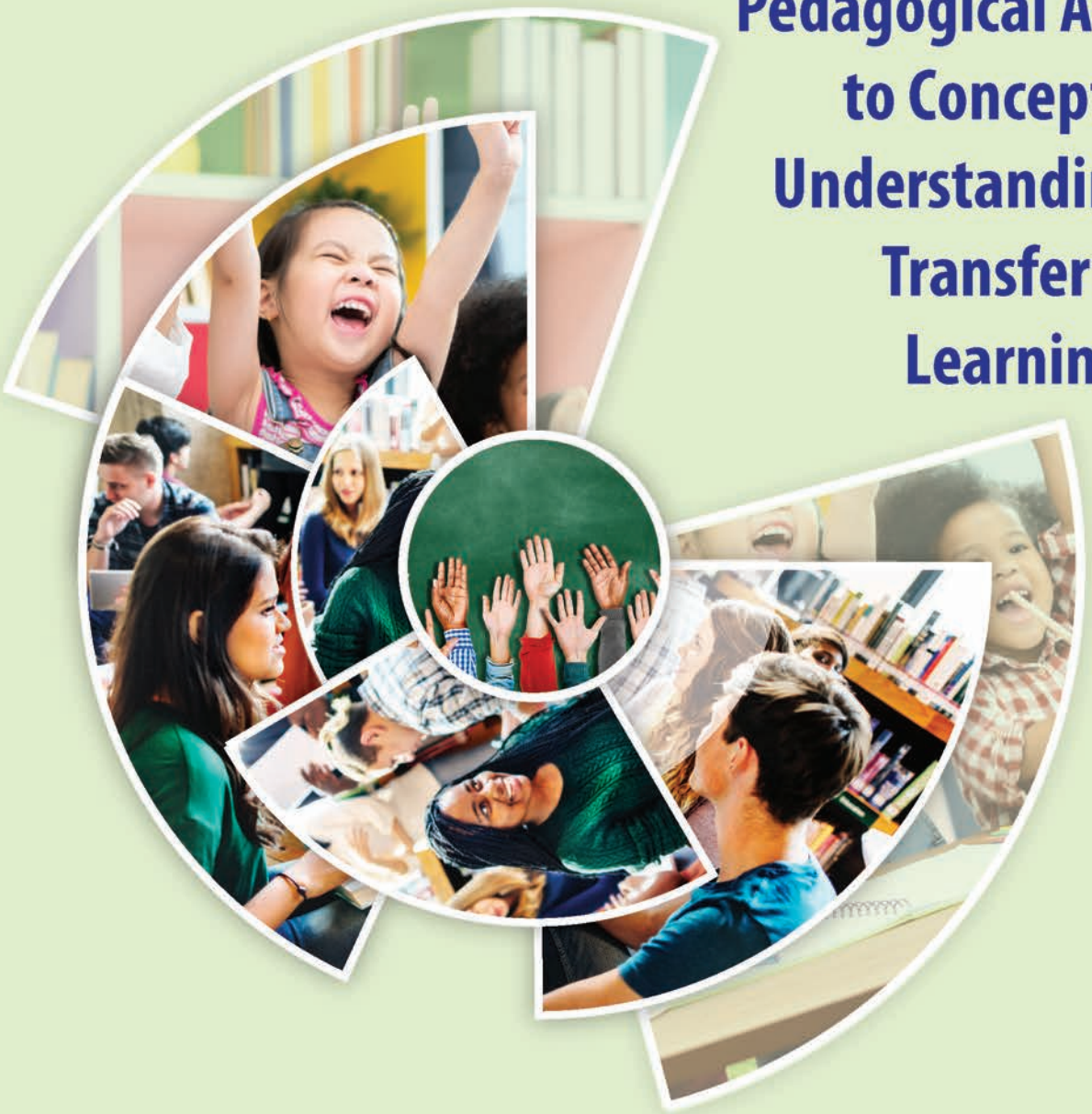
Alberta Regional Consortia

The ARPDC Pedagogical Approach to Conceptual Understanding and Transfer of Learning



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Purpose/Background

The pedagogical practices of teaching for conceptual understanding and transfer of learning are applicable to be used with any curriculum document or approach. Educators can develop concepts and build conceptual learning experiences from a Knowledge and Skills paradigm to a conceptually based paradigm of Know/Understand/Do (KUD) to explore deep learning and learning transfer.

In addition to this Literature Review on a *Pedagogical Approach for Teaching for Conceptual Understanding and Transfer of Learning,* ARPDC has included an annotated bibliography.

Though this review does not claim to be a complete, comprehensive or exhaustive collection of texts in the realm of conceptual understanding and transfer of learning, it summarizes a broad range of findings, knowledge and expertise on the topic.

Synthesis

The science behind cognitive processes is the foundation of teaching and learning. In order to foster cognitive processes, we need to ensure that we are creating opportunities, developing a growth mindset and ensuring that learning is both inclusive and accessible for all learners.

We can honour the ideas of growth mindset and inclusivity, along with consideration for differentiation, when we intentionally plan for conceptual understanding. Attributes of a pedagogical approach to conceptual understanding and transfer of learning include conscious and intentional planning for a culture of deep learning, while also addressing learning outcomes, quality assessment and instructional design.

The shift from teaching and learning topically to teaching and learning conceptually promotes the achievement of the Alberta ***Teaching Quality Standard*** including:

1. **Fostering Effective Relationships** "A teacher builds positive and productive relationships with students, parents/guardians, peers and others in the school and local community to support student learning."
2. **Engaging in Career-Long Learning** "A teacher engages in career-long professional learning and ongoing critical reflection to improve teaching and learning."
3. **Demonstrating a Professional Body of Knowledge** "A teacher applies a current and comprehensive repertoire of effective planning, instruction, and assessment practices to meet the learning needs of every student."
4. **Establishing Inclusive Learning Environments** "A teacher establishes, promotes and sustains inclusive learning environments where diversity is embraced and every student is welcomed, cared for, respected and safe."

Like the ***Teaching Quality Standard***, building teacher capacity toward a conceptual understanding of deeper learning will provide clarity by supporting teachers in leading students toward academic success and achievement.

This thematic review has been organized through four key focus areas that guide the development of the *ARPDC Pedagogical Approach to Conceptual Understanding and Transfer of Learning:*

- Planning for a Culture of Deep Learning
- Planning to Address Learning Outcomes
- Planning Quality Assessment
- Planning Instructional Designs

These focus areas are interwoven and cannot necessarily be treated as isolated components. The goal of conceptual understanding is to capitalize and leverage the connection of all focus areas to create optimal learning experiences.

Planning for a Culture of Deep Learning

> *A learner-centred culture fosters the development of student competencies, student engagement and motivation that is "...culturally responsive, appropriate, compatible and relevant" (Bransford, Brown & Cocking, 2000) to the students.*

Intentionally planning a deep learning culture can help students develop conceptual understanding. To this end, this literature review uncovered three main areas of focus:

Value student thinking – revealing prior knowledge, making connections, problem-solving, student engagement and motivation, competency in thinking to develop and deepen understanding. As noted in Bransford above, the concept of context adds to the ability of the student (learner) to immediately begin to make more sense of the topic they are addressing that day.

Learning for understanding and transfer – uncovering conceptual understanding and transfer of understanding.

Relationships and interactions – safe space, diversity and inclusive, thinking language, growth mindset, thinking routines, time, teacher as learner.

COMPETENCIES – VALUING STUDENT THINKING

Today's learner acquires (processes) and interacts with information as never before. The beginning of formal education was based on the need to give students the information that was deemed essential for them to know, for whatever purpose. Memorization and rote learning increased factual and skill fluency which enabled the learner to be successful in the workplace.

In today's world, students must use facts and skills to support critical and creative thinking and to solve complex problems. Alberta's *Student Competencies* include these life-long skill sets (problem-solving, critical thinking, creative thinking) as well as other attitudes, skills and knowledge students need to develop and apply for successful learning, living and working (Alberta Education, 2016). When teachers plan, they need to ensure that they provide context to enhance or ensure student understanding of the competencies being addressed. In doing this prior planning, they prepare the "ground" for students to both learn and to utilize the ideas/competencies as context for further learning. Ron Ritchhart agrees that the goal for education in the 21st century is cultivating these lifelong skill sets (Ritchhart, 2015, p. 19). He notes:

> *What we see as most important to develop is not a discrete collection of knowledge but rather a set of broad characteristics that motivate learning and lead to the generation of usable knowledge. Some might say this is the profile of a twenty-first-century learner... This is what we must be teaching for and trying to achieve for every student.*

To promote these life-long skills, effective teachers provide "students with an intellectual life into which they might grow... where thinking is valued, visible and actively promoted as part of the ongoing, day-to-day experience" (Ritchhart, 2015, p. 34). In doing so, they provide students with the ability to learn-"unlearn"-relearn ad infinitum as needed throughout their lives.

OPPORTUNITIES – LEARNING FOR UNDERSTANDING AND TRANSFER/RELATIONSHIPS AND UNDERSTANDING

With the assumption that a welcoming, inclusive and encouraging learning environment exists, there is copious amounts of research that supports the idea that students who are able to understand the relevance of the learning and connect to it in a personal way are more engaged and motivated to learn (Ritchhart, 2015, Bransford, et al., 2000, Stern, et al., 2018, Wiggins & McTighe, 2005, Mehta & Fine, 2019, Wathall, 2016, etc.).

