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Building thinking classrooms

Building Thinking Classrooms: A Student-Centered Approach to Mathematics Learning A teacher's struggle to implement rich mathematics tasks has sparked Peter Liljedahl's research into 14 optimal practices for thinking that create an ideal setting for deep mathematical learning. When combined, these unique practices transform mathematics classrooms by shifting from traditional instruction to a learner-centered approach. This student-owned method requires teachers to rethink how they introduce concepts and encourages active learners in the math classroom. A building thinking classroom engages students in collaborative problem solving, focusing on activity, discussion, and student collaboration over direct instruction. Teachers act as guides rather than experts, allowing learners to build thinking skills alongside math knowledge. For instance, in a middle school classroom, students work in groups, sharing their process with the teacher, who moves around the room to facilitate discussion. Liljedahl's approach is based on more than 10 years of research and collaboration in over 400 K-12 classrooms. The Ultimate Guide To Metacognition provides practical tips and ideas for teachers to encourage metacognitive learning in math students. By adopting this student-centered method, schools can create an environment that fosters deep mathematical thinking and learning. Thinking classrooms prioritize student-centered learning over traditional practices like scripted lessons. This shift enables learners to develop problem-solving skills, think critically, and take ownership of their knowledge. Peter Liljedahl's work highlights nine key elements that distinguish a thinking classroom from a non-thinking one. These include: - **Tasks**: Learners engage with open-ended problems, and tasks are used to support or hinder student progress. - **Communication**: Tasks are shared verbally and through written forms, but without direct teacher feedback. - **Groups**: Students form groups randomly, promoting diversity and collaboration. - **Workspace**: The classroom is organized to facilitate independent work, with ample space for students to write and think. - **Room organization**: There's no designated "front" of the room, allowing learners to move freely. - **Questioning**: Teachers encourage question-asking and provide guidance without answering questions directly. - **Hints and extensions**: Students are prompted to find their own solutions; hints come from within the task itself or from resources like textbooks. - **Leveling**: Learners progress at their own pace, with teachers adjusting instruction as needed. - **Assessment**: Focus is on processes and understanding learning, rather than just product. In a thinking classroom, collaboration and problem-solving are highly valued. Students learn by working together, sharing resources, and explaining their thought processes to others. This approach fosters an interactive environment where learners construct knowledge, engage with peers, and develop essential skills for lifelong learning. Collaborative Problem-Solving in Math Education The use of collaboration in math problem-solving supports student learning by encouraging active engagement, critical thinking, and persistence. Research suggests that non-permanent vