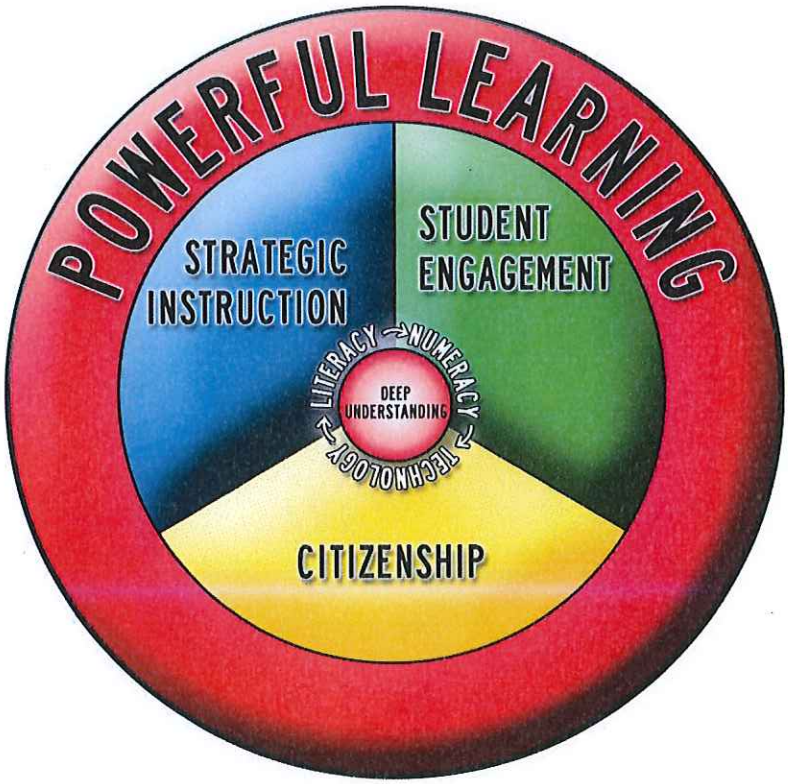
GHSD System Improvement



Golden Hills School Division No. 75

Powerful Learning

Powerful Learning encompasses the design and implementation of engaging classroom experiences that lead students to **a deeper understanding and application of curricular outcomes.** It is the overarching construct that incorporates all aspects of previous system improvement work in Golden Hills School Division that have been found to be effective in increasing student learning including "Assessment for Learning'. Powerful Learning is infused with high impact strategies and learning approaches designed to foster innovation and lifelong learning. It also incorporates 21st century learning principles and embodies the Alberta Education's *Inspiring Education* statement that "all students are inspired to achieve success and fulfillment as *engaged thinkers* and *ethical citizens* with an *entrepreneurial spirit*." The ultimate goal of Powerful Learning is to foster creators, connectors and collaborators, who critically and thoughtfully contribute to the world.

Students move towards deep understanding when they see and hear other's perspectives, insights and questions. This requires habits of mind such as open-mindedness and persistence as well as a thinking disposition, including critical and creative thinking. Powerful Learning experiences ensure that students have something to think about creating a complimentary synergy between foundational elements and higher

level thinking. This invites students to construct a deeper understanding by extending ideas, making connections, inferring and by focusing on big ideas or central concepts. The intention of Powerful Learning is to help students acquire the thinking skills necessary to solve problems, make decisions, form judgments and engage in creative endeavors. This enables students to use or apply the learning in new and innovative ways. Reasoning with evidence is a primary focus and is instrumental in developing a "thinking disposition". As well, consideration is given to creating a safe learning environment where unusual ideas are supported, students are provided choice, novelty is incorporated and constructive feedback is provided. These are the basic conditions of a creative learning environment as outlined by Drapeau. (Drapeau, 2011, p 30. As cited in Drapeau, 2014)

The GHSD **Literacy and Numeracy Foundational** Frameworks are intended to ensure that basic skills and knowledge are acquired from which students can move to higher levels of thinking and application. These foundational frameworks support Powerful Learning and provide common guidelines for practices in all classrooms. They are research based and describe the key assumptions/ philosophies, high impact strategies and practices, and assessment approaches identified as best practices in GHSD. (Refer to appendix for copy)

Powerful **learning utilizes technology as a learning tool** in order for students to be able to communicate, research and create deeper understandings and new learning. Students work to discover and master content knowledge in addition to being able to create, extend, innovate and apply this content knowledge. The importance is recognized in being able to use technology well to support teaching and learning (Fullan & Langworthy, 2014). Through the effective use of technology, students are able to select, organize and design learning to be shared both within and beyond the classroom. Technology facilitates the opportunity to shift the emphasis of learning from content and skills to higher order tasks and thinking. Technology can also help GHSD teachers to meet the differentiated needs of learners, enabling all students to experience a successful learning experience.