In their new book *Search for Deeper Learning*, Jal Mehta and Sarah Fine's research findings demonstrate that "powerful learning is fundamentally about **connections** between humans as well as the subjects and their applications to the world beyond school" (Mehta & Fine, 2019, p. 377). The *Teacher Clarity Playbook* (Fisher, Frey, Amador & Assof, 2019) provides two questions surrounding the information/concepts students need to learn and verbs that teachers can use in their planning to assist in this learning. These two questions are:

1. What other knowledge and skills would students need in order to develop such an argument?
2. How might a student demonstrate this skill? (*Teacher Clarity Playbook*, p. 3)

These questions refer to, and require, that prior knowledge and prior skills are vital for the teacher to "mine" in order to build new knowledge; and that the learning plan needs to include what is being taught and how it is going to be assessed. It is through this planning and understanding of student learning needs that the teacher provides opportunities for all students to learn. If the student feels that the teacher is there to help them and they have a clear understanding of what they are supposed to be learning, they are three times more likely to learn it (Hattie, 2012). It is just as likely that they are feeling both encouraged and motivated to be in the class.

Jennifer Wathall, the author of *Concept-Based Mathematics*, dedicates a chapter to student motivation and engagement (Wathall, 2016, p.131).

> *At school, providing opportunities for students to communicate and construct learning through engaging collaborative tasks not only increases student motivation but also improves conceptual understanding. The collaborative process engages our individual and group intellect, leads to deeper understanding, and offers new insights and creative solutions.*

As engaged students are seen as being more conducive to learning, they are also more likely to take their learning and apply their skills and knowledge in new ways to solve problems and resolve situations.

THE (LEARNING) ENVIRONMENT AND INTELLECTUAL DISCOURSE

One core learning principle suggested by the National Research Council (Bransford, Brown, & Cocking, 2000) is that "teachers must draw out and work with the pre-existing understandings that their students bring with them" (Bransford, Brown, & Cocking, 2000, p. 19). Teachers need to recognize the value of each student's complex and diverse personal experiences and understandings in order to allow for the cognitive process of creating long term knowledge in the brain. Again, this circles back to the idea of ensuring that the students are able to make contextual

sense of the work they are engaged in as a pedagogical approach to helping them learn in a way that they can then use this information with clarity. It is important to note or emphasize that, no matter the curriculum direction teachers are required to follow, the ability to engage the learner and make the learning relevant to them adds to the likely transfer of that learning and their ability to further apply that learning in relevant ways in the future.

Fisher, Frey, et al. discuss the need to ask students to explain their learning (*The Teacher Clarity Playbook*, p.121) as this will provide insights into students' perceptions and how teachers might leverage those to enhance learning. The well-worn PLC questions have been asked in numerous ways over the years and continue to provide constructive ways to measure success. In this case, these are:

1. Ask students what they are learning and why they are learning it, or What do we expect our students to learn?
2. How will we know when they have learned it? What were your pre-assessment and post-assessment processes connected to the learning goal?
3. Share results with students. How will we respond when some students do not learn? How will we respond when some students already know it?

Ritchhart's (2015) research suggests that learning environments where students can safely and freely expose their prior understandings require the creation of classroom conditions that empower **thinking** as the primary action in learning. Effective learning environments foster a culture where thinking is valued and it is known that learning is a consequence of thinking. Everyone has a role in supporting the learning that happens in the classroom.

In *Creating cultures of thinking: The eight forces we must truly master to transform our schools*, Ritchhart identifies eight "cultural forces" that provide a structure to support educators in the intentional design of their classroom culture to ensure that thinking about the information they encounter permeates the student experience.

These forces are derived from Ritchhart's active research in classrooms. Ritchhart outlines leverage points in an educational setting that teachers can reflect on and act within to affect a greater emphasis on making thinking a highly valued component of learning.

Source - Worldwide Cultures of Thinking Project, 2015
Ron Ritchhart, Project Zero at Harvard University.

These eight cultural forces are:

1. Time – Investing in time to make time, recognizing time as a statement of your values
2. Opportunities – Crafting vehicles for deep thinking and learning
3. Structures and Routines – Supporting and scaffolding learning and thinking
4. Language – Purposeful choice of "Language Moves" that promote thinking
5. Modelling – Seeing ourselves through our students' eyes
6. Interactions and Relationships – Forging relationships that empower learners
7. Physical Environment – Using space to support learning and thinking
8. Expectations – High expectations **for all** learners and learning

Ritchhart acknowledges that group culture is constantly evolving. When teachers engage each force to its best effect, they are on the road to unlocking student learning potential.

Alberta's ***Education Act*** (2019) calls upon teachers to maintain "welcoming, caring, respectful and safe learning environments that respect diversity and nurture a sense of belonging and a positive sense of self" (p. 10). This is achieved in classrooms through inclusive practices that are outlined in the ***Teaching Quality Standard***. Opportunities for inclusive classroom practices abound in a conceptual approach – highlights from this review include natural opportunities for multiple entry points in the design of learning, the ability to create learning opportunities that capitalize on the interests of students as a lens through which to explore concepts, and support of students by viewing conceptual teaching as an iterative approach that values personal growth.

KEY FINDINGS

The key to creating a culture of deep learning revolves around ensuring that students are able to transfer their learning outside of their classroom. Their ability to apply their learning from one situation to another in a reflective manner is essential. By highlighting what we're doing in class and what its purpose is, we address:

1. "What do we expect students to learn?"
2. "How will we know when they have learned it?"
3. "How will we respond when some students do not learn?"
4. "How will we respond when some students already know it?" (DuFour, DuFour, Eaker & Many, 2010)

In essence, we look at how we can ensure that students are knowing, understanding, and doing (KUD) – in other words, what we intend them to do in order to enhance student learning. Along with this goes the understanding of the importance that there is a "gradual release of responsibility" in how the teacher plans for student learning. A gradual release of responsibility ensures that transfer occurs. Critical thinking as well as skill development are further elements necessary to ensure that a transfer of learning occurs. The reflection that results from critical thinking also helps to ensure that students are more engaged in actively learning a topic.

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Planning to Address Learning Outcomes

A pedagogical approach that addresses conceptual understandings and transfer of learning ensures an iterative learning process across all grade levels and subject areas. Curriculum forms the basis for teaching and learning in the province. The ways in which curriculum is implemented and how teaching approaches are planned – including the use of research-based strategies – is the pedagogical approach. Conceptual understanding and transfer of learning can be applied to any curriculum.

Regardless of curriculum or program of studies documents, the ways in which learning outcomes are unpacked and taught at each grade level are guided by the conceptual and procedural knowledge in the curriculum. Starting with the curricular expectations, teachers make pedagogical decisions and design approaches as they strive to transfer that curricular understanding into something their students can use, manipulate and discuss. Through these processes, teachers strive to create a stronger tie or connected learning experiences in the classroom, particularly as they continually clarify year-long, unit and lesson learning objectives.

Consider Fisher and Frey's (2019) language of learning progressions and learning intentions in their work, *The Teacher Clarity Playbook*, as an example of focused planning that supports clarity and conceptual understanding over time. They note that "a sequence of learning progressions frames the planning needed for students to reliably learn" (p. 10). This progression is implemented through "unpacking" or "unwrapping" the expected standards that will set up learning to allow for student mastery.

KEY FINDINGS

Grant Wiggins' work on *Understanding by Design* still stands true. Regardless of curriculum structures, it is essential that the teacher remembers that true understanding is revealed when learners can autonomously make sense of and transfer their learning through authentic performances. Wiggins notes that the six facets of understanding – the capacity to explain, interpret, apply, shift perspective, empathize and self-assess – serve as indicators of understanding.

Planning is a process that includes the creation of meaningful and contextually relevant experiences that assist the teacher in guiding student learning. Teachers should consistently assess where students' learning lies on this journey and provide modifications as needed so students can "get it" and are able to move on. The development of plans that run the gamut from year-long plans to lesson plans can help provide for those meaningful progressions. As Fisher and Frey note, " [l]earning progressions articulate a pathway to proficiency" (p. 10). They refer to the planning as poles in a tent or stones on a pathway – essential structures to get to the final product.

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Planning Quality Assessment

Popham (2008) suggests that assessment is best viewed as a process – a systematic series of actions directed toward a specific end, specifically the "enhancement of student learning" (p. 13). Teachers who mindfully plan for quality formative and summative evaluation throughout the learning process set the stage for successful learning experiences throughout the lesson, unit and year. Quality instruction is tied into meaningful, quality assessment and guidance for further learning.

Part of the challenge that comes with the assessment portion of our planning is to understand its intent. Rather than explore the philosophical debates related to assessment, this review focuses on how some educators use assessment in their practice as it relates to teaching for conceptual understanding and learning transfer.

Brookhart (2010) maintains that "most students actually like to think... well-designed assessments bring thinking "out of the kids' heads" and make it visible in students' words, writing and products. Work that makes cognitive complexity, reasoning, judgement, problem solving and creativity visible allows both teachers and students to describe and appraise students' thinking and to think together. When teachers use powerful instruction that is carefully planned to scaffold student thinking, they create classrooms that support the natural learning process. For students to be able to engage in deep critical inquiry, they require the requisite background knowledge and conceptual understandings that allow them to reach thoughtful and reasoned judgements.

