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MAJOR INNOVATION REQUIRE ALIGNING THE EFFORTS OF ALL THOSE INVOLVED IN STUDENTS' MATHEMATICAL DEVELOPMENT

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Live as if you were to die tomorrow.
Learn as if you were to live forever
Gandhi

Just as everyone has a unique fingerprint, every student has an individual learning style. Chances are, not all of your students grasp a subject in the same way or share the same level of ability. So how can you better deliver your lessons to reach everyone in class? Consider differentiated instruction – a method you may have heard about but have not explored.

History of differentiated instruction

The roots of differentiated instruction go all the way back to the days of the one-room schoolhouse, where one teacher had students of all ages in one classroom. As the educational system transitioned to grading schools, it was assumed that children of the same age learned similarly. However, in 1912, achievement tests were introduced, and the scores revealed the gaps in student's abilities within grade levels.

What differentiated instruction means

Carol Ann Tomlinson is a leader in the area of differentiated learning and professor of educational leadership, foundations, and policy at the University of Virginia. Tomlinson describes differentiated instruction as factoring students' individual learning styles and levels of readiness first before designing a lesson

plan. Research on the effectiveness of differentiation shows this method benefits a wide range of students, from those with learning disabilities to those who are considered high ability.

Differentiating instruction may mean teaching the same material to all students using a variety of instructional strategies, or it may require the teacher to deliver lessons at varying levels of difficulty based on the ability of each student [1].

Teachers who practice differentiation in the classroom may:

– design lessons based on students' learning styles.

– group students by shared interest, topic, or ability for assignments.

– assess students' learning using formative assessment.

– manage the classroom to create a safe and supportive environment.

– continually assess and adjust lesson content to meet students' needs.

Differentiated instruction may be planned earlier than working with students in classrooms and also happens in the moment. As teachers arrange their instruction in real time to respond to unanticipated strengths and needs surfacing from assessment.

The diversity is one of the province's greatest advantages. By ensuring equity of opportunity for learning in education system, we can help all students achieve excellence. Pedagogues play a key role in designing learning experiences that are responsive to the student's development, strengths and needs.

Teachers who effectively differentiate:

– consistently assess student progress in multiple ways

– build extensive knowledge about how students learn and effective pedagogy

– reflect critically on their practice.

What is necessary to effective instruction in Mathematics?

Designing effective instruction in mathematics involves balancing understanding of mathematical concepts with procedural fluency. Effective instruction involves intentional approaches, strategies, and learning activities based on mathematical and pedagogical knowledge and understanding of student mathematical development. Using assessment to inform instruction is essential to a precise, timely and differentiated response that addresses the diversity of student learning needs.

Elements of effective mathematics instruction include:

– relevant and engaging tasks, including parallel tasks

– a variety of representations of the mathematics

– access to mathematics learning tools and technology

– frequent and varied assessment of student understanding.

The importance of differentiation for students learning mathematics

Student readiness, interests and learning preferences vary greatly within any mathematics classroom. Students will differ in their knowledge and

understanding of mathematical concepts and in their use of mathematical skills such as mental math and estimation. Students also vary in their application of the mathematical processes:

– solving problems in new situations

– reasoning skills including proportional reasoning, and spatial reasoning

– reflecting on and monitoring one's thinking

– selecting and using a variety of learning tools and computational strategies

– connecting mathematics to real life and to other mathematical ideas

– representing mathematical ideas and relationships concretely, pictorially, numerically, and algebraically

– communicating mathematical thinking orally, visually, and in writing, using everyday language and mathematical vocabulary.

The seven mathematical processes support the acquisition and use of mathematical knowledge and skills.

Responding to differences in readiness helps students feel capable and increases their motivation to learn. Addressing student interests and learning preferences provides relevance and autonomy – factors key to student engagement [2].

