |
| Starter: How will students reflect back on prior knowledge? | With a partner solve the subtraction problem. Explain to another pair how you solved the problem. 172-48= (vertically) | |
| Learning Skills: What and how will students use learning skills?<br><br>Highlight and explain. | Responsibility: Completing work independently and using the answer key to check work<br>Collaboration: Solving subtraction problem together<br>Communication: Explaining their work<br>Interdisciplinary Skills:<br>Innovation & Technological Skills: Seesaw<br>Enterprise:<br>Inquiry:<br>Research:<br>Critical Thinking: Solving word problems | |
| Vocabulary: How will students be introduced to lesson vocabulary? | Subtraction, difference, decompose, minuend<br>Use the vocab words to label each part of your problem. | |
| Develop: What will students be doing to develop understanding? | Students will use the place value chart and drawings to solve the subtraction problems on the board. | What critical questions do I plan on asking?<br>Remember: What does it mean to subtract?<br>Understand: How can we use place value to subtract?<br>Apply: Can you explain how to decompose a ten?<br>Analyze: What works better, using a drawing or |
| Secure: What will students be doing to secure understanding? | Students will solve subtraction problems with decomposition on their own and use an answer key to check their work. If they have more than 3 mistakes, they will look at a video or example on the table to help them. Then try 2 more problems. | |
| Progress Check (Mini Plenary | 1, 2, 3 or 4/red, yellow, green<br>If you are not sure how to use drawings to decompose a subtraction problem you are a 1/red<br>If you can use a drawing to decompose a subtraction problem but still have some mistakes you are a 2/yellow<br>If you can show a partner how to use a drawing to decompose a subtraction problem you are a 3/green | |

| | | |
|---|---|---|
| Apply: What will students be doing to apply understanding to real-world context? | Students will solve subtraction word problems using decomposition; RDW (Read, Draw, Write) | written method to solve a problem?<br>Evaluate: Can you correct a mistake in someone else's work?<br>Create: How would you explain how to solve a word problem using decomposition? |
| Challenge: | If time allows, students will model how to solve a word problem using decomposition on Seesaw. | |
| Plenary: How will students reflect back on learning/progress made in the lesson? | Exit ticket: Eureka page 68 (Homework) – Explain the mistake and identify the correction. | |

## Appendix D: Grade 2 Science Lesson

| | G&T | SoD | ELL | Emirati |
|---|---|---|---|---|
| Name(s) | | | | |

| What will be visible at the front of the classroom? |
|---|
| **Teacher Question:**<br>Does the shape of an object help its function when solving a problems in civilizations?<br>K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. |
| What will be visible in the classroom? (Front of class, at tables, on wall) |
| Success Criteria/Learning Outcomes:<br>D: I can identify what environmental problems a civilization might have<br>S: I can think of possible solutions to solve a problem<br>A: I can design and build a model to show how the shape of an object or tool can help solve the problem<br>C: I can evaluate if the shape of the object is best for solving the problem |

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| Starter: How will students reflect back on prior knowledge? | | |
| Learning Skills: What and how will students use learning skills?<br><br>Highlight and explain. | Responsibility: Students must read a text and find a real-world problem on their own.<br>Collaboration: Students will work in groups to design and build a model<br>Communication: Students will reflect on their model and share conclusions after they build<br>Interdisciplinary Skills:<br>Innovation & Technological Skills: Students will use the iPads to watch videos and read articles, they will also come up with their own solutions and build models<br>Enterprise:<br>Inquiry:<br>Research: Watching videos and reading articles to find a problem<br>Critical Thinking: Finding the problem and solution | |
| Vocabulary: How will students be introduced to lesson vocabulary? | Vocabulary Review<br>-As a class quickly review key vocabulary for the design process<br>-Students will be asked to use vocabulary in discussions<br>-Design process<br>-Design<br>-Plan<br>-Build<br>-Test<br>-Improve<br>–Engineering<br>-Problem | |
| Develop: What will students be doing to develop understanding? | Cause and Effect Chart:<br>-Students will read articles and watch videos about real world problems happening in modern civilizations<br>-They will have to make a conclusion on what a problem could be.<br>-They will use a cause and effect chart to identify the key causes of the big problem<br>Guiding Questions | What critical questions do I plan on asking? Remember: Can you give me an example of interdependence of |

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| | -what is the problem?<br>-What is the effect?<br>-How can we use the design process to create a solution? | living things in a habitat?<br>Understand: What problems do these living things face?<br>Apply: What are some solutions can we create to solve these problems?<br>Analyze: Analyze your solutions and decide which one would be the best and why?<br>Evaluate: What worked well with your design?<br>Create: How would you improve your model? |
| Secure: What will students be doing to secure understanding? | Brainstorm:<br>-Students will brainstorm possible solutions<br>-Students will choose a solution their group thinks is best<br>Guiding Questions:<br>-What is our solution?<br>-How do we hope it will work?<br>-What might go wrong with our design? | |
| Progress Check (Mini Plenary | | |
| Apply: What will students be doing to apply understanding to real-world context? | Design and Build<br>-Students will draw and label a diagram listing materials and function<br>-Students will use real materials to build design<br>-Lower ability groups will be given materials to support their progress, where higher ability groups will choose from a variety of materials<br>-Students will test design and identify problems<br>-Students will retest design after fixing problems | |
| Challenge: | Evaluation Checklist<br>-Students will reflect on their model<br>-Students will use success criteria to complete a checklist<br>-Students will have area to write areas of development for their tool<br>-Students will post their problem, solution and evaluation onto SeeSaw | |
| Plenary: How will students reflect back on learning/progress made in the lesson? | Peer assessment– students go around and give feedback to other groups on their model. | |