Assessment designed to enhance learning and engage the learner in wanting to learn more is a vital prerequisite that must be built into the teacher planning process. This means getting past assessment as simply a marking post that indicates some measurement of past learning. When assessment moves beyond the retrieval of information, then students have to understand and process information in a different way. In their *Powerful Instruction and Powerful Assessment: The Double-Helix of Learning*, Garfield Gini-Newman and Laura Gini-Newman note that if students are encouraged to develop automaticity in subjects such as math, music and languages, they are able to recognize and use patterns, historical insights and scientific knowledge to make connections beyond the specifics of the topics they explore (Gini-Newman and Gini-Newman, 2020).

Planning, instruction and assessment also needs to reach all learners. Shelley Moore notes in her blog, "What if we totally changed how we plan, teach and assess? What if we started to look at our classes and students as different communities, different communities that we also teach differently…even if they are taking the same course. Offering students varying amounts of support…not because of their special needs category or label, but just because they need it" (November 2013).

Part of instruction and assessment considers the students... who gets it and who does not get it plus what do I need to do to ensure that the ones who do not get it are provided ways to ensure they do get it. In essence, teaching is both complex and simple. Simple in the way that, in the classroom, we see that the teacher uses curriculum while also addressing the needs of their students. Each group of students consists of different students than the class before or the year before. As noted many times by multiple authors referenced in this review, how are you planning for student learning using their prior learning as context? How are you consistently assessing for

understanding and undertaking course corrections to ensure all students are learning. When you determine a need or needs, how have you planned to modify what these needs are? Essentially, what are you, as their teacher, going to do in order to address those new needs? There is no one else to do this for students; therefore it is less a question and more, how are you, the classroom teacher addressing the needs that assessment uncovers?

The Alberta ***Teaching Quality Standard*** compels teachers to apply student assessment and evaluation practices that include generating evidence of student learning to inform teaching practice through a series of balanced assessment experiences. Support for Alberta teachers' assessment practice is available through the Alberta Assessment Consortium (AAC), which works towards enhancing the capacity of teachers and leaders in the area of assessment as well as through the development of a broad range of classroom assessment materials, directly aligned to Alberta curriculum. As we understand learning in this way to be iterative (rather than linear), current assessment and reporting practices may need to evolve. Control over standardized provincial assessment is limited, but if teachers intentionally plan for assessments to promote students' understanding of outcomes at a conceptual level, the transfer to standardized tests could be just another "way" to show what they know.

KEY FINDINGS

Assessment is a critical and vital piece **for/of** learning and the key to the **transfer** of learning. It is through assessment that we see evidence of the transfer of learning and how students are "forced" to make that transfer. This type of assessment must be part of the planning process. Such planning should focus on what students need to learn and why it is important; it can be realized through approaches such as a backwards design model, which plans assessment first and includes formative assessment as part of the process of learning.

Wiggins (2010) notes that it is important to establish and keep highlighting transfer goals. This explicitly and regularly alerts learners to the goal of both the learning and the goal of transfer. Wiggins realizes that many students actually do not realize that this is the goal of learning in school. Many believe that school is structured to capture their ability to recall and plug in the correct answers on tests. By making it clear that the real goal is transfer, there is a role for critical thinking in learning that goes beyond memorization. Wiggins also reinforces the need to ensure that teachers repeat the transfer performance they expect to see at the end of a term, unit, lesson.

Explicit expectations should be established, such as "by the end of the term, you will be able to do "x" on your own and also be able to discuss similar situations using the concepts you have learned. In this way, it is clear to the learner that it is not just mimicry of the material that is measured or is valued in the class.

Along the way, we deliberately plan to ensure that we remember to make space for those learners who, initially do not "get it" the way it was first taught. How do we adjust to meet these student's needs?

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Planning for Instruction (Instructional Design)

The teacher, the student and the curriculum converge in the classroom. As such, teachers need to ensure that their lessons reflect that reality. What worked last year or with the last class may not work with some of the new students in a classroom. The teacher has to be cognizant of each year's students and make pedagogical decisions through intentional planning that serves to assist the learning of their current students.

It is important to realize that the selection of quality instructional strategies and planning for direct instruction remain a critical part of the teaching/learning process. "It takes the skilled use of instructional strategies used by teachers for students to develop a deep and transferable conceptual understanding as well as develop the capacity to think conceptually" (Garfield, 2019).

Teaching for conceptual understanding promotes an iterative approach to teaching and learning. There is value for teachers in the **process** of planning, not simply the product of the planning. Supporting teachers as learners and guiding teachers through the process of planning instruction deepens pedagogical understanding. Just as teachers ask students provoking questions to support the learning process, so too must teachers be guided and questioned during their learning process as they shift to teaching for conceptual understanding and transfer.

Scaffolding learning through both planning and instruction (gradual release of responsibility moving from I do, you do to you do, I observe, etc.) ensures that the transfer of learning occurs. That transfer is "affected by the degree to which people learn related information more quickly" (Bransford, J. et al 2001), as each student processes and applies that learning differently from one situation to another.

The Alberta ***Teaching Quality Standard*** requires that teachers plan and design learning activities that not only address the learning outcomes outlined in programs of study, but also incorporate a range of instructional strategies while considering variables for student differentiation. Almarode and Miller (2013) combine brain research with practical strategies for lesson planning and instruction for optimal student cognitive engagement. The strategies are framed in the context of science and math lessons, but can be transferred and used in other subject areas as well. For example, vocabulary activities and games to make students comfortable with relevant vocabulary (2013, p. 32) can apply across multiple subject areas. Other activities promoted for brain engagement include concept mapping (pp. 49-51) and encouraging student talk (pp. 52-53). Teaching strategies involved in planning for conceptual understanding include creating novelty (pp. 67-94), establishing relevance (pp. 95-123) and maintaining an optimal learning pace (pp. 124-152). When these planning and learning strategies are incorporated into a conceptual learning approach, teachers will promote lasting memory for their students and "ultimately increase the level of student achievement" (p. 181).

KEY FINDINGS

Planning involves more than just scripting how a school year will go. True planning takes the confluence of the three most important factors for effective teaching and learning into account. These three factors are the teacher, the student and the curriculum. It is impossible to script a school year before knowing the students. Coming up with a plan to engage this year's students; crafting an assessment plan for this year's students; along with determining how the needs of current students and expected curricular outcomes can best be met are key.

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Gini-Newman, G. & Case, R. (2015). Creating thinking classrooms: Leading educational change for a 21st century world. Vancouver, BC: Critical Thinking Consortium.

Gini-Newman, G. & Gini-Newman, L. (n.d.). Powerful Instruction and Powerful Assessment: The Double-Helix of Learning. Retrieved electronically August 24, 2020 from https://researcharchive.canadianschoollibraries.ca/wp-content/uploads/2020/08/TMC6_2020_Gini-NewmanGini-Newman.pdf.

Marschall, C. & French, R. (2018). Concept-based inquiry in action: Strategies to promote transferable understanding. Thousand Oaks, CA: Corwin Press. (Chapter 4 "Engage" connected to Metacognition)

Moore, S. (2016). One without the other: Stories of unity through diversity and inclusion. Winnipeg, MB: Portage & Main Press.

Stern, J., Lauriault, N., & Ferraro, K. (2018). Tools for teaching conceptual understanding: Harnessing natural curiosity for learning that transfers elementary. Thousand Oaks, CA: Corwin Press.

Recommendations

In supporting and building capacity toward a pedagogical approach for teaching for conceptual understanding and transfer of learning, ARPDC recommends the following as part of your professional learning:

- **Promote a Growth Mindset and the Learning Process**

  Be transparent when communicating that *Teaching for Conceptual Understanding and Transfer of Learning* is a process and may not have linear or straightforward progress. With Ritchhart's identified eight cultural forces in mind, supporting teachers as learners and guiding teachers through the process of planning instruction deepens pedagogical understanding.

  Consider using a conceptual approach for in-servicing and training teachers, modelling the process and emphasizing the value in experiencing the process, not just the product.

- **Establish a Clear Goal for Learning Transfer**

  > *"Students with conceptual understanding know more than isolated facts and methods. They understand why a [mathematical] idea is important and the kinds of contexts in which it is useful. They have organized their knowledge into a coherent whole, which enables them to learn new ideas by connecting those ideas to what they already know".* (Meyer)

  Ensure a clear understanding of, focus on and communication of the transfer of learning with teachers and students. Transfer of learning is the process of applying learning from one situation to another. "Transfer is affected by the degree which people learn related information more quickly" (Bransford et al, 2001).

  Ensure that you plan in a way that structures your year into topics and then lessons. Planning helps ensure transfer because the teacher looks at the standard, competencies and outcomes and then uses contextual knowledge in order to respond to those important PLC questions that are focused on student learning.

- **Plan**

  Clearly understand that, as noted by Fisher, Frey and Hattie in *Visible Learning for Literacy* (2016), learners deserve a great teacher, not by chance, but by design.