When designing powerful learning tasks teachers' pay attention to high yield strategies, outlining an intentional sequence of learning activities that starts with the learning outcomes, clusters and aligns with essential learning, as well as utilizes assessment for learning approaches and strategies. Purposeful, ongoing assessment for learning approaches ensures students are gaining a deep understanding of the core learning goals/skills and is imperative to student success. This type of intentional design allows teachers to consider the scope of student needs in their classroom and therefore

allow for multiple entry points so that all students can participate in the task. Core competencies such as: collaboration, communication, critical thinking, and problems solving are integrated when designing units. Design structures such as "Understanding by Design- UBD" (Wiggins & McTighe, 2005) or the "Cascading Curriculum" principles (TC2), are used in planning. This type of design involves the purposeful development of what the teacher and student work will look like as well as what will be collected as evidence of learning. Deciding how students can demonstrate a deep understanding, requires being able to plan for multiple ways of representing and expressing ideas.

Designing powerful learning incorporates **the design of authentic, rigorous units of study, the implementation of strategic learning, as well as a focus on student engagement, and citizenship.** It is the integration of all of these elements that supports deep understanding of curricular objects and enables students to acquire a disposition for all learning, now and in their future.

Implementation of Powerful Learning

GHSD is currently focused on the implementation of Powerful Learning throughout all schools. Implementation includes development of "Assessment for Learning" strategies, intentional integration of Critical Thinking challenges and a clear understanding of the characteristics of powerful learning tasks including those outlined through the Galileo Network. The core competencies and the GHSD Literacy and Numeracy Frameworks are integrated in the planning of well-designed learning experiences.

Areas of strategic instruction are also outlined in this document as well as within the GHSD Literacy and Numeracy Frameworks. These Frameworks describe the key assumptions and beliefs that form the foundation of literacy and numeracy learning in GHSD. Key resources and strategies are also outlined in these frameworks to encourage common practice throughout the district.

It is recognized that this is a starting point and that GHSD will continue to incorporate relevant research including such areas as learning theory/brain research and research on high impact strategies. Since the inception of AISI, research has guided the implementation of best practices in our classrooms and it will continue to do so.

Characteristics of Powerful Learning

In order to ensure the development of deep understanding of curriculum essentials learning opportunities incorporate a number of key characteristics of powerful learning. These characteristics are foundational to the planning of lessons and units in GHSD.

Fostering Critical Thinking

GHSD has recognized the importance of infusing critical thinking into our classrooms and has partnered up with the Critical Thinking Consortia (TC2) including Garfield Gini-Newman and key facilitators. The TC2 team has worked with GHSD teachers to understand the tweaks they can make to lessons in order to intentionally develop critical thinking. Students are invited to think critically or reason using a set of criteria. When students are offered a critical challenge and encouraged to engage in critical inquiry, increased engagement and deeper learning can be achieved. Garfield encourages "teachers to activate learning about a topic by involving students in shaping questions to guide their study, giving them ownership over the direction of these investigations and requiring that students critically analyze and not merely retrieve information." (Gini-Newman & Gini-Newman, p. 35). In this way, according to Garfield, a shift occurs from covering curriculum to students uncovering the curriculum". The content of the curriculum is "problematized" which then leads to an investigation and discovery connected to the real world. Through this type of investigation students draw conclusions, make decisions and solve problems. This emphasis is consistent with Inspiring Education. **Critical thinking** is one of the core competencies identified by Alberta Learning. In order to foster critical thinking and problem solving, GHSD teachers are encouraged to reflect on their own inquiry and investigative processes and thereby learn how they as teachers observe, think, and question their students (Galileo Network).

Encouraging Creativity and Innovation

Designing powerful learning incorporates opportunities for students to develop creativity in their classrooms. **Creativity** is a core competency defined by Alberta Learning as the ability to apply creative thought processes to create something of value. Moving away from scripted lessons to asking questions that encourage critical and creative thinking helps our students to think in both divergent and convergent ways, analyzing and evaluating as they learn. Drapeau states that both divergent and convergent thinking are necessary for creativity. (Drapeau, 2014) "A student uses divergent thinking to generate different solutions to a problem or challenge and then uses convergent thinking to decide which one will provide the best results". (Drapeau, 2104) "The creative process includes elaborating on the initial ideas, testing, and refining them and even rejecting them." (Drapeau, 2011, As cited in Drapeau, 2014, p 2) As well, innovation is encouraged in

GHSD. **Innovation** as one of the core competencies is defined by Alberta Learning as the capacity to create and apply new knowledge to create new products or solve complex problems.

Engaging in Sustained Inquiry

Through powerful questions and learning tasks, GHSD teachers ignite inquiry in a sustained manner and "hook" student interest and motivation to learn. Sustained inquiry engages students in bigger questions that do not have immediate answers, questions that lead to more enduring investigations. It also develops habits of critical and creative thinking in all areas of learning.

Learning in the World:

Fostering Authenticity and Real World Connections

The importance of designing authentic tasks and inquiries guides the design of powerful learning in GHSD. Task design considers what is meaningful and relevant for the students. Authentic tasks are defined by Galileo are "tasks and inquiries that have personal meaning to students, reflect real life work, has students create and contribute to the world's knowledge and demands a variety of roles and perspectives".