## Appendix E: Grade 3 English Language Arts Lesson

| | G&T | SoD | ELL | Emirati |
|---|---|---|---|---|
| Names | | Daniel<br>Yousef<br>Hadi | Shayan<br>Yousef | |

| **What will be visible at the front of the classroom?** |
|---|
| **Teacher Question:** what are the important parts of the chapter?<br>**Standard/Learning Objective:**<br>RL.3.9. Compare and contrast the settings of stories written by the same author about the same or similar characters |
| **What will be visible in the classroom? (Front of class, at tables, on wall)** |
| **Success Criteria/Learning Outcomes:**<br>• D: I can list the 5 senses I heard to describe setting in a story<br>• S: I can give examples of what senses an author used to describe the setting of a story<br>• A: I can use a Venn Diagram to identify similarities and differences of setting in two texts by the same author<br>• C: I can debate which setting was described better to the reader using success criteria |

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| **Starter: How will students reflect back on prior knowledge?** | **I used to Think, But now I know:**<br>-Students will be asked How can a author write a good setting? What is needed?<br>-Teacher will record thinking on I used to Think part of chart paper |
| **Learning Skills: What and how will students use learning skills?**<br><br>**Highlight and explain.** | Responsibility: Students will be working in centers to complete their assignments.<br>Collaboration: Students will be working together to find key details<br>Communication: students communicate their learning by comparing settings and events in two different stories.<br>Innovation & Technological Skills: Students can define or translate any words as needed.<br>Enterprise:<br>Inquiry:<br>Research: students and research and record important events in the text<br>Critical Thinking: students can identify, categorize, and record key details from the assigned chapter(s) and can explain why they chose specific details to answer questions about the text. |
| **Vocabulary: How will students be introduced to lesson vocabulary?** | -Students will be doing word work in writing cycle<br>-Students will go through vocabulary for text reading at guided reading table |
| **Develop: What will students be doing to develop understanding?** | **Eyes Closed Listening**<br>-Students will listen to the teacher read a story out loud<br>-Students will identify what senses they hear<br>-Students will then read own text in a group and list the senses used to describe setting |
| **Secure: What will students be doing to secure understanding?** | **Text Detective**<br>-Students will look at example text and identify where senses were used |

**What critical questions do I plan on asking?**
**Remember:** What was the title of your book and where does the story take place?
Apply: How did recognizing key details help you retell and compare?

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| | -Students will underline the part of the text that use the sense<br>-Students will go to their own text and find examples of senses | Analyze: How are our Magic Tree House books similar? How are they different?<br>Evaluate: "How do you feel about sharing your knowledge of your Magic Tree House book with others?"<br>Create: Can you create your own version of an intro to children's rights? |
| **Progress Check (Mini Plenary** | **Thumbs Up Thumbs Down**<br>**-**Teacher will use thumbs up thumbs down to check if any students need help on what they are doing | |
| **Apply: What will students be doing to apply understanding to real-world context?** | **Venn Diagram**<br>**-**Groups will use a Venn Diagram to compare the two settings read in class<br>-Students will identify what senses both of the books used and which ones were unique to each book<br>-Students will come together on carpet to share Venn Diagram<br>-Students will discuss in mini-groups why it is important to use as many senses as possible when describing setting<br>*-Based on our Venn Diagram, which setting gives the reader more detail?*<br>*–Should a writer use one sense or many when describing the setting?*<br>*-How does using more senses make the setting more interesting to the reader?*<br>*-Why might some stories not give a reader so much detail about a setting?* | |
| **Challenge:** | **Debate:**<br>-Teacher will put students in groups to defend a book setting<br>-Students will be given time to plan argument why their book has the better settings<br>-Teacher will guide students with prompts<br>*-Our book has the best setting because…*<br>*-An example of this is…*<br>*-Your book would be better if…*<br>-Students will then have their debate with guidance of the teacher | |

| **Progress Check: How will students reflect back on learning/progress made in the lesson?** | Visible Trackers:<br>Students will put their names to show where they have progressed to in the lesson<br>Students will share their main ideas, and own introductions to Children's Rights. |
|---|---|