The Mathematics Scenarios

The teachers in the following scenarios have a deep understanding of their discipline and the curriculum for the subjects they teach. They have attended to each of the components in the Complexity of Learning and Teaching diagram by:

– setting up reliable, engaging and inclusive learning environments:

– designing learning experiences that focus and engage their learners;

– selecting appropriate instructional strategies that help students meet their learning goals.

The scenarios illustrate how the teachers assess to understand the learning

needs of their students, use this information to shape instruction and reflect on their practice.

The scenarios show how the teachers carefully plan instruction to differentiate for the variety of learners in their classroom. They also adapt to meet specific, perhaps unanticipated, needs that arise during instruction. In each example there is a clear learning goal and an evident plan for differentiated instruction based on assessments of student interests, learning preferences and readiness. Technology is used to support and enhance differentiation. Each scenario incorporates some or all of the key features of differentiated instruction [3].

We want our students to understand and use their strengths so we differentiate their learning based on this. We group students based on their area of certainty and let them join the centre whose task's initial representation is the one with which they are most confident. In addition, we pair students, within the centres, based on their readiness and provide them with a task at an appropriate level of challenge. We addresse their readiness needs by providing parallel tasks tasks of varying degrees of complexity, at each centre and by scaffolding our instruction as we work with various pairs of students in each of the centres. We have designed the centre activities to engage all of the students in several of the mathematical processes including representing, connecting, problem solving and communicating.

A tiering strategy can be applied to achieve learning goals in mind which is differentiated based on readiness of the students. Strategy is a component of student literacy. Teachers support students in strategy use by modelling_subject-specific processes and explaining how they reflect thinking in the subject.

Class learning profiles are useful tools to help teachers consider the characteristics of their students, including diverse learning preferences. Brainstorming, as assessment for learning, provides opportunities for teachers to identify the mathematics readiness of their students. The exit card is an effective strategy for self-assessment and will yield reflection and diagnostic information for future planning. Students demonstrate metacognitive thinking when they recognize how their attitudes, habits and dispositions influence the extent of their learning.

The experiences students have as they actively develop their individual pathways plans, allow them to gather information about themselves and their opportunities; consider feedback from their teachers, parents and peers; make decisions and set goals and develop plans for achieving their goals.

Pros and cons of differentiated instruction

The benefits of differentiation in the classroom are often accompanied by the drawback of an ever-increasing workload. Here are a few factors to keep in mind:

Pros

Research shows differentiated instruction is effective for high-ability students

as well as students with mild to severe disabilities.

When students are given more options on how they can learn material, they take on more responsibility for their own learning.

Students appear to be more engaged in learning, and there are reportedly fewer discipline problems in classrooms where teachers provide differentiated lessons.

Cons

Differentiated instruction requires more work during lesson planning, and many teachers struggle to find the extra time in their schedule.

The learning curve can be steep and some schools lack professional development resources.

Critics argue there is not enough research to support the benefits of differentiated instruction outweighing the added prep time [4].

Conclusion

Mathematics is creative, exciting and multifaceted. Mathematics is the future. Without mathematics, key modern technologies would be unimaginable. In fact, without mathematics, the entire universe would most likely remain a complete mystery to us. Current research findings show that the nature of mathematics teaching significantly affects the nature and outcomes of student learning. This highlights the huge responsibility teachers have for their students' mathematical well being. In this article, we offered some of principles as a starting point for discussing change, innovation. This article offers ways to address that complexity and to make mathematics teaching more effective. Major innovation and genuine reform require aligning the efforts of all those involved in students' mathematical development: teachers, researchers, parents, specialist support services and the students themselves. Changes need to be negotiated and carried through in the classrooms, teams, departments, and faculties, and in teacher education programs. Innovation and reform must be provided with adequate resources. Universities need to ensure that their teachers have the knowledge, skills, resources to provide students with the very best learning opportunities. In this way, all students will develop their mathematical proficiency. In addition, all students will have the opportunity to view themselves as powerful learners of mathematics.

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