When learning moves beyond the classroom, students are engaged in being able to "observe, interact, collaborate and create with experts" (Galileo) in the community. "Inquiries and tasks are developed that require student collaboration to acquire and use competencies expected from high performance work environments: teamwork, problem posing, problem solving, communication, decision making and project management." (Galileo). In the design of learning, every attempt is made by teachers to consider what the discipline calls for (i.e. in mathematics we consider how to help students to learn how to think like a mathematician). GHSD teachers also make every attempt to provide students with "worthwhile work". In order to foster authenticity and real world connections there is a deliberate development of the competency of collaboration and communication (two core competencies as identified through Alberta Learning. Alberta Learning describes **collaboration** as ability to interact positively and respectfully with others in creating new ideas and developing products. **Communication** is defined by Alberta Learning as the ability to use technology to develop competencies and ability to critically interpret and evaluate ideas, the ability to access, analyze, integrate and manage large volumes of information. Communication includes the dialogue between teachers as they examine their own practice and examine current literature (as defined by Galileo Network).

Learning Through Assessment: Assessment for Learning (AFL)

GHSD has focused on improving student learning through developing teacher practice in attending to ongoing "minute-by-minute and day-to-day formative assessment" (Wiliam, 2011, p. 27). Formative assessment "encompasses all those activities undertaken by teachers and /or students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged" as cited in Wiliam, 2011. Wiliam states "An assessment functions formatively to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers to make decisions about the next steps in instruction…" (Wiliam 2011, p. 43). In order for teacher and learners to determine next steps, it is imperative that teachers determine "where students are at in their learning, where they are going and how to get there". The AFL strategies implemented in GHSD help teachers to plan with clear goals linked to curriculum, as well as understand how to provide extensive descriptive feedback during the learning. Hattie (2009) identified in his research (meta-analysis of 800 research studies) that "feedback" is ranked as having a high impact on learning, which is consistent with teacher observations in GHSD.

GHSD achievement results have improved by integrating effective assessment for learning practices. GHSD positive results as supported by a large body of research that shows the positive impact of Formative assessment upon improving student learning.
GHSD has identified the following key components of "Assessment for Learning" to be implemented during the instructional process to improve teaching and learning.

Technology Enhanced Learning Environments

Technology is integrated into the learning environment as the tool to gather information, construct new learning, document learning and extend learning to creations and innovations. Technology is used to facilitate the creation and communication of learning with others. Galileo Learning Network identifies characteristics of strong Inquiries and tasks that permit students to select appropriate technologies to create, contribute, connect and collaborate with others. GHSD supports the role of technology as outlined in Inspiring Education "Ultimately, the power of technology should be harnessed to support innovation and discovery, not simply to aid teaching. We need to engage learners to use these technologies as designers and creators of knowledge".

Strategic Instruction

Strategic instruction is a powerful student-centered approach that implements high-impact, research-based teaching strategies in order to improve student achievement. These strategies help students to efficiently grasp core curricular competencies, as well as organize, analyze and manage information. Strategic instruction enables students to effectively gain foundational skills, in order to become innovative thinkers, creators and doers. Research supports the use of high impact strategies to increase student achievement. GHSD has identified a number of high-impact strategies that are encouraged in all classrooms.

Teaching is a highly complex activity. Learning theory and brain research has increased the efficacy of teaching. This research continues to illuminate the most effective ways to support deeper learning and understanding. As new research emerges, it will continue to inform future practice. The following strategies are known to demonstrate a high impact on learning.

Assessment for Learning:

Formative assessment can be seen as an on-going process that relies on several measures over time. It is viewed as a process rather than a singular event (Bennett, 2011). Formative assessments use information from the judgment of student work and performance to improve student achievement (Sadler, 1989). Students are provided with feedback as to how successfully a task has been completed or is being completed. They use this feedback to improve upon their achievement. Information collected through the use of formative assessment is used to further student learning (Ayala, 2005). Teachers create instruction based on evidence gathered through formative uses of assessment. These formative interactions are designed to encourage thought on the student's part (Black & William, 2009). Teachers use information from these interactions in order to make decisions surrounding the curriculum and the direction of learning. They determine whether to move forward, how to move forward and where to encourage student focus. This view focuses on the process of developing and changing instruction to match student needs.

Overview / Implementation

Curriculum Essentials	• Prioritized curriculum • Planning with the end in mind (Enduring Understandings) • Specific and student friendly learning targets/sharing outcomes with students • Assessing to the outcomes

Effective Questioning	See '**Effective Questioning**' section below
Effective Feedback	See '**Effective Feedback**' section below
Exemplars	• Provides models of tasks at varying levels of achievement • Allows students to see where they are at in relation to the learning goal
Rubrics	• Communicates success criteria • Co-creating rubrics in student friendly language
Student Goal Setting	• Specific, Measurable, Achievable, Realistic, Time Framed • Making adjustments and monitoring to reach goal
Peer and Self-Assessment/ Feedback	• Students use rubrics, checklist and guides to focus self- reflections • Teachers model and teach the tools of how to self and peer assess
Triangulation of Data	• Data is gathered and provides evidence of where the student is at in relation to the learning outcome. This might be in the form of a product, conversation or observation. • Teachers and students gather evidence to inform student learning through a variety of sources. • Teachers adjust their teaching in the moment to further student understanding and address misunderstandings.
Additional Resources	For additional formative assessment strategies and descriptions go to: Tools for Formative Assessment - Techniques to Check for Understanding - Processing Activities – http://www.levy.k12.fl.us/instruction/Instructional_Tools/60FormativeAssessment.pdf Dodge, J. (2009). *25 Quick Formative Assessments for a Differentiated Classroom*. New York: Scholastic Inc. Moss, C. & Brookhart, S. (2009). *Advancing Formative Assessment in Every Classroom-A Guide for Instructional Leaders*. Alexandria: ASCD. William, D. (2011). *Embedded Formative Assessment*. Bloomington: Solution Tree.