| **Student Name** | **SoD, ELL, G&T, AG** | **Differentiated Strategies** | **Expected Outcomes** | **If Applicable: How will LSA be utilized appropriately?** |
|---|---|---|---|---|
| Shayan Yousef | SoD | Providing models of expected work supports all learners, but especially challenged learners.<br>They do not read the text aloud rather, they have someone next to them to support their reading.<br>Groups are partnered. This allows you to support the struggling reader partnerships | Share one important event.<br>Have one peer read for him | Consider the use of a literacy aide or other adult who can circulate and assist groups with the procedural steps.<br>Teacher will allow students to listen to Dragon of the Red Dawn at home (on audiobooks or read aloud by a caregiver) as students read along silently. |
| Daniel | SoD | Daniel will listen to picture books.<br>He will point out to the character and setting when asked.<br>Danny put in order three pictures related to the story. | Daniel should be able to point out to characters when asked.<br>Daniel should be able to point out to settings when asked.<br>Daniel should be to place three pictures sequence in the right order. | Ms. Kate will help Daniel remain composed and confident. She will read the book.<br>She will scaffold his learning by asking him prompting questions. |
| Hadi | AG | Hadi will benefit from check ins to monitor his progress, to ensure he is using his time accordingly. | Hadi takes more time to produce written work, but will complete most of it. | |
| Viola<br>Michele<br>Shaheen | | | | |

## Appendix F: Grade 3 Math Lesson

| | G&T | SoD | ELL | Emirati |
|---|---|---|---|---|
| Names | | Daniel<br>Yousef<br>Hadi | Shayan<br>Yousef | |

**What will be visible at the front of the classroom?**

**Teacher Question:**

- How can we find the area of a rectangle with array?
- What strategy could you use to find the total area?

**Standard/Learning Objective:** 3.MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

**What will be visible in the classroom? (Front of class, at tables, on wall)**

**Success Criteria/Learning Outcomes:**

- **Develop:** I can use tiles to complete an array and find the unknown area.
- **Secure:** I can use the ruler and then skip count to find the unknown area.
- **Apply:** I can solve word problems involving finding an unknown area.

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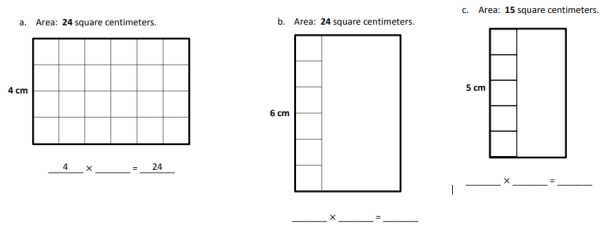
| **Starter: How will students reflect back on prior knowledge?** |  <br>**Sharing learning target**: Teacher shares the learning outcome and asks students to connect the target with previous learning.<br>Teacher shares the expectations and explain any confusing work.<br>**Starter:** Teachers asks students to work independently to solve all three problems independently for 3 minutes, she displays the answers afterwards.<br>If students are able to complete all three answers correctly they will go to apply.<br>If students are able to complete two answers correctly they will go to secure.<br>If students are able to complete only one correctly or none they will stay with the teacher on the carpet for mini lesson. |
| **Learning Skills: What and how will students use learning skills?**<br><br>**Highlight and explain.** | Responsibility: Students should be able to move to the next learning step based on the success criteria routine set in the classroom.<br>Collaboration: Students will be working together to find and solve their math problem.<br>Communication: students should be able to communicate the steps and strategies they have undertaken to solve a specific problem.<br>Innovation & Technological Skills: students should be able to use their iPads to review the concept taught in case of confusion ( self -regulatory learning)<br>Inquiry: students will use what they already know about arrays, multiplication and area model to find an answer to a problem.<br>Critical Thinking: students will reflect on their answers and check with their peers to compare and identify what makes more sense |
| **Vocabulary: How will students be** | During the collaborative work of students solving the application problem, teacher poses promoting questions through which she will introduce the new vocabulary word: centimeter ruler, unknown area, tiled rectangle. |

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| **introduced to lesson vocabulary?** | To solve the application problem, students are working collaboratively in heterogeneous groups. Then they share their strategies together. Then the teacher shares her answer and starts sending students off based on their conceptual understanding. | |
| **Develop: What will students be doing to develop understanding?** | Students will use tiles to cover different rectangles.<br>• Students will be able to Understand the relationship between side lengths and area. Teacher Draw the rectangle and side length shown on the right and asks students to Use square inch tiles to show this rectangle as an array, place tiles to make the known side.<br>• Tell your partner about the relationship between the side lengths and the area. Write an equation to show your thinking. Be sure to include the units.<br>• Repeat the process using a rectangle with a known side length of 5 inches and an area of 15 square inches. Ask students to write an unknown factor problem, $5 \times = 15$, and then use the tiles to solve. | **What critical questions do I plan on asking?**<br>**Remember**: how many total tiles will you use to make our rectangle?<br>**Understand**: how can I use mental math to solve this equation?<br>**Apply**: How are the areas related? (The area of 1(f) is half the area of 1(c).) How might you have figured that out just by knowing the side lengths of each array?<br>**Analyze**: Compare Problems 1(b) and 1(e) and Problems 1(a) and 1(c). How does each pair show commutativity?<br>**Evaluate**: what strategy did you use to find the unknown side length? Is there another way you could have figured it out?<br>**Create**: Is there another way to know whether this equation is true?" |
| **Secure: What will students be doing to secure understanding?** | • Students will work with their partners to complete problem set 1 on their math journals<br>• The first problem asks students to use the centimeter side of a ruler to draw in the tiles, and then skip-count to find the unknown area. Write a multiplication sentence for each tiled rectangle.<br>• While students are working on this section, circulate and provide feedback on student work. Encourage them to explain their reasoning | |
| **Progress Check (Mini Plenary** | As students are working independently or in small groups they move based on their level of understanding of the concept based on the success criteria. | |

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| **Apply: What will students be doing to apply understanding to real-world context?** | Descriptions<br>Students are working on solving word problems where they have to identify the unknown side using the area as a reference.<br>Students working above grade level may be eager to find the area of two combined rectangles.<br>Keep these learners engaged by optimizing their choice and autonomy.<br>Request from them an alternative model, such as a tape diagram.<br>They may enjoy offering two more examples of their own in which they use the standard algorithm to compose larger units twice. |
| **Progress Check: How will students reflect back on learning/progress made in the lesson?** | Visible Trackers:<br>Students will put their names to show where they have progressed to in the lesson<br>Students will return their exit tickets. Teachers would focus on the strategies they have used to solve the problem. |

| **Student Name** | **SoD, ELL, G&T, AG** | **Differentiated Strategies** | **Expected Outcomes** | **If Applicable: How will LSA be utilized appropriately?** |
|---|---|---|---|---|
| Danny | SoD | Danny is following an accommodation program that develops his basic math skills: using sensory objects and manipulatives for a short period of time | Danny can be given a paper grid where he can cover a small rectangular shape and count up to 10 to find the total amount of tiles he placed.<br>Will support Danny to start with one example and watch Danny complete the other example with visual prompts. | If Danny shows signs of frustration and can take away from learning to calm for 5 minute breaks if needed |
| Shayan<br>Yousef<br>Hadi<br>Ghali | ELL | Hadi and Yousef will be working at first in small groups to develop an initial understand through collaborative discourse with peers and teacher guided questions.They compare their thinking to the other team members' thinking.<br>When working in guided groups or independently: They will share their strategy with | Able to develop an initial understanding of the forming a rectangle by tiling with unit squares to make arrays | Teacher will ask questions using the mathematical discourse prompts. |

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| | | their peers and check their answers with their partners, then with the teacher.<br>They will use pictorial representation to explain their strategies.<br>They will use manipulative to help them understand the concept of arrays and ultimately cover the area.<br>Simplify and clarify your script for English Language Learner: Rephrase, "What information do we know?" to "How many rows of inch squares? How do you know?"<br>They can refer to the lesson video to self correct.<br>Teacher will provide DIRt feedback. | | |
| Viola Samer Shaheen | HA | Use of mathematical discourse to guide their collaborative work during the application problem.<br>Solve real life word problems with their peers and check their answers using the answer key.<br>Complete problem set 3 using the Read Draw Write strategies.<br>Providing a written explanation of the strategies they used to solve the problem. | Develop higher order thinking by reflecting on their work and compare it to others.<br>Use of mathematical discourse.<br>Identify the area formula based on patterns noticed and drawings.<br>Solve real problems using the area formula, skip counting, estimating, measure with ruler, tape diagram strategy or any other strategy. | |

## Appendix G: Grade 3 Math Lesson

| | G&T | SoD | ELL | Emirati |
|---|---|---|---|---|
| Names | | Daniel<br>Yousef<br>Hadi | Shayan<br>Yousef | |

**What will be visible at the front of the classroom?**

**Teacher Question:**

- Why is not necessary to draw all of the unit squares in an incomplete array, to find an area?
- What equation or formula can we use to find of a given rectangle?

**Standard/Learning Objective:** 3.MD.7 Relate area to the operations of multiplication an d addition. a. Find the area of a rectangle with whole- number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths. b. Multiply side lengths to find areas of rectangles with whole- number side lengths in the context of solving real world and mathematical problems, and represent whole- number products as rectangular areas in mathematical reasoning.

**What will be visible in the classroom? (Front of class, at tables, on wall)**

**Success Criteria/Learning Outcomes:**

- **Develop:** I can draw rows and columns to determine the area of a rectangle given an incomplete array.
- **Secure:** I can identify and use the area of a given rectangle using the area formula.
- **Apply:** I can solve word problems involving finding an unknown area.

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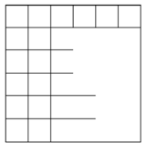
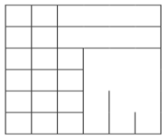
| **Starter: How will students reflect back on prior knowledge?** | **Sharing learning target**: Teacher shares the learning outcome and asks students to connect the target with previous learning.<br>Teacher shares the expectations and explain any confusing work.<br>**Starter:** Teachers asks students to work independently to solve all three problems independently for 3 minutes, she displays the answers afterwards.<br>If students are able to complete all three answers correctly they will go to apply.<br>If students are able to complete two answers correctly they will go to secure.<br>If students are able to complete only one correctly or none they will stay with the teacher on the carpet for mini lesson.<br>a.  <br>b.  <br>c.  |
| **Learning Skills: What and how will students use learning skills?**<br><br>**Highlight and explain.** | **Responsibility**: Students should be able to move to the next learning step based on the success criteria routine set in the classroom.<br>**Collaboration**: Students will be working together to find and solve their math problem.<br>**Communication**: students should be able to communicate the steps and strategies they have undertaken to solve a specific problem.<br>**Innovation & Technological Skills:** students should be able to use their iPads to review the concept taught in case of confusion ( self -regulatory learning)<br>**Inquiry**: students will use what they already know about arrays, multiplication and area model to find an answer to a problem.<br>**Critical Thinking:** students will reflect on their answers and check with their peers to compare and identify what makes more sense |
| **Vocabulary: How will students be** | During the collaborative work of students solving the application problem, teacher poses promoting questions through which she will introduce the new vocabulary word: incomplete array, columns and rows, unknown area, tiled rectangle. |

| | | |
|---|---|---|
| **introduced to lesson vocabulary?** | To solve the application problem, students are working collaboratively in heterogeneous groups. Then they share their strategies together. Then the teacher shares her answer and starts sending students off based on their conceptual understanding. | |
| **Develop: What will students be doing to develop understanding?** | Students will use tiles to cover different rectangles.<br>Minh skip-counts by sixes to find the total square units in the rectangle below. She says there are 36 square units. Is she correct? Explain your answer.<br>  <br>• Students will be able to estimate and draw the missing square unit inside an array. Teacher Draw the rectangle and side length shown on the right and asks students to Use square inch tiles to show this rectangle as an array, place tiles to make the known side.<br>• Tell your partner about the relationship between the side lengths and the area. Write an equation to show your thinking. Be sure to include the units.<br>• Repeat the process using a rectangle with incomplete arrays: area model 1 and area model 2. Ask students to write an equation to represent the area. | **What critical questions do I plan on asking?**<br>**Remember**: how many total tiles will you use to make our rectangle?<br>**Understand** : How can an array of square units help you find the area of a rectangle?<br>**Apply**: How can we find the number of rows in an incomplete array? How can we find the number of columns in an incomplete array?<br>**Analyze**: What equation can be used to find the area of the rectangle?<br>**Evaluate**: what strategy did you use to find the area of an incomplete array? Is there |
| **Secure: What will students be doing to secure understanding?** | • Students will work with their partners to complete problem set 1 on their math journals<br>• The first problem asks students to represents 1 square centimeter. Draw to find the number of rows and columns in each array. Match it to its completed array. Then, fill in the blanks to make a true equation to find each array's area.<br>• While students are working on this section, circulate and provide feedback on student work. Encourage them to explain their reasoning | |
| **Progress Check (Mini Plenary** | As students are working independently or in small groups they move based on their level of understanding of the concept based on the success criteria. | |
| **Apply: What will students be doing to apply understanding to real-world context?** | Descriptions<br>Students are working on solving problem set 2; one and two step word problems where they have to identify the area using the area formula<br>Students working above grade level may be eager to find the area of two combined rectangles.<br>Keep these learners engaged by optimizing their choice and autonomy;.<br>Request from them an alternative model, such as a tape diagram. They may enjoy offering two more examples of their own in which they use the standard algorithm to compose larger units twice. | |

| | | |
|---|---|---|
| | | another way you could have figured it out? **Create**: Is there another way to solve this problem? |
| **Progress Check: How will students reflect back on learning/progress made in the lesson?** | Visible Trackers:<br>Students will put their names to show where they have progressed to in the lesson<br>Students will return their exit tickets. Teachers would focus on the strategies they have used to solve the problem. | |

| **Student Name** | **SoD, ELL, G&T, AG** | **Differentiated Strategies** | **Expected Outcomes** | **If Applicable: How will LSA be utilized appropriately?** |
|---|---|---|---|---|
| Danny | SoD | Danny is following an accommodation program that develops his basic math skills: using sensory objects and manipulatives for a short period of time | Danny can be given a paper grid where he can cover a small rectangular shape and count up to 10 to find the total amount of tiles he placed.<br>Will support Danny to start with one example and watch Danny complete the other example with visual prompts. | If Danny shows signs of frustration and can take away from learning to calm for 5 minute breaks if needed |
| Shayan Yousef Hadi Ghali | ELL | Scaffold the following sequence further by beginning with a basic 2 by 2 rectangle in which 2 tiles are missing. Graduate to a 2 by 3 rectangle in which tiles or lines are missing. Continue step by step until students are ready for rectangles with larger areas. Also, adding color to alternating tiles to assist with counting or distinguishing tiles from rectangles or blank space. | Able to develop an initial understanding of the forming a rectangle by drawing arrays and columns to complete the area. | Teacher will ask questions using the mathematical discourse prompts. |

| | | | | |
|---|---|---|---|---|
| | | Hadi and Yousef will be working at first in small groups to develop an initial understand through collaborative discourse with peers and teacher guided questions.They compare their thinking to the other team members' thinking.<br>When working in guided groups or independently: They will share their strategy with their peers and check their answers with their partners, then with the teacher.<br>They will use pictorial representation to explain their strategies.<br>They will use manipulative to help them understand the concept of arrays and ultimately cover the area.<br>They can refer to the lesson video to self correct.<br>Teacher will provide DIRt feedback. | | |
| Viola<br>Samer<br>Shaheen | HA | Use of mathematical discourse to guide their collaborative work during the application problem.<br>Solve real life word problems with their peers and check their answers using the answer key.<br>Complete problem set 3 using the Read Draw Write strategies.<br>Providing a written explanation of the strategies they used to solve the problem. | Develop higher order thinking by reflecting on their work and compare it to others.<br>Use of mathematical discourse.<br>Identify the area formula based on patterns noticed and drawings.<br>Solve real problems using the area formula, skip counting, estimating, measure with ruler, tape diagram strategy or any other strategy. | Students provide feedback to each other.<br>Complete the challenge. |

## Appendix H: Grade 3 Math Lesson

| | G&T | SoD | ELL | Emirati |
|---|---|---|---|---|
| Names | | Daniel<br>Yousef<br>Hadi | Shayan<br>Yousef | |

**What will be visible at the front of the classroom?**

**Teacher Question:**

- How can we use/interpret the area model to draw a rectangular array?
- What equation or formula can we use to find of a given rectangle?

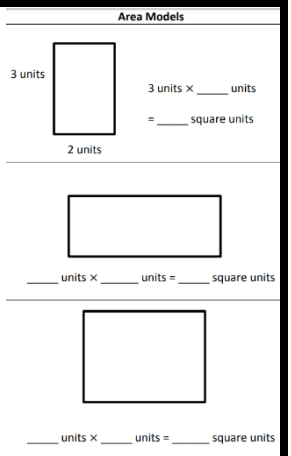
**Standard/Learning Objective:** 3.MD.7 Relate area to the operations of multiplication an d addition. a. Find the area of a rectangle with whole- number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths. d.Recognize area as additive. Find the areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.

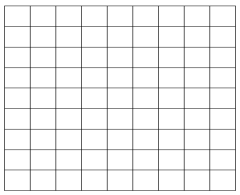
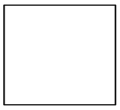
**What will be visible in the classroom? (Front of class, at tables, on wall)**

**Success Criteria/Learning Outcomes:**

- **Develop:** I can explore the relationship between units and area.
- **Secure:** I can interpret area models to make rectangular arrays.
- **Apply:** I can solve word problems involving interpreting area model to find area.

| | |
|---|---|
| **Starter: How will students reflect back on prior knowledge?** | **Sharing learning target**: Teacher shares the learning outcome and asks students to connect the target with previous learning.<br>Teacher shares the expectations and explain any confusing work.<br>**Starter:** Teachers asks students to work independently to solve all three problems independently for 3 minutes, she displays the answers afterwards.<br>If students are able to complete all three answers correctly they will go to apply.<br>If students are able to complete two answers correctly they will go to secure.<br>If students are able to complete only one correctly or none they will stay with the teacher on the carpet for mini lesson. |
| **Learning Skills: What and how will students use learning skills?**<br><br>**Highlight and explain.** | **Responsibility**: Students should be able to move to the next learning step based on the success criteria routine set in the classroom.<br>**Collaboration**: Students will be working together to find and solve their math problem.<br>**Communication**: students should be able to communicate the steps and strategies they have undertaken to solve a specific problem.<br>**Innovation & Technological Skills:** students should be able to use their iPads to review the concept taught in case of confusion ( self -regulatory learning)<br>**Inquiry**: students will use what they already know about arrays, multiplication and area model to find an answer to a problem.<br>**Critical Thinking:** students will reflect on their answers and check with their peers to compare and identify what makes more sense |
| **Vocabulary: How will students be introduced to** | During the collaborative work of students solving the application problem, teacher poses promoting questions through which she will introduce the new vocabulary word: rectangular array, area model, unit size, square unit |



| | | |
|---|---|---|
| **lesson vocabulary?** | To solve the application problem, students are working collaboratively in heterogeneous groups. Then they share their strategies together. Then the teacher shares her answer and starts sending students off based on their conceptual understanding. | |
| **Develop: What will students be doing to develop understanding?** | Students will use tiles to cover different rectangles.<br>2. Jillian arranges square pattern blocks into a 7 by 4 array. Draw Jillian's array on the the grid below. How many square units are in Jillian's rectangular array?<br>a.<br>  <br>b. Label the side lengths of Jillian's array from Part (a) on the rectangle below. Then, write a multiplication sentence to represent the area of the rectangle.<br>  <br>• Students will be able to arrange square pattern blocks into 7 by 4 array. They will draw it on the grid. Then they will transfer it to draw a rectangular area without arrays and make the connection between both areas. Then they write the multiplication sentence. Teacher try to collect as many strategies as possible to allow for peer influence to take place and for students to be exposed to as many strategies and learn the one they felt more confident with.<br>• Tell your partner about the relationship between rectangular array and area model.<br>• Repeat the process using lesson 7 homework. | **What critical questions do I plan on asking?**<br>**Remember**: How might you find the area?<br>**Understand**: what was your strategy to find the total number of squares when drawing a rectangular array?<br><br>**Apply**: what is the connection between the rectangular array and area model? Why is it important to label the unit when you are talking about area?<br><br>**Analyze**: compare two rectangles with the same area total, do they have the same area?<br><br>**Evaluate**: For Problem4(b),most students answered that Mrs. Barnes' array probably had 24 squares. Is there another answer that makes sense? Compare the area |
| **Secure: What will students be doing to secure understanding?** | • Students will work with their partners to complete problem set 1 on their math journals<br>• The first problem asks students to Find the area of each rectangular array. Label the side lengths of the matching area model, and write a multiplication equation for each area model.<br>• While students are working on this section, circulate and provide feedback on student work. Encourage them to explain their reasoning | |
| **Progress Check (Mini Plenary** | As students are working independently or in small groups they move based on their level of understanding of the concept based on the success criteria. | |

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| **Apply: What will students be doing to apply understanding to real-world context?** | Descriptions<br>Students are working on solving problem set 2; one and two step word problems where they have to identify the area using the area formula<br>Students working above grade level may be eager to find the area of two combined rectangles.<br>Keep these learners engaged by optimizing their choice and autonomy.<br>Request from them an alternative model, such as a tape diagram. They may enjoy offering two more examples of their own in which they use the standard algorithm to compose larger units twice. | model to the array. How are they the same and different?<br><br>**Create**: Is there another way to solve this problem? |
| **Progress Check: How will students reflect back on learning/progress made in the lesson?** | Visible Trackers:<br>Students will put their names to show where they have progressed to in the lesson<br>Students will return their exit tickets. Teachers would focus on the strategies they have used to solve the problem. | |

| **Student Name** | **SoD, ELL, G&T, AG** | **Differentiated Strategies** | **Expected Outcomes** | **If Applicable: How will LSA be utilized appropriately?** |
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| Danny | SoD | Danny is following an accommodation program that develops his basic math skills: using sensory objects and manipulatives for a short period of time | Danny can be given a paper grid where he can cover a small rectangular shape and count up to 10 to find the total amount of tiles he placed.<br>Will support Danny to start with one example and watch Danny complete the other example with visual prompts. | If Danny shows signs of frustration and can take away from learning to calm for 5 minute breaks if needed |
| Shayan<br>Yousef<br>Hadi<br>Ghali | ELL | Students will be prompted to approach rectangle E first because it is the easiest.<br>Hadi and Yousef will be working at first in small groups to develop an initial understand through collaborative discourse with peers and teacher guided questions. They compare their thinking to the other team members' thinking.<br>When working in guided groups or independently: They will share their strategy with their peers and check their | Able to develop an initial understanding of the forming a rectangle by drawing arrays and columns to complete the area. | Teacher offer practice with 1 by *n* rectangles to build fluency and confidence.<br>Teacher will ask questions using the mathematical discourse prompts. |

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| | | answers with their partners, then with the teacher.<br>They will use pictorial representation to explain their strategies.<br>They will use manipulative to help them understand the concept of arrays and ultimately cover the area.<br>They can refer to the lesson video to self correct.<br>Teacher will provide DIRT feedback. | | |
| Viola<br>Samer<br>Shaheen | HA | Use of mathematical discourse to guide their collaborative work during the application problem.<br>Solve real life word problems with their peers and check their answers using the answer key.<br>Complete problem set 3 using the Read Draw Write strategies.<br>As a challenge complete the application problem. This problem reviews multi step word problems.<br>Providing a written explanation of the strategies they used to solve the problem. | Develop higher order thinking by reflecting on their work and compare it to others.<br>Use of mathematical discourse.<br>Identify the area formula based on patterns noticed and drawings.<br>Solve real problems using the area formula, skip counting, estimating, measure with ruler, tape diagram strategy or any other strategy. | Students provide feedback to each other.<br>Complete the challenge. |

## Appendix I: Grade 3 Science Lesson

| | G&T | SoD | ELL | Emirati |
|---|---|---|---|---|
| Names | | Daniel<br>Yousef<br>Hadi | Shayan<br>Yousef | |

**What will be visible at the front of the classroom?**

**Teacher Question:** How does inherited information cause organisms to function differently?
**Standard/Learning Objective:**
LS3.B: Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)

**What will be visible in the classroom? (Front of class, at tables, on wall)**

**Success Criteria/Learning Outcomes:**

- Develop: I can predict the function of different bird beaks
- Secure: I can investigate to find the function of different bird beaks
- Apply: I can connect the function of bird beaks to inherited traits
- Challenge: I can point out how the function of specific inherited traits are necessary for an organism's survival.