  It is through intentional planning for a culture of learning, quality assessment and quality instructional practices that opportunities are created for transfer that students can harness for greater learning opportunities. As noted by Fisher & Frey et al in *The Teacher Clarity Playbook,* and echoed and supported by numerous educational theorists, planning builds clarity – clarity of communication, clarity of intention, clarity of direction, clarity of instructional goals and even clarity of the planned instruction planned. Planning also structures expectations of the student, expectations of the curricular topic and/or outcomes and expectations of the teacher.

Hattie (2009) notes that teacher expectations have a relatively powerful influence on student achievement (p. 43) – we often get what we expect. Low expectations on the school's or teacher's part will likely lead to poor results. Planning appropriate learning opportunities and experiences and then selecting assessments that reflect the expectations of the planning will increase students' understanding of what they are expected to learn and how it will be assessed.

- **Establish a clear understanding of 'concept'**

  Understand, develop and use "concepts" as a foundation in the journey to conceptual understanding for transfer of learning.

  Addressing concepts goes beyond facts and dates but places those pieces of information into connected parts that can be used to inform further learning. Erickson and Lanning noted in *Transitioning to Concept-Based Curriculum and Instruction* (2013) that "concepts are mental constructs that are abstract, timeless and universal" (p. 33). As a result, they transfer to multiple situations. This provides the "focus and depth" to a student's study "and allows for synergistic thinking." Erickson, Lanning & French's *Concept-Based Curriculum and Instruction for the Thinking Classroom* (2017, 2nd ed.) explores the ideas of macro (big picture) and micro concepts, which further build upon the non-linear aspect of conceptual thinking.

- **Promote alignment to the Alberta Teaching Quality Standard**

  Align teaching for conceptual understanding and transfer of learning with the Alberta ***Teaching Quality Standard***:

  TQS #2. *A teacher engages in career-long professional learning and ongoing critical reflection to improve teaching and learning.*

  TQS #3. *A teacher applies a current and comprehensive repertoire of effective planning, instruction, and assessment practices to meet the learning needs of every student.*

  (a) planning and designing learning activities that

  - foster student understanding of the link between the activity and the intended learning outcomes;

  -incorporate digital technology and resources, as appropriate, to build student capacity for:

  - *acquiring, applying and creating new knowledge*
  - *communicating and collaborating with others*
  - *critical-thinking*
  - *accessing, interpreting and evaluating information from diverse sources*

Conclusion

Building capacity toward a pedagogical approach for teaching for conceptual understanding and transfer of learning meets the Alberta *Teaching Quality Standards* and promotes high quality instruction and learning for current Alberta curriculum as well as any new curriculum that may be developed in the future across grade levels and subject levels.

> *Learning is most successful when teachers see learning through the eyes of their students and students see themselves as their own teachers: This is Visible Learning. (Hattie 2009, 2012)*

Appendix: Annotated Bibliography

Books

Almarode, John T. & Miller, Ann M. (2013). Captivate, activate, and invigorate the student brain in science and math, grade 6-12. Thousand Oaks, CA: Corwin Press.

Almarode and Miller combine recent brain research with practical strategies for lesson planning and instruction for optimal student engagement. The examples focus on Science and Math but most of the practices will easily transfer to other subjects. Each chapter begins with information about the brain, then provides relevant strategies for engaging student brains. The strategies include vocabulary activities, concept mapping, encouraging student talk, creating novelty, establishing relevance, maintaining the optimal learning pace and promoting lasting memory. Each chapter ends with "Engaging Professional Development Tasks" that model the type of tasks that we can use with students. The primary purpose of this book is to help teachers "create an engaging climate by inviting students to think, and then follow up by giving them the opportunity to show and tell what they thought about" (p. 31).

Almarode, John T. & Miller, Ann M. (2018). From snorkelers to scuba divers in the elementary science classroom: Strategies and lessons that move students toward deeper learning. Thousand Oaks, CA: Corwin Press.

From Snorkelers to Scuba Divers in the Elementary Science Classroom is written to encourage teachers to spend more time thinking about and planning the 'cognitive moment' versus the lesson plan. Almarode and Miller use the metaphor of snorkeling (surface level learning) and scuba diving (deep conceptual learning) to help the reader relate to a suggested instructional framework that is intended to "*promote higher-order thinking and deep conceptual understanding* in the K-5 science classroom" (Introduction). It is critical to emphasize that there is value in surface knowledge with advancing learning or going deeper requires that first level of knowledge. Consider one first swimming on the surface in the ocean, one sees, smells, tastes, and feels a number of different elements learning through the experience. The addition of a mask and snorkel expands the learning experience, subsequent additions of fins and then full scuba equipment takes the learning opportunity much deeper.

Bransford, John, Brown, Ann L., & Cocking, Rodney R. (2000). How people learn: Brain, mind, experience and school. Washington, DC: National Academy Press.

This book is a synthesis of research about the mind, the brain, and the process of learning. Over the last two decades the information from many disciplines of science has exploded, uncovering new understandings about what it means to 'know something'. It includes information on neural processes and implications for teachers and the students they teach including the teaching of metacognitive skills should be integrated into the curriculum in a variety of subject areas.

The work emphasizes 'hallmarks' of new science of learning (pp. 8-13):

- Learning with Understanding (vs. memorizing)
- Pre-Existing Knowledge
- Active Learning

As a part of the teaching and learning process, teachers must draw out and work with the pre-existing understandings that their students bring with them and teach some subject matter in depth, while providing many examples in which the same concept is at work, thus providing a firm foundation of factual knowledge (pp. 19-21).

Brookhart, Susan M. (2010). How to assess higher-order thinking skills in your classroom. Alexandria, VA: Association for Supervision and Curriculum Development.

Brookhart begins by laying out principles for assessment in general and for assessment of higher-order thinking in particular. She then defines and describes aspects of higher-order thinking according to the categories established in leading taxonomies. She describes these higher order thinking categories – with accompanying examples of each for clarity – as:

> *(1) those that define higher-order thinking in terms of transfer, (2) those that define it in terms of critical thinking, and (3) those that define it in terms of problem solving. (Introduction, p. 3)*

This work connects to conceptual understanding by focusing on the value of students providing opportunities for students to develop the competencies of problem-solving, critical thinking and creative and innovative thinking. She notes these as vital in order for the student to become a thinking adult:

> *The goal of teaching here is seen as equipping students to be able to reason, reflect, and make sound decisions. Higher-order thinking means students can do this. One of the characteristics of "educated" people is that they reason, reflect, and make sound decisions on their own without prompting from teachers or assignments." (Introduction, p. 8)*

Brookhart shares examples of:

- Instructional strategies that are student-centred and require real-world application of their understanding
- The assessment practices that support the complexity of thinking that conceptual understanding requires

These are based upon the foundations of the cognitive taxonomy of Bloom and she provides examples and structure for addressing each:

> *1. Knowledge involves the recall of facts and concepts.*
>
> *2. Comprehension involves basic understanding. The classic assessment to see whether students comprehend a concept or story is to ask them to restate it in their own words.*
>
> *3. Application involves using facts and concepts to solve new or novel problems, but they can be problems that are similar to ones students have solved before. Application-level problems usually have one correct answer.*

4. Analysis involves breaking down information into its parts and then reasoning with that information. There are often many different acceptable responses to analysis-level tasks.

5. Synthesis involves putting parts together to form a new whole. Synthesis Level tasks require arranging ideas in a new or original way.

6. Evaluation involves judging the value of materials and methods for various purposes. Evaluation-level activities usually ask students to make a claim about the worth of something and explain their reasons. (p. 40)

Davies, A. & Busick, K. (2007). Classroom Assessment: What's Working in High Schools? Book Two. Courtenay, BC: Connections Publishing.

This book, second in the series focused on high school classroom assessment questions examines the work of a number of practicing classroom teachers/former classroom teachers who now work in curriculum leadership positions, etc. Each of the teachers are divided into two thematic areas, *Involving students in providing proof of learning* and *Reconsidering marking, grading and reporting* and each provides practical ideas that are easily adapted for use in our classrooms.

From Student led portfolio conferences in a rural high school through accountability for learning by being systems oriented, standards based and skilled at using effective assessment for learning approaches, the first section shows a number of practical uses to maximize student understanding of the learning that is expected of them in the class. Four of the five authors focus specifically on portfolio use in order to build shared communities of learning through general effective portfolio usage to more focused work on math portfolios specifically. The second theme uses four teacher perspectives on assessment including focus on formative assessment, reflective assessment,summative assessment and when to use which approach along with a chapter on assessment in an IB setting. The last mentioned chapter provides insight into the theory of knowledge and biology and how assessment can work to enhance the student learning experience.

Elder, Linda & Paul, Richard (2012). The thinker's guide to analytic thinking: How to take thinking apart and what to look for when you do. Thinker's Guide Library available through electronic license.

Thinking in and of itself is not enough to bring clarity. "Everyone thinks; it is our nature to do so. But much of our thinking, left to itself, is biased, distorted, partial, uninformed, or downright prejudiced" (Elder, 2012). Learning to analyze our thinking requires the learner to connect the structures of our thoughts with specific questions for reflection. When the example that a thought is based on assumptions is considered, analyzing our thinking requires us to ask the question, "What assumptions am I using in my reasoning?" As we increase understanding of how our thoughts are structured, we learn to ask ourselves and others the questions implied or related to these structures. The process leads to subsequently deeper analytical thinking and, by extension, deeper understanding of the related concepts under examination. The authors explore 35 dimensions of critical thinking and provide several steps to guide the learning/thinking process.

As a learner – and we are all engaged or should be engaged in learning – we prefer the facts as we know them and that support our understanding or conclusions that align with the understanding with which we are most comfortable. The analytical thinker, the critical thinker "requires intellectual integrity," which though uncomfortable at times helps clarify understanding and takes all learning deeper.

Secondary teachers would be well served in reading this book, Social Studies teachers perhaps most of all. The authors repeatedly illustrate how analytical thinking pushes and pulls the thinker to reflect on other points of view acknowledging that discomfort or intellectual dissonance this process can create, it is a difficult thing to come to understand that one's point of view requires changing with the introduction of new evidence.

Erickson, H. Lynn (2008). Stirring the Head, Heart, and Soul (3 Ed). Thousand Oaks, CA: Corwin Press.

Erickson provides a description of a curriculum design that focuses on quality instruction and includes very user-friendly structures, planning tools and classroom examples of the effective teaching strategies she advocates for in order to assist students as they analyze and synthesize facts/information to build a deep understanding of "big ideas. There is a discussion of the positives and negatives of new approaches including positives such as increased articulation amongst various curricula; however, negatives such as elimination of so called frills like art and music along with increased focus on technical skills for particular jobs bring their own concerns (p. 2).

Erickson, H. Lynn & Lanning, Lois (2014). Transitioning to concept-based curriculum and instruction: How to bring content and process together. Thousand Oaks, CA: Corwin Press.

Erickson, H. Lynn, Lanning, Lois, & French, Rachel (2017). Concept-based curriculum and instruction for the thinking classroom. Thousand Oaks, CA: Corwin Press.

Transitioning to Concept-Based Curriculum and Instruction and *Concept-Based Curriculum and Instruction for the Thinking Classroom, 2nd Ed* are both written to introduce readers to the idea of going beyond coverage and memorization in the classroom and beginning to facilitate deeper learning through concept-based instruction. The books take the reader through Erickson's *Structure of Knowledge* and Lanning's *Structure of Process* and provide an explanation of how to plan instruction that moves from 2-dimensional teaching (facts and skills) to 3-dimensional instruction (know, understand and do).

A focus on steps of planning is presented by the authors to illustrate some essentials when planning:

> *Step 1: Create a unit title. The unit title can be engaging for students but needs to clearly indicate the content focus.*
>
> *Step 2: Identify the conceptual lens. The conceptual lens is a concept that provides focus and depth to the study and ensures synergistic thinking.*

Step 3: Identify the unit strands. Strands will be subject areas for inter-disciplinary units. The strands will be major headings, which break the unit title into manageable parts for intra-disciplinary units. In a process discipline, the strands are defined: understanding, responding, critiquing, and producing. Strands are placed in a web around the unit title.

Step 4: Web out the unit's topics and concepts under the strands. After brainstorming, underline the concepts under each strand so they can be easily accessed in the next step.

Step 5: Write the generalizations you expect students to derive from the unit study. Craft one or two generalizations using the conceptual lens, and one or two generalizations for each of the strands. Sometimes a generalization will address one or more strands (especially in a process discipline). A unit of study may have 5 to 9 generalizations, depending on the grade level and length.

Step 6: Brainstorm the guiding questions. Guiding questions facilitate student thinking toward the generalizations. Guiding questions should be coded as to type (factual, conceptual, debatable). Each generalization needs a mixed set of 3 to 5 factual and conceptual questions developed during the planning process, and 2 or 3 provocative questions for the unit as a whole.

Step 7: Identify the critical content. The critical content is the factual knowledge required for grounding the generalizations, deepening knowledge of the unit topic, and defining what students may need to know about processes/skills.

Step 8: Identify the key skills. The key skills may be drawn verbatim from academic standards or national curricula. Key skills transfer across applications and are not tied to specific topics until they appear in the learning experiences.

Step 9: Write the common, culminating assessment and scoring guide/rubric. The culminating assessment reveals student understanding of an important generalization (or two), their knowledge of critical content, and key skills. Develop a scoring guide, or rubric, with specific criteria for evaluating student work on the task.

Step 10: Design suggested learning experiences. Learning experiences ensure students are prepared for the expectations of the culminating assessment and reflect what students should understand, know, and be able to do by the end of the unit. Learning experiences are meaningful and authentic. Included in this section are suggestions for pacing, other assessments, differentiation strategies, and unit resources.

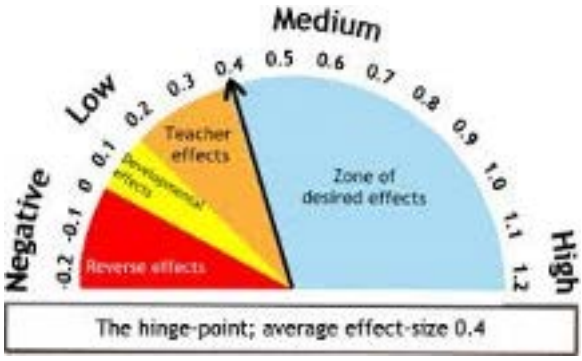
Step 11: Write the unit overview. The unit overview is written to read to the students to hook or grab their interest and attention and to introduce them to the study. (Erickson, Lanning, & French, 2017)

Fisher, Douglas; Frey, Nancy, & Hattie, John (2016). Visible Learning for Literacy – Grades K-12. Thousand Oaks, CA: Corwin Press.

The question is not whether these literacy practices have impact but, more importantly, which "literacy practices ensure students demonstrate more than a year's worth of learning for a year spent in school."

Based on 15 years of research involving millions of students, this book applies this research directly to:

- How to use the right approach at the right time to hit the surface, deep and transfer of learning
- Which routines are most effective during these specific phases of learning (Zone of Desired Effect as seen in the Barometer of Influence image)
- How the mind frames for teachers can inspire them to be change agents in students' lives



Fischer, Douglas, Frey, Nancy, Amador, Olivia, & Assof, Joseph (2019). The teacher clarity playbook: A hands-on guide to creating learning intentions & success criteria for organized, effective instruction. Thousand Oaks, CA: Corwin Press.

This book is sorted into modules that are "designed to move you systematically through a process that begins and ends with the standards, from analysis through assessment…[the intent is] to build a habit of mind of how it is that you systematically and efficiently analyze standards, build curriculum, teach, and assess" (pg. xviii).

It begins by helping teachers differentiate between concepts and skills and then guiding them through learning progressions, intentions, and success criteria. As the guide moves into making learning relevant, the authors suggest taking points for each of the learning intentions. Unfortunately, this appears to reduce the conceptual relationship that is key for learning transfer to something the teachers say or briefly discuss in a lesson, rather than what the students uncover for themselves. The overall intention of this book is solid as it guides teachers in thinking deeply about their planning, while encouraging collaboration with others throughout the process. It would be best used alongside some of the other books in this list to truly engage students in deep learning and concept transfer.

Gini-Newman, G. & Case, R. (2015). Creating thinking classrooms: Leading educational change for a 21st century world. Vancouver, BC: Critical Thinking Consortium.

Gini-Newman supports teachers and educational leaders in their efforts to navigate planning for thinking classrooms. His book takes researched beliefs and furthers the discussion about making planning,teaching, assessing and learning more effective and impactful. He utilizes five principles highlighted by people discussing reforming education and builds a well-structured discussion on these and their role in education. The five principles are:

- Engage students
- Sustain inquiry
- Nurture self-regulated learners
- Create assessment-rich learning
- Enhance learning through digital technology (p. 19)

Hattie, John, Fisher, Douglas, Frey, Nancy, Gojak, Linda, Moore, Sara Delano, & Mellman, William (2017). Visible learning for mathematics: What works best to optimize student learning. Thousand Oaks, CA: Corwin Press.

As with other books based on John Hattie's *Visible Learning* (2009), this book focuses on the effectiveness of practices during the surface learning, deep learning and transfer of learning stages, but through the lens of mathematical understanding. Each level of learning plays an important part in helping learners intentionally strengthen their conceptual understanding of different mathematical knowledge. The authors of the book incorporate recommendations on the teaching practices that have been analyzed for their effectiveness, and discuss why the practices should be incorporated and when it is most effective to use each of them. It also looks at ineffective practices that need to be eliminated from the classroom. The goal of the book is to support teachers in becoming purposeful, reflective math teachers who foster students in becoming independent, conceptual learners.

Lanning, Lois A. & Brown, Tiffanee (2019). Concept-based literacy lessons: Designing learning to ignite understanding and transfer. Thousand Oaks, CA: Corwin Press.

Tiffanee Brown has taken the lead in professional learning sessions related to this work co-authored with Dr. Lois Lanning. In many ways, this co-authored book is a natural passing of the concept-based leadership torch from Dr. Lanning. Tiffanee Brown writes about the tremendous impact of Dr. Lanning's *Designing a Concept-Based Curriculum for English Language Arts* (2013, Corwin) on her practice and career arch, culminating in the co-writing of this book.