Effective Feedback (AFL):

Timely and concise feedback provides students with information about what they know or don't know and is used, by teachers, to direct further instruction. Teachers can use this feedback to help students bridge the gap between what they know and what they need to know (Ayala, 2005). As students use feedback, they become capable of building upon their own learning and develop enhanced metacognition and increased motivation (Brookhart, 2012). "When teachers seek, or at least open to, feedback from students as to what students know, what they understand, where they make errors, when they have misconceptions, when they are not engaged-then teaching and learning can be synchronized and powerful. Feedback to teachers helps make learning visible" (Visible Learning, 2009, p.173). The most effective feedback provides information to students about their tasks and how to do it more effectively (Hattie & Timberley, 2007).

Strategy	Overview / Implementation
Effective Feedback that Moves Learning Forward	• Teachers give feedback that is focused, specific and descriptive. • Feedback is timely and limited in the amount of feedback at one time. • Facilitates the development of self-assessment • Includes affirmations, noticing and naming good qualities in a student's work that enables the student to adjust what they are doing to improve learning by understanding specific next- steps.

Critical Thinking:

Critical thinking engages students in exploring provocative questions or challenges and encourages students to investigate, reflect, create and share their understandings. When someone is thinking critically they are assessing or judging the merits of potential options based on a set of relevant criteria.

In order to foster critical thinking, students need opportunities to build upon their prior knowledge, communicate with peers, develop knowledge and skills to analyze information and draw their own conclusions in an engaged classroom.

	Overview / Implementation
Developing Intellectual Tools	○ **Background Knowledge-** relevant background knowledge and information about a topic that is required for thoughtful reflection. It is the "content" that we need to be able to think critically. ○ **Criteria for Judgment-** appropriate criteria used for judging the merit and reasonableness of the choices in a thinking challenge ○ **Critical Thinking Vocabulary-** refers to concepts that address distinctions

	underlying being able to think critically such as conclusion, correlation, justify, relevant, evidence and proof ○ **Thinking Strategies-** the knowledge and use of appropriate procedures and processes when thinking through a challenge. There are many strategies that can guide students through challenges that they encounter ○ **Habits of Mind-** values and attitudes or dispositions of a careful and conscientious thinker such as persistence, open mindedness, fair mindedness and tolerance to ambiguity (Case, 2005)
Effective Questioning	See '**Effective Questioning**' section below

Effective Questioning:

Questioning has been found to be the second most dominant teaching method after teacher talk, with teachers spending 35-50% of teaching time posing questions (Hattie, 2009, p. 182). Questioning is a powerful strategy for teaching concepts, building comprehension and helping students to assume an inquiry stance towards learn. Asking questions to foster an inquisitive stance helps students to be open to new ideas. Most questions that teachers ask are questions they already know the answer to (guess what is in the teachers head types of questions) as cited in (Hattie, 2009. p. 182). The importance of questions that will propel learning and build curiosity are highlighted in Ritchhart et.al's work (2011). A balance of the types of questions and the use of questions that will foster inquiry and critical thinking are encouraged in the implementation of Powerful Learning.

Overview / Implementation

Key Ideas	• Teachers plan the questions they ask to help students focus on the most important concepts and the criteria for success. • Teachers use powerful questions…ones that give you lots of information, are specific to the person or situation, are open-ended and usually not easy to answer • Teachers use provocative questions to prompt student reflection on their understanding. • Teachers ask questions that encourage students to reflect upon peers' ideas and to respond to them. • Teachers use appropriate wait time before getting student responses • Teachers use a variety of ways to gather student responses (e.g., pulling names from a jar, students write down their responses, etc.)

Levels of Questions	**Address all three levels of questions:** 1) Gather - collecting information, fact finding, recall 2) Process - comparing, analyzing 3) Apply - evaluate, judge, application **Constructive Questioning**: (Ritchhart, Church & Morrison, 2011) • defined as questions that help to advance understanding. "These are questions that ask students to connect ideas, to make interpretations, to focus on big ideas and central concepts, to extend ideas and so on" (Ritchhart et.al, 2011, p. 33). • questions are asked to guide, direct and push forward student's understanding of important ideas **What are good questions?** • help students make sense of concepts and deepen understanding • open-ended • empower students to unravel misconceptions • require students to make connections and generalizations • accessible to all students and will offer multiple entry points • leads students to "wonder" **How are good questions created?** • consider the goal of the lesson • consider misconceptions • consider the connections you want to make between the lesson goals and other concepts • consider assessment **What are teacher's responsibilities?** • model inquisitiveness allowing students to see teachers as open to new ideas, being persistent in searching for answers and demonstrating the ability to listen and collaborate. • understand the learning embedded in the question • present it clearly • set clear and reasonable expectations for the work • allow for individual approaches, methods or answers • add variety or more data to be accessible for all • use concrete materials • allow time • create a safe environment with routines and procedures in place • practice wait time • discuss answers focusing on student thinking
Making Thinking Visible:	