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| **Starter: How will students reflect back on prior knowledge?** | Think 1, Think 2<br>-As a class student will be asked what they know about traits<br>-Students will talk to a shoulder buddy first<br>-Students will share with teacher<br>-Teacher will write student responses on Think 1 section of chart paper |
| **Learning Skills: What and how will students use learning skills?**<br><br>**Highlight and explain.** | Responsibility: Students will be working in centers to complete their assignments.<br>Collaboration: Students will be working together to find key details<br>Communication: students communicate their learning by comparing settings and events in two different stories.<br>Innovation & Technological Skills: Students can define or translate any words as needed.<br>Enterprise:<br>Inquiry:<br>Research: students and research and record important events in the text<br>Critical Thinking: students can identify, categorize, and record key details from the assigned chapter(s) and can explain why they chose specific details to answer questions about the text. |
| **Vocabulary: How will students be introduced to lesson vocabulary?** | -During the starter and the prediction teacher will highlight key vocabulary words and writes them on the white board: inherited trait, variation of trait, similar organisms, functions, offspring, beak types.<br>-Teacher will use students discussions to identify vocabulary meaning |

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| **Develop: What will students be doing to develop understanding?** | **Prediction:**<br>-Students given pictures of 4 different bird beaks<br>-Students will be asked to write the function of each of the bird beaks<br>-Teacher will model a prediction for the class<br>-Students will write their predictions in A3 investigation package | **What critical questions do I plan on asking?**<br>**Remember: What is a prediction?**<br>**Understand: What are the steps of the investigation?**<br>**Apply**: What are the different variables? |

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| | -Students will complete prediction chart for each bird beak | **Analyze**: What does your data tell you?<br>**Evaluate:** Is this a fair test? |
| **Secure: What will students be doing to secure understanding?** | **Investigation and Observations**<br>-Students will go over beak experiment<br>-Teacher will model as a whole class first round of investigation<br>-Teacher will ask students to identify the dependent, independent and controlled variables in the investigation<br>-Students will be given roles for the investigation<br>-Students will use A3 investigation package to record their observations | |
| **Progress Check (Mini Plenary** | **Thumbs Up Thumbs Down**<br>Teacher will ask students to put thumbs up if their investigation is going fine<br>Teacher will ask students to put thumbs down if they need help<br>Teacher will assist any group needing help | |
| **Apply: What will students be doing to apply understanding to real-world context?** | **Analysis**<br>-Teacher will give mini lesson on structure and how to use a bar graph<br>-Students will take their observations and make a bar graph for each beak<br>-Students will answer questions based on their bar graphs<br>Guiding Questions<br>*-What beak worked the best for eating ….?*<br>*-What beak worked was not very good for eating ….?*<br>*-Is there any beak that was the best for more than one type of food?* | |
| **Challenge** | **Conclusions**<br>-Students will compare their predictions with their analysis<br>-Students will revise their predictions if they were initially wrong<br>Guiding Questions<br>*-What makes beak shape an example of an inherited trait?*<br>*-How does the shape of a whooping cranes beak affect the way the beak function?*<br>*-Using your understanding, which birds in the picture would challenge the birds investigated for food?* | |

| **Progress Check: How will students reflect back on learning/progress made in the lesson?** | **Progress Movement:**<br>-At the end of each lesson students will move their names to show where they are on the investigation progress chart<br>-Students will reflect as a class to add to Think 2 new learning<br>-Teacher will ask students questions based on the learning<br>*-What is something new you learned about traits*<br>*-How did you think like a scientist?*<br>*-What challenges did your team face? How did you overcome them?* |
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| **Student Name** | **SoD, ELL, G&T, AG** | **Differentiated Strategies** | **Expected Outcomes** | **If Applicable: How will LSA be utilized appropriately?** |
|---|---|---|---|---|
| Shayan Yousef Hadi | SoD | Providing models of expected work supports all learners, but especially challenged learners.<br>Students in this group will benefit from check ins to monitor their progress and to make sure they stay on task. | Write a prediction as a group.<br>Follow the investigation steps. | Teacher would guide students through the process before and during the investigation.<br>Teacher would model one example to help students with their predictions.<br>Provide a video with the required steps they need to undertake in order to complete all steps. |
| Daniel | SoD | Daniel will be working with a small group during the investigation.<br>Some scientific tools will be provided specifically to him in order to avoid any unnecessary stress that might cause when he requests a tool and cannot find it.<br>When students are writing their predictions Daniel will be working on his ipad to interact with an app related to his parents traits. | Attempt to work in group.<br>Match parents to offspring using visuals. | Ms. Kate will help Daniel remain composed and confident. She will support him in joining the groups and attempting to participate.<br>She will scaffold his learning by asking him prompting questions. |
| Viola Michele Shaheen | AG | | | |