Concept-Based Literacy Lessons follows a step-by-step methodology, holding to the foundational principles of CBI. Guiding questions, factual, conceptual and debatable, help advance student understanding, question early conclusions, focus and refine thinking throughout lessons and units. The guiding questions further help identify and understand concepts under exploration, skills under development and solidify understanding of generalizations. This is not a book of theory, but one focused on application, supporting the writing of lessons and units that help "grow independent and proficient readers, writers, speakers, thinkers and so on" (p. 65). The authors weave four literacy strands – Understanding, Responding, Critiquing, and Producing – into each unit and into each lesson's planning. Differentiation is well supported in the model, as is constant formative assessment and the generation of finished products, demonstrating transfer of learning and attainment of the target concepts.

Concept-Based Literacy Lessons begins with the assumption that careful planning leads to higher student understanding and success. We can build upon the many high-impact literacy practices we currently use by approaching our work through a conceptual lens that enhances learning transfer for long-term understanding and retention.

Lent, ReLeah Cossett & Gilmore, Barry (2013). Common Core CPR: What about the Adolescents Who Struggle… or Just Don't Care? Thousand Oaks, CA: Corwin Press.

The authors provide engaging and practical strategies to support reluctant learners in reading, writing, speaking and reflection. *Common Core CPR* clarifies how to approach day-to-day teaching through scaffolding student understanding of complex text, and models strategies leading to deeper thinking and engagement. The text shares how to encourage and develop a culture of reading for all.

The authors note that:

- Students learn best when they are both motivated and active (p. 5)
- Teaching students to read skeptically creates citizens who are better able to cut through political jargon, commercial sales, and wholesale propaganda (p. 110)

Marschall, Carla & French, Rachel (2018). Concept-based inquiry in action: Strategies to promote transferable understanding. Thousand Oaks, CA: Corwin Press.

Concept-based Inquiry in Action combines the pedagogies of inquiry-based learning with concept-based learning, using active questioning by students to drive learning that supports transferable conceptual understanding. This highly accessible book offers practical strategies for "*how* to use inquiry to move students from lower level knowledge to deep conceptual understanding and transfer" (p. xv) through a framework of six phases: engage, focus, investigate, organize, centralize and transfer.

Each chapter blends *theory* of concept-based inquiry with classroom *practice* using frequent visuals within the book and additional support through the **http://www.connectthedotsinternational.com** website that offers illustrative videos, podcasts and other resources to support implementation.

McTighe, J. & Willis, J. (2019). Upgrade your teaching: Understanding by design meets neuroscience. Alexandria, VA: Association for Supervision and Curriculum Development.

In this text, the authors suggest that integrating neuroscience understanding into the classroom has improved students' results. The implication is that if you want students to learn, you must incorporate transfer into the classroom. If students demonstrate their understanding in their own ways and are able to apply it across several applications they have transferred their learning.

Neuroplasticity is noted as a lifetime potential. Integrating neuroscience-based strategies, such as different modes of delivering a lesson (audio, visual), grows students' brains and these approaches can be utilized as appropriate at any time in a student's life. Teachers who integrate performance tasks into a lesson allows students to actively learn because the student has had to "be active and involved"in the learning, there is no passive acceptance of a lesson. When students are *doing* something with the learning, it makes the learning more "accepted" into the student's brain and also ensures it has a long-term impact. In essence, what I do, I remember.

Understanding by Design strategies supports the learning experience and improves student results.

- Starting at the transfer goal for students and work backwards.
- Lessons introduce new knowledge of ideas and concepts the student needs to learn.
- Transfer occurs when students apply what they can do, what they know and understand to different situations and unfamiliar problems.
- Assessments of a transfer goals should be performance based.
- Meaning making is more than just teaching facts.

Mehta, Jal & Fine, Sarah (2019). In Search of Deeper Learning: The Quest to Remake the American High School. Cambridge, MA: Harvard University Press.

Mehta and Fine explore the conditions that need to exist at the classroom, school, and system levels if we hope to develop deeper learning as the norm, rather than the exception. Utilizing a case study approach, they explore several classrooms and clubs where deeper learning takes place, as well as the evolution in practice the teachers took to get to this depth of learning. Writers acknowledge that there is no 'single recipe' for deeper learning. Through their case studies, they found several common themes which has led to their list of characteristics of deeper teachers. They also acknowledge the many constraints and roadblocks that can hinder deeper learning in our current school systems/ structures.

The final chapters of the book are a call to action for systems and leaders to make changes. They reimagine the grammar of schooling, offering that it can be considered a continuum of evolution because getting there will require many little steps. Mehta and Fine maintain that "an enormous amount depends on whether or not we can summon the courage and the will to make this shift. Schools lay the foundation of our economy and our path to equity... If we cannot shift from a world where learning deeply is the exception rather than the rule, more is in jeopardy than our schools. Nothing less than our society is at stake" (p. 400).

The authors found that:

- Deep learning occurs at the intersection of three virtues: mastery, identity, and creativity
- Learning can appear deep but is actually shallow in practice
- "We need to change student learning, so we need to change schools, so we need to change systems" (p. 363)

Moore, Shelley (2016). One without the other: Stories of unity through diversity and inclusion. Winnipeg, MB: Portage & Main Press.

Shelley Moore is a teacher, consultant, PhD candidate (UBC) and passionate supporter of inclusion. Using personal stories and connections, Moore offers insight and practical strategies for inclusion of all learners in our classrooms. Extending from this book are her blog, at **https://blogsomemoore.com** and YouTube channel at **https://www.youtube.com/channel/UCU-GCW3-EwNxcbJEFKKaABw**, which continue the conversation and vision for a truly inclusive learning environment.

Upon first read, some may not see the connection between this book and conceptual understanding and teaching for learning transfer. While she doesn't address this topic directly, she argues that design is the most underutilized support for learners in the classroom. We cannot guide students towards deeper understanding and learning transfer if we don't first take stock of who they are and what strengths and needs they bring with them.

National Research Council (2005). How Students Learn: Mathematics in the Classroom. Washington, DC: The National Academies Press. https://doi.org/10.17226/11101

The authors state three principles that support concept-based curriculum model:

- Principle #1– Teachers must engage students' preconceptions (p. 219)
- Principle #2 – Understanding requires factual knowledge and conceptual frameworks. (p. 231)
- Principle #3 – A metacognitive approach enables student self-monitoring. (p. 236)

Paul, Richard & Elder, Linda (2014). The miniature guide to critical thinking concepts and tools. Thinker's Guide Library available through electronic license.

A pocket guide for teachers and students alike, this quick read provides the reader with key points, definitions and questions to check reasoning and thinking process as one works to develop critical thinking skills and habits. The authors share definitions and questions to guide reflection as they explore the role of working toward greater clarity, accuracy, precisions, relevance, depth, breadth, logic, significance and fairness in one's view, thinking and writing.

Eight essential intellectual traits are identified and contrasted with their opposite. For example, Intellectual Humility vs Intellectual Arrogance or Intellectual Empathy vs Intellectual Narrow-mindedness (p. 21). These challenge the reader to reflect on their own habits of thought. The process of applying ten intellectual standards to the eight elements of reasoning as one develops the eight intellectual traits that are presented as the guide to critical thinking.

There is hope for all of us as we're reminded that in all aspects of our life we're on a journey of critical thinking development from the unreflective thinker, largely unaware that there are significant problems with our thinking, to the accomplished thinker where the intellectual skills and virtues discussed are second nature in all our thoughts.

Ritchhart, Ron (2002). Intellectual character: What it is, why it matters and how to get it. San Francisco, CA: Jossey-Bass.

This is the first of four books written or co-written by Ron Ritchhart, related to developing a personal culture of thinking and drawing out one's thinking in a manner that makes it clearly visible or consciously undertaken by all in the classroom experience. In the first three chapters, the author provides models of along with ways to examine and consider the educational significance of various "thinking dispositions" like open-mindedness and inquisitiveness.

The challenge of character in this work speaks more to what David Perkins referenced as the "commitment to imagination, evidence, inquiry, fairness…" (Ritchhart, 2002), rather than how smart an individual may be on the surface. The questions posed in the preface, "What if education were less about acquiring skills and knowledge and more about cultivating the dispositions and habits of mind that students will need for a lifetime of learning, problem solving, and decision making? What if education were less concerned with the end-of-year exam and more concerned with who students become as a result of their schooling?" set the tone for the entire book.

Intellectual character is the term the author uses to frame the work behind "developing habits of mind, patterns of thought and general dispositions toward thinking." The development of habits that enable thinking to flourish requires a commitment of teachers, schools and the community that works to foster growth as thinkers and learners; and as more than vessels to be filled with knowledge, which at least on the surface is more readily measurable in high-stake exams such as the Alberta PAT or Diploma exams.

The author illustrates the difference with an invitation to adults – "How would you do on a high school social studies, math or science exam?" Most adults couldn't pass the exam without a refresher course. However, passing an exam within months of completing a course is taken as an indicator of mastery, when it really is memory work. Intellectual character development as a focus is foundational to supporting students in becoming thinkers and learners capable of applying or transferring those traits to new information and environments. It may be too simplistic, but the reader may be well-served to consider the difference between being smart as measured by IQ, SAT and Diploma scores and acting smart as measured by actions, interactions and ability to transfer knowledge to new situations. The latter speaks to intellectual character.

Ritchhart, Ron, Church, Mark, & Morrison, Karin (2011). Making thinking visible: How to promote engagement, understanding, and independence for all learners. San Francisco, CA: Jossey-Bass.

This work speaks to one particular mindset: learning that lasts occurs best when the learner is able to recognize their thinking and sharpen their ability to think through a variety of moves or routines that fit the individual learner.

- Unpacks the importance of thinking
  - Provides a map of thinking involved in understanding (p. 11)
- Advocates for the use of *thinking routines* to make thinking visible as an important facet of learning. Explains routines for:
  - Introducing and Exploring Ideas
  - Synthesizing and Organizing Ideas
  - Digging Deeper into Ideas
- Discusses ways to "bring the power of visible learning to life"

Ritchhart, Ron (2015). Creating Cultures of Thinking: The 8 Forces We Must Master to Truly Transform Our Schools. San Francisco, CA: Jossey-Bass.

This book focuses on the role of classroom culture in both nurturing and guiding the development of thinking skills in our students. This work builds upon his earlier works on authentic engagement (2004) and dovetails nicely with his earlier work on intellectual character from 2002. He notes that:

> *In 2002, in the book Intellectual Character, I reviewed the call for Habits Of Mind, intellectual passions, and thinking dispositions being championed from various circles and found agreement around six broad characteristics: curiosity, open-mindedness, being strategic, having a healthy skepticism, being a truth seeker, and being metacognitive. (p. 18)*

Much of his work, and especially this book, centers on:

- The school's need to focus on the development of student thinking skills
- The role of classroom culture in building the foundation for teaching thinking skills
- Classroom culture must be one where learning is clearly/visibly supported

Ritchhart notes that at this book's core is a *what if*. "What if we sought to develop a culture of thinking in our schools, classrooms, museums, meetings, and organizations?" (p. 30)

Ritchhart states early on in this book (Chapter 2) that it is vitally important that the teacher understand that what they "believe about their students and their abilities" shapes how they will work with those students. In essence, we believe that the students can understand therefore we can teach them for understanding with an emphasis on thinking skills not just regurgitation. The book is full of practical scenarios and resources. At the end, there is a reminder that along with possible structures and teacher skill, this will take time and consistency in approach.

Schimmer, T. (2011). Ten Things that Matter from Assessment to Grading. Don Mills, ON: Pearson Canada.

A book structured into short chapters, each focusing on an area in your teaching that matters as it relates to how you work with your students to how you assess them. The ten areas that matter are:

1. Being the Change Matters
2. Confidence Matters
3. Assessment Accuracy Matters
4. Descriptive Feedback Matters
5. Differentiated Instruction Matters
6. Student Ownership Matters
7. Accurate Grades Matter
8. Practice Matters
9. Improvement Matters
10. Professional Learning Matters

Schimmer sees the need for teachers to actively work to address the knowing-doing gap and presents the reader with strategies and approaches that balance research and practical application in an easily understood manner. The author asserts that it is the teacher who needs to first change what and how they approach the act of teaching in their classrooms. This is based on his belief in Stephen Covey's belief that "I am personally convinced that one person can be the change catalyst or transformer." It is the job of the teacher to not only make appropriate pedagogical decisions, but also to ensure that these decisions lower the anxiety level of their students. This can be done by creating routines that are clearly known and understood by students and are consistently used by the teacher. In assessment, this means students are well prepared to take an exam – no pop quizzes and no "gotchas," as these are counterproductive to assessing what students know and can do. Schimmer believes that when students know the learning target (that which is expected of them), they are able to take increased responsibility for their learning. It is the role of the teacher to ensure that they build expectations of success by overpreparing their students.

Schimmer notes that it is also important that teachers know the purposes of assessment and the form that assessment takes, depending on its purpose. Assessment for learning provides descriptive feedback for students that clearly shows them how they can improve. This feedback is provided to show students how they can move forward in their learning. Feedback that fails to promote thinking is not powerful feedback. As Dylan Wiliam noted, "To be effective, feedback needs to cause thinking."

This book also explores the importance of differentiated instruction in order to build equity of access to learning and excellence for every student. It highlights what the teacher can do through differentiation to allow each student to move to the edge of improvement and allow each student to then move past that edge. This all means that planning is vital in today's classroom, that is, what are your big ideas, plan for pacing, assessment focus, etc. A plan is not a script as a script does not take into account the need to differentiate.

This relatively short book provides a powerful look at the changes we need to both take and actively incorporate in order to be effective teachers.

Stern, Julie, Lauriault, Nathalie, & Ferraro, Krista (2018). Tools for teaching conceptual understanding: Harnessing natural curiosity for learning that transfers - Elementary. Thousand Oaks, CA: Corwin Press.

In the first chapter, this book shows that concept-based teaching helps young learners uncover conceptual relationships in a way that is developmentally appropriate. Readers will learn:

- Why conceptual learning is a natural fit for children
- Strategies for introducing conceptual learning
- Instructional strategies to help students learn inductively
- How to plan, assess and differentiate in a concept-based classroom

This book expands on the work of Lynn Erickson with practical strategies that teachers can use in elementary classrooms. Many of the strategies would also transfer to junior high and high school settings.

- Explains why conceptual learning is a natural fit for children
- Strategies for introducing conceptual understanding to students
- Strategies to help students uncover and transfer concepts
- Write lessons plan
- Assess understanding
- Differentiation strategies
- How concept-based teaching aligns with best practices

Stern, Julie, Ferraro, Krista, & Mohnkern, Juliet (2017). Tools for teaching conceptual understanding: Designing lessons and assessments for deep learning - Secondary. Thousand Oaks, CA: Corwin Press.

Written prior to the elementary edition, the majority of the message is the same. Chapter 5 in both books presents a different perspective – with each focusing on secondary or elementary levels as they relate to assessment.

> *Innovation requires the creative transfer of the fundamental and powerful concepts of the traditional disciplines. We should put real-world challenges in front of students that require them to improvise based on what humanity has already discovered. Innovators stand on the shoulders of past scientists and mathematicians in order to innovate. They don't invent without a deep understanding of how the world works. (p. 1)*

Tomlinson, Carol A. (2017). How to differentiate instruction in academically diverse classrooms. Alexandria, VA: Association for Supervision and Curriculum Development.

Carol Ann Tomlinson has written extensively on the concept of differentiating instruction since the 1990s. It is essential that we remember that differentiated instruction is more than just a series of strategies that one uses to provide different assignments to different students. It is a deliberately planned rethink of your practice to reflect the identified needs of the learners in your classroom.

At its root are the following "must understand" pieces that the author provides for the reader to further enhance their differentiated instruction practice. These are:

- What differentiation is and why it's essential
- How to set up the flexible and supportive learning environment that promotes success
- How to manage a differentiated classroom
- How to plan lessons differentiated by readiness, interest, and learning profile
- How to differentiate content, process,and products
- How to prepare students, parents, and yourself for the challenge of differentiation

This book allows you to gain an increased understanding of differentiation and what it is and is not. Differentiated instruction is not just another term for individualized instruction. It is much richer and complex than that. As Tomlinson notes, " In a differentiated classroom, the goal is to have students work consistently with a wide variety of peers and with tasks thoughtfully designed not only to draw on the strengths of all members of a group but also to those students' area of need" (p. 4). As a result, it looks at multiple areas of classroom learning and practice with the intention of engaging all learners with powerful ideas/meaningful learning that they can both clearly understand and utilize.

It is made clear that the practice of differentiation requires you to be a more active teacher. It also needs ground rules that provide you the ability to monitor the multiple activities that the students are engaging in during the day. The author also notes that differentiation is not for the "few," but is meant to provide all learners with the support and guidance they require in order to be successful learners.

As such, this is more than giving individuals different or varied expectations. It is proactive and requires the teacher to understand the learner's needs and then plan accordingly; including prior knowledge of work and assessments to help gain increased understanding and insight into these needs.

In knowing your learners, you can manage what you plan to do; what various students need in order to learn; and the product needed to ensure that the outcomes are demonstrably learned by all. Thus the three elements of differentiated instruction are content, process and product.

> *Students differ as learners...attending to these differences requires a flexible approach to teaching – One, that is rooted in an inviting environment, assessment to inform instruction, and flexible classroom management* (p.13).

Wathall, Jennifer T. H. (2016). Concept-based mathematics: Teaching for deep understanding in secondary classrooms. Thousand Oaks, CA: Corwin.

This text is a three part examination into the Lanning/Erickson concept-based model as it applies to secondary Mathematics.

- Part 1: What is concept-based curriculum and instruction in Mathematics: Research and Theory
- Part 2: How to craft generalizations and plan units of work to ensure deep conceptual understanding
- Part 3: How do we engage students through instructional practice? Strategies to engage and assess

The work supports drawing out deeper thinking through the use of inquiry to foster synergistic thinking, to stimulate student motivation and interest and to build a deeper understanding of transferable concepts. It also provides examples of what the three levels of inquiry (structured, guided and open) might look like.

Wathall supports her process with the research of Porovik and Gardiner (2007), who identify some of the top traits of mathematically-able students that are fostered through the use of inquiry-based teaching, such as the ability to make and use generalizations, utilize analogies and make connections as well as having a lack of fear of "being lost" and having to struggle to find one's way through a problem.