"Making Thinking Visible" as outlined by Ron Ritchhart, Mark Church and Karin Morrison (2011) strives to help students achieve deeper understanding through the use of thinking routines and effective questioning. To think or understand "deeply" means "there is a focus on developing understanding through more active and constructive processes" (Ritchhart et al. 2011, p. 7). When students develop a greater awareness of "how they think", they become independent learners capable of directing and managing their own thinking and learning. Ritchhart states that thinking routines act as tools for promoting thinking, as well as provide structures and patterns for thinking. GHSD teachers strive to build student understanding by making thinking visible in their classrooms. Routines for introducing learning, synthesizing and organizing ideas and digging deeper into ideas are outlined.

Overview / Implementation

Thinking Moves	Ritchhart et.al describes key thinking moves that are involved in different kinds of thinking in order to understand. These include: • observing closely and describing what is there • building explanations and interpretations • reasoning with evidence • making connections • considering different viewpoints and perspectives • wondering and asking questions • uncovering complexity and going below the surface of things
Ways to make the thinking visible	Ritchhart et al. (2011) has identified three ways to make thinking more visible. "Through questions, teachers can model their interest in the ideas being explored; help students to construct understand and facilitate the illumination of students' own thinking to themselves". (Ritchhart, Church & Morrison, 2011, p. 31)
Thinking Routines	Three clusters of thinking routines make thinking visible according to Ritchhart et al. (2011). Ritchhart defines thinking routines as any procedure, process or pattern of action this is used repeatedly to manage and facilitate the accomplishment of specific goals or task. Routines for **Introducing and Exploring Ideas** (i.e. See-Think-Wonder, Chalk Talk) Routines for **Synthesizing and Organizing Ideas** (i.e. Headlines, CSI: Color, Symbol, Image) Routines for **Digging Deeper into Ideas** (i.e. What Makes you Say That, Step Inside)

Intentional/Explicit teaching of Academic Vocabulary:

Marzano and Pickering (2005) reported that when students have general knowledge of the terms that are important to content taught in school, achievement is significantly improved. One of the most crucial advantages that teachers can provide, particularly for students who do not come from academically advantaged backgrounds, is systematic instruction in important academic terms.

Strategy	Overview / Implementation
Academic Vocabulary	Explicitly teaching academic vocabulary involves 6 basic steps. Attending to all steps ensures best results. Step 1. Introduction: Provide a description, explanation and or examples of the new term. Step 2. Restate: Students explain or describe the term in their own words. An academic notebook is suggested to keep track of the terms. Step 3. Draw & Self Assess: Students draw a picture, symbol or graphic to represent the meaning of the term. Students self-assess their level of understanding of the term. Step 4. Activities: Provide activities to engage students as they work to remember the terms. Ex: antonyms/synonyms, compare/contrast, morphology. Step 5: Talk: Discussing the terms with a peer allows for misunderstandings to present themselves and knowledge to deepen. Step 6: Games: An engaging way to learn the terms. Frequent use of the terms helps transfer the terms into long memory.

Cues and Organizers:

The use of cues and organizers provide students with a conceptual framework to hook new learning on to and they enhance student's ability to retrieve, use and organize what they already know about a topic. The use of a variety of graphic organizers throughout the learning provides opportunities for students to extend and apply knowledge. Advance organizers are stories, pictures and other introductory materials or tasks that set the stage for learning (Dean, Hubbell, Pitler & Stone, 2012). Post organizers are tasks completed at the end of learning that summarizes or captures the key ideas.

	Overview / Implementation
Graphic Organizers	Advanced and post organizers, Concept Mapping, Web, Venn Diagram, Timeline, RAN/KWL, Story Map.

Nonlinguistic Representations:

Nonlinguistic representations have been found to provide students with useful tools that merge knowledge presented in the classroom with ways of understanding and remembering knowledge (Jewitt, 2008). Nonlinguistic representation strategies are ones which help students represent understanding and elaborate on that knowledge using mental images or imagery. Nonlinguistic representations involve imagery, creating pictures and engaging in kinesthetic activity. Research has found this to be a powerful strategy because it taps into a student's natural tendency for visual image processing. This strategy helps students to construct meaning of relevant content and skills and have a better capacity to recall it later (Medina, 2008). Studies in Beesley and Apthorp's, 2010, analysis indicated that the impact of using nonlinguistic representations can multiply when teachers and students use the strategy in combinations with other strategies.

Strategy	Overview / Implementation
Physical Models	Hands on tasks to create concrete representations of knowledge.
Mental Imagery	Students are asked to create a mental picture of the information to help them make sense of what they are learning to and to help store it in long term memory. Incorporate sounds, smells, tastes and visual details as part of the overall mental picture.
Creating Pictures	Students draw or color pictures that represent knowledge. Using pictures helps students to represent their learning in personalized ways. "Draw what it means to you."
Kinesthetic Activity	Students engage in physical movement associated with specific knowledge to generate understanding of content/skills. When students move they create more neural networks in the brain and learning is enhanced. Examples: • Role Play • Acting out vocabulary words • Using your body or hand movements to illustrate concepts • Card sorts (First Steps) • Use bodies to demonstrate understanding of motions of objects (ie. planets orbiting the sun). As students make the motions and talk about what they are doing, they encode information in their memory in multiple ways and help to increase understanding.

Identify Similarities and Differences:

The set of instructional strategies that cluster around identifying similarities and differences involve students in comparisons, classifications, metaphors and analogies. These strategies help students move from existing knowledge to new knowledge, concrete to abstract and separate to connected ideas. Twelve studies were reviewed in a meta-analysis, 2010, conducted by McREL researchers. The effect size of these strategies was .66 which is equivalent to a 25 percentile point gain (Dean, Hubbell, Pitler & Stone, 2012). This indicates that students benefit from the explicit instruction in processes which use similarities and differences.

Strategy	Overview / Implementation
Comparing	Venn Diagram
Classifying	The process of organizing things into groups and labeling them according to their similarities.
Metaphors	The process of identifying a general or basic pattern in a specific topic and then finding another topic that appears to be quite different but has the same general pattern. It provides an anchor for new abstract learning through the intentional teaching of metaphors to focus on how items are similar on an abstract level.
Analogies	The process of identifying relationships between pairs of concepts and pairs of relationships. It guides us to see relationships between things that seem dissimilar on the surface. ex) A is to B as C is to D. 1. Identify how the two items in the first pair are related 2. State the relationship in a general way 3. Identify another pair of items that share a similar relationship Resource: Page 90 The Highly Engaged Classroom Resource: The Sourcebook for Teaching Science provides an online guide for how to teach science through the use of analogies. http://www.csun.edu/~vceed002/ref/analogy/analogy.htm

Generating and Testing Hypotheses:

Generating and testing hypotheses deepens student knowledge because it requires the use of critical thinking skills when analyzing and evaluating. Problem solving, experimental inquiry and investigation are incorporated to generate and test a hypothesis. Generating and testing hypotheses applies knowledge through the use of two thinking processes. One of these processes is deduction which involves using general rules to make a prediction about a future event or action. Induction is the second thinking process, which involves making inferences based upon knowledge that the student already has. This involves drawing new conclusions or identifying rules based upon observations. This strategy enhances students understanding of and ability to use knowledge by engaging them in the mental process required for making and testing hypothesis.

Strategy	Overview / Implementation
Generating and Testing Hypotheses	Hypothesizing includes predicting, inferring, deducting and theorizing. By engaging them in mental processes that involve making and testing hypotheses, students' understanding and ability to use knowledge is enhanced. This moves them beyond "right answer learning." Classroom Practices: 1. Engage students in a variety of structured tasks for generating and testing hypothesis. These tasks include: • Systems Analysis: Analyzing parts of a system and the manner in which they interact. • Problem solving: Problem solving involves overcoming constraints or limiting conditions that are in the way of achieving goals. • Experimental inquiry: The process of generating and testing explanations of observations. • Investigation: The process of identifying and resolving issues regarding past events about which there are confusions or contradictions. 2. Ask students to explain their hypotheses and their conclusions helps students deepen their understanding of the principles they are applying.

Summarizing and Note-Taking:

Summarizing and note-taking are essential elements of learning. Summarizing is the process of distilling information down into its most essential points to increase understanding, memorizing, and learning what is relevant. Note-taking is the process of capturing key ideas through writing, drawing, etc. These are essential strategies because they involve higher-order thinking skills. Note-taking strategies are not intuitive which means that students benefit from explicit instruction in note-taking, particularly those that are guided by the teacher and are structured.

Strategy	Overview / Implementation

Summarizing and Note-Taking	**SUMMARIZING STRATEGIES**
	Rule based summarizing strategy
	• take out material that is not important to understanding
	• take out words that repeat information
	• replace a list of things with one word that describes them
	• find a topic sentence or create one
	Use summary frames
	• a series of questions designed to highlight the critical elements of a specific text pattern
	• six frames
	  ○ narrative
	  ○ topic-restriction-illustration
	  ○ definition
	  ○ argumentation
	  ○ problem-solution
	  ○ conversation
	Teach student reciprocal teaching
	• for expository text
	• four roles
	  ○ summarizer
	  ○ questioner
	  ○ clarifier
	  ○ predictor
	Note-Taking:
	Give students teacher prepared notes
	• show the organizational structure, model
	Teach a variety of note-taking formats
	• webs, words, pictures, computer generated notes, outlines

	Provide opportunities for students to revise their notes and use them for review • leave spaces in notes for revisions as learning takes place • provide feedback during review to allow for growth in the skill development • narrow the margins (allows room for additions or corrections)

Metacognition:

Research shows that metacognition can be taught in order to help students improve their own learning. The awareness and understanding of one's own thought processes- Thinking About Thinking.

Strategy	Overview / Implementation
Metacognition	Fitting Metacognition into Classroom Instruction: • Explicitly teach students what metacognition means. • Share the goals of learning activities in advance, and guide students to plan strategies and monitor their progress toward achieving those goals. • Model your own use of metacognition by thinking out loud. When reading aloud, make-and correct-mistakes and show how you use context to establish the meaning of unfamiliar words. Predict what might happen in a science experiment. Talk through the steps of solving a math problem. • Add steps to encourage self-reflection, goal-setting and self-assessment into lessons and learning. [1] • Plan–Do–Review: A metacognitive approach to problem solving involves three main steps: (1) identify possible solutions and plan how to implement the most likely one, (2) implement the solution, and (3) assess its effectiveness and make adjustments if necessary. [2] [1] Lovett, M. C. (2008). Teaching metacognition [PowerPoint presentation]. Retrieved fromhttp://net.educause.edu/upload/presentations/ELI081/FS03/Metacognition-ELI.pdf [2]http://www.ascd.org/publications/educational-leadership/oct14/vol72/num02/%C2%A3The-Boss-of-My-Brain%C2%A3.aspx

Teaching Approaches:	
Strategy	**Overview / Implementation**
Direct Instruction	Direct instruction involves the following components: • teacher specifies learning outcomes • teacher knows and communicates success criteria • builds commitment and engagement in learning task (the hook) • lesson design includes-consideration of background knowledge, modeling, & check for understanding • guided practice • lesson closure • independent practice
Reciprocal Teaching	Palincsar (1986) describes the concept of reciprocal teaching: Reciprocal teaching refers to an instructional activity that takes place in the form of a dialogue between teachers and students regarding segments of text. The dialogue is structured by the use of four strategies: summarizing, question generating, clarifying, and predicting. The teacher and students take turns assuming the role of teacher in leading this dialogue. Reciprocal teaching involves the following components: • students take turns being the teacher • teacher and students take turns leading the dialogue
Problem-Solving Teaching	Problem-solving teaching involves the following components: • defining or determining the cause of the problem • identifying, prioritizing and selecting alternatives for a solution • using multiple perspectives to uncover the issue related to a particular problem • designing an intervention plan • evaluating the outcome

Student Engagement

Student engagement has long been at the core of effective schooling. The type of engagement that is being fostered in GHSD is "Intellectual Engagement". Engagement is thought of as motivation, attention, interest, effort, enthusiasm, participation and involvement. According to Marzano et. al (2011) four topics that constitute the model of attention and engagement are: emotions, interest, perceived importance and perceptions of efficacy. Student engagement involves providing students with opportunities to experience interactive learning/cooperative learning in a supportive environment. "Engagement" is understood in GHSD as a focus on framing learning using relevant and powerful questions, meaningful challenges and authentic applications that extend beyond the classroom and when possible have global connections.

Ways to engage students:

- **Posing guiding inquiry questions**- According to Jeffrey Wilhelm in his book, Engaging Readers & Writers with Inquiry, guiding questions create a clear focus that connects students to socially significant material and learning. This leads to exciting conversations that bring together the students' lives, the course content, and the world in which they live as they consolidate concepts, vocabulary strategies and ideas.
- **Attending to students' feelings**- Marzano states that if students are low on energy or feeling bored, frustrated, or rejected by the teacher or their peers, it is likely that they are not attending to classroom activities. If a teacher does not have a student's attention, there is little hope that the content being addressed will enter his or her working or permanent memory. Teachers can effectively use pacing and incorporating physical movement into lessons to help students feel energized; they can also demonstrate intensity and enthusiasm and use humor to help students feel stimulated. Establishing personal relationships and fostering positive peer relationships in a fair and supportive classroom atmosphere can also be effective.
- **Use games and inconsequential competition-** Help maintain situational interest. Games should always have an academic focus. They provide opportunities to test understanding through friendly competition. For exercises, check out: marzanoreseach.com/classroom strategies
- **Initiate friendly controversy-** Controversy can trigger and maintain situational interest, especially when opposing views are expressed. Controversy should not be avoided. Friendly controversy should leave the students with some unanswered questions so they seek more information. Class votes on issues, a debate, a town hall meeting - which has students looking at various perspectives - the legal model

and perspective analysis are opportunities to initiate friendly controversies around curriculum to create interest.

- **Present unusual information**- Creates a sense of curiosity and invites students to engage by filling in bits of information that may be missing.
- **Vary questioning-** Asking questions excites a student's working memory, thus eliciting students' attention. To avoid other students from disengaging, several techniques are considered effective: call on students randomly, paired response, wait time, response chaining, choral response and simultaneous individual responses.
- **Connecting to students' lives**- Comparison tasks where students relate new knowledge to topics of personal interest. Analogy problems are effective ways to connect to students lives.
- **Conducting purposeful research-** When students are able to use what they have learned to effect change in their communities directly, they are much more likely to feel the work is important, thus connected to engagement.
- **Thinking critically-** Cognitively complex tests that are perceived as important are engaging for students.
- **Provide choice-** Building choice into activities helps students perceive classroom activities as important. Choice can be provided through allowing students to choose tasks, choice of reporting formats, choice of learning goals and choice of behaviors.
- **Real world application-** Provides students with a sense that what they are doing in school is important. This is by providing tasks that provide a goal that extends beyond the classroom.
- **Drawing conclusions supported with evidence**
- **Involving students in planning**
- **Involving students in monitoring-** Develops self-efficacy as students chart their progress, on a specific learning goal, over time.
- **Using effective feedback**- Praising effort and aspects of a task are highly motivational and steer students toward the intended result.
- **Teaching self-efficacy-** Students should be directly involved in discussing self-efficacy and studying it first hand through correlating effort and preparation with achievement.
- **Involving students in self-reflection**
- **Involving students in peer-reflection**
- **Involving students in progress and results-** Tracking can reinforce efficacy and help students feel that they can do the required work. This requires a great deal of planning and preparation by the teacher.