Wiggins, G. & McTighe, J. (2005). Understanding by Design (expanded 2nd edition). Alexandria, VA: Association for Supervision and Curriculum Development.

The UbD Framework provides a three-stage backwards design process to support teachers in teaching and assessing for understanding and learning transfer.

- A way of thinking purposefully about curricular planning
- Begins with considering what we want students to understand
- What will be the evidence of student understanding
- Designing learning experiences to target desired results

> *To get beyond mere rote learning and recall, we have to be taught and be assessed on an ability to see patterns, so that we come to see many "new" problems we encounter as variants of problems and techniques we are familiar with. That requires education on how to problem solve using big ideas and transferable strategies, not merely how to plug in specific facts or formulas. (p. 40)*

Articles

Erikson, L. (2012). Concept-Based Teaching And Learning. IB Position Paper: International Baccalaureate Organization. Available at http://www.ibmidatlantic.org/Concept_Based_Teaching_Learning.pdf.

Assessing conceptual understanding via literacy-infused, inquiry-based science among middle school English learners and economically-challenged students (Lara-Alecio et al., 2018). The authors compared students in treatment and control grade 6 Science classes. Learning was measured using a big idea assessment tool referred to as Big Ideas in Science Assessment (BISA). Students, especially English learners, gain a better understanding of science concepts if the lessons are built to include big ideas and overarching science concepts.

McCoy, Jan & Ketterlin Geller, Leanne (2004). Rethinking Instructional Delivery for Diverse Student Populations. *Intervention School Clinic*, 40, 88-95.

The authors began with the research done through the University of Oregon that concluded that, if teachers identify and build upon concepts in their practice, an overt identification of concepts, their characteristics and attributes with the use of graphic organizers can help students with identified reading difficulties as well as "average" students to learn. The authors noted the efficacy of modifying instructional approaches then to wait for the students to become better readers. By providing research where concept based teaching (clear target of instruction was concept, and the use of graphic organizers to illuminate concept) was used in one group and traditional teaching in the other. Students, especially those with identified weaknesses, were more successful in the concept class than the traditional one.

McTighe, J., Seif, E., & Wiggins, G. (2004). You Can Teach for Meaning. *Educational Leadership*, 62(1), 26-30.

Teaching is more than simply covering content – learning is more than merely taking something in and assessment is more than simple recall. The authors begin this piece with the three-part statement that the learner must be able to link new information to prior learning/information, relate facts to the "big idea," explore essential questions and apply their learning in a new context in order for teaching for meaning. This means teachers must address these questions:

- What are the big ideas and core processes students need to understand?
- What will I look for, as evidence, that students understand the big ideas and can apply their learning in meaningful and effective ways?
- What teaching strategies will help the students make meaning?

The authors note that these are important for the teacher to remember:

- Importance of big ideas
- Students can only make meaning when they are asked to inquire, think at high levels and solve problems
- Students should be expected to apply knowledge and skills in meaningful tasks within authentic contexts

- Teachers should regularly use thought provoking, engaging and interactive learning strategies
- Students need the opportunity to revise their work using clear examples of successful work, with known criteria and feedback (McTighe et al, 2004)

Nicholas A. (2015). A concept-based approach to teaching speech acts in the EFL classroom. EL*T Journal*, October 2015 69(4), 383-394.

The author takes concept based instruction and overlays it into the context of language instruction. The article postulates that if the language learner develops a deeper understanding of a skill or knowledge area in language learning, it has the same impacts in other types of subject learning; it allows for the student to then apply the learning into a variety of other situations (p. 383).

It requires an orientation (gaining understanding of the method of language construction) followed by execution (utilizing the learning) concluded with control (assessing whether it was effective). One of the first examples provided is the use of the statement," How is it going?" This can be a simple greeting, inquiry into health or inquiry into the progress of some activity. The author notes that, when a learner more clearly understands the varied contexts, then they are more able to navigate the language correctly.

Perkins, D. & Salomon, G. (1988). Teaching for transfer. *Educational Leadership*, 46(1), 22-32.

While dated, the basics of the authors' discussion and the examples they provide are solid. One may take offence at the "r" word used in relation to a weaker group of student's abilities in a learning area however when one moves past this, there are some strong examples that are very clear and easy to understand in relation to transfer in teaching.

The premise is simply put, transfer is when something is learned in one context and then utilized or referred to in another (p. 22). While the concept of transfer in education should be intuitive (of course, we want our students, who first read a Dick and Jane primer, to eventually go on to read newspapers and then take the information they gather to make decisions about who to vote for) it may not always be so. The authors argue that we have to pay attention to ensure we are providing for transfer. The need to move beyond passive knowledge to more useful, active knowledge is essential to their discussion. They discuss low road transfer that which triggers routines such as a car driver also being able to drive a larger truck and high road transfer which requires a deliberate focus on more abstract thinking. They also provide an overview of implicit and explicit instruction for transfer of learning with the note that implicit teaching does not always lead to transfer.

Ritchhart, Ron. & Perkins, Richard (2008). Making thinking visible. *Educational Leadership*, 65(5), 57-61.

The authors provide an opening example of a grade 5 classroom in Australia following a "thinking routine" that clearly illustrates ways to both activate thinking and make that thinking visible to others observing those students (as well as being visible to the students themselves).

They then note six principles connected to the Visible Thinking approach:

- Learning is a consequence of thinking.
- Good thinking is not only a matter of skills, but also a matter of dispositions. Open mindedness, curiosity, attention to evidence, skepticism, and imaginativeness all make for good thinking (Perkins & Ritchhart, 2004; Perkins, Tishman, Ritchhart, Donis, & Andrade, 2000).
- The development of thinking is a social endeavor.
- Fostering thinking requires making thinking visible.
- Classroom culture sets the tone for learning and shapes what is learned.
- Schools must be cultures of thinking for teachers.

As a result, the important task of teachers is to foster a culture of thinking and to ensure students know that their teachers are interested in their ideas.

Schools implementing the Visible Thinking approach became more learner oriented than work oriented and students participate more actively in the visible thinking sessions, discussions and activities. The article includes links to 30+ visible thinking techniques.

Sel, Burcu & Sözer, Mehmet Akif (2019). The effect of conceptual change texts on the level of conceptual understanding of students. *International Electronic Journal of Elementary Education [IEJEE]* March 2019, 11(4), 383-391.

The authors present the case that constructivist education understanding requires that the learner can "make" the information permanent and can transfer it to other areas of life through general abstraction, analysis and various other constructs (their work here is specific to Social Studies and the multidimensional nature of the subject). They make note that Social Studies requires that the learner find "acceptable" significance to the world and its social order with the information they gather (MoNe 2005).

- Requires analysis of the multiple viewpoints found in social studies concepts.
- Concepts are viewed as mental structures.
- They note that abstraction skills are required to be able to do this well.
- It is important to build conceptual understanding and to build discrimination of the contradictions/ contradictory concepts that are found to not be grounded in reality/fact.
- In the conceptual change model they note the need to build upon existing information so that the new information interacts with existing information. In this interaction,there can be changed viewpoints.

The authors identify four stages in th conceptual change process:

- Dissatisfaction – is it incomplete?
- Intelligibility – is it understandable?
- Plausibility – is it logical/consistent?
- Fruitful (use) – can it be transferred? (p. 384)

Twyman, Todd, Ketterlin-Geller, Leanne R., McCoy, Jan D., & Tindal, Gerald (2003). Effects of Concept-Based Instruction on an English Language Learner in a Rural School: A Descriptive Case Study. *Bilingual Research Journal*, 27(2), 259-274.

The author's previous research indicated that intentional alignment of curriculum and instruction along with assessment that utilizes concept-based instruction (CBI) resulted in "significant" gains in learning for low performing students and those with disabilities who were the target groups of the research. (See Nolet & Tindal, 1994; Hollenbeck & Tindal, 1996; McCleery & Tindal, 1999). This paper further validates CBI as a pedagogical approach.

They note that traditional instruction success is often predicated on students having both adequate prior knowledge and the reading/writing skills to make sense of that content. They confirm that students with learning needs require their teachers to accommodate for them by modifying instruction and also address the gap in language skills so they are able to understand the content and are able to express their learning so that they may be assessed. The authors postulate that facts are hard (called dense) for these students. They found that these students are better able to grasp concepts, attributes and examples, especially when accompanied by graphic organizers.

Willis, J. & McTighe, J. (2019). Upgrade Your Teaching: Understanding by Design Meets Neuroscience. Alexandria, VA: Association for Supervision and Curriculum Development

The UbD design is based on "the idea that long-term achievement gains are more likely when teachers teach for understanding of transferable concepts and processes while giving learning multiple opportunities to apply their learning in meaningful and authentic contexts." (p. 23)

Based on the knowledge that the brain organizes new information by making connections to pre-existing understandings, instruction should mimic how humans naturally learn. It should offer opportunities for students to:

- Pre-activate existing understanding
- Make connections of new information to the pre-existing understanding of concepts
- Mentally manipulate, construct new ideas
- How the transfer of newly acquired knowledge and skills to novel situations will promote the creation of durable long-term memory and conceptual understandings (p. 30)

Ultimately the goal of UbD is how will the planned unit "optimize achievement and success for all learners" (p. 30).

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