Citizenship

The need to help students develop the skills for citizenship and social responsibility has become increasingly evident in our classrooms. "In addition to producing students who are culturally literate, intellectually reflective, and committed to lifelong learning, high quality education should teach young people to interact in socially skilled and respectful ways; to practice positive, safe and healthy behaviors; to contribute ethically and responsibly to their peer group, family, school and community: and to possess basic competencies, work habits and values as a foundation for meaningful employment and engaged citizenship (as cited in Greenberg et al, 2003). In other words, students also need to learn how to demonstrate social, emotional and behavioral regulation. Helping students gain skills in conscious regulation of their own actions, leads to increased control and problem solving abilities. The development of self-regulation provides the foundation for higher metacognitive functioning, which enables students to respond to complex challenges.

In order to foster innovative thinkers, doers and connectors, students in Golden Hills School Division (GHSD) strive to acquire the skills and attributes necessary to be successful in a globally connected world. It has become increasingly important that GHSD promote active involvement with diverse communities and real-world challenges.
With this in mind, it is clear that learning experiences need to continue to move beyond the delivery and memorization of knowledge and skills. Instead, learning experiences need to foster deeper thinking which will enable students to think about and understand related concepts, solve problems and apply learning across settings and through time. It is more important to know how to access information and be a self-motivated learner than it is to memorize content and procedures. It has also become increasingly clear that we need to teach students how to effectively collaborate with one another in order to become innovators and generators of new knowledge facilitated through the meaningful integration of technology. In order to be effective in collaboration, it begins with a foundation of social and emotional competencies. CASEL 2008 identifies five core competencies in social and emotional learning: self-awareness, self-management, social awareness, relationship skills, and responsible decision making.

- Self-awareness is defined as the ability to accurately recognize one's emotions and thoughts and their influences on behavior. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and optimism.

- Self-management is defined as the ability to regulate ones' emotions, thoughts and behaviors effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working toward achieving personal and academic goals.
- Social awareness is defined as the ability to take the perspective of and empathize with others from diverse background and cultures, to understand social and ethical norms for behavior, and to recognize family, school and community resources and supports.
- Relationship skills are the ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively and seeking and offering help when needed.
- Responsible decision-making is defined as the ability to make responsible and constructive choices about personal behavior and social interaction based on consideration of ethical standards, safely concerns, social norms, the realistic evaluation of the consequences of various actions and the well-being of self and others.

Through an increased focus on citizenship and global connectedness we recognize that, as Daniel Pink indicates, students will "...need to be able to design innovations, communicate through compelling stories, develop rapport with others and synthesize seemingly disconnected pieces of information in new way" (as cited by Dean, Hubbell, Pitler, & Stone, 2012).

Our learning experiences in our classrooms in GHSD need to foster creative, critical and reflective thinking rooted in strong social-emotional learning for today and for tomorrow.

Implications: Need for Explicit Instruction

Skills of Self-Regulation

Self-regulation is the ability for a student to adjust their level of alertness and how they display their emotions through their behavior to attain goals in socially adaptive ways (Bronson, 2001). The need for the intentional integration of instruction in self-regulation has become evident.

Skills of Collaboration
Effective communication includes teaming, collaboration and interpersonal skills, personal, social and civic responsibility, and interactive communication. We naturally assume that students know these skills. **Collaborative skills include listening, reasoning together and building upon each other's ideas.**

Perspective Taking Skills & Ways to Handle Conflict
Students benefit from learning to show empathy. Roots of Empathy can be used to teach communication and specific skills for perspective taking and handling conflict.

Problem Solving Strategies
Problem solving strategies such as anti-bullying, online behaviors and digital citizenship where clear policies have been designed are important for students to be socially responsible.

Develop Cultural Understanding and Global Awareness
Develop cultural understanding and global awareness by engaging with learners from other cultures. Help students show understanding of human, cultural, and societal issues related to technology and practice legal and ethical behavior through digital citizenship.

Constructive Controversies
Incorporate constructive controversies into instruction which can result in students inventing more creative solutions to problems, becoming more original in their thinking, generating and utilizing more ideas and analyzing problems at a deeper level.

Summary: Due to the vast and rapidly growing amount of information and knowledge in our world, it is important that learning tasks move to higher levels of abstraction such as concepts and principles, and that learning tasks organize that knowledge and help students to see patterns and connections between factual knowledge and transferable constructs (Pickering, 2010). Technological advances, globalization and the increased complexity of our world necessitates that GHSD teachers shift traditional instruction and design learning experiences to meet the needs of our digitally competent students in order to prepare them for a rapidly changing world.

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APPENDIX A

Literacy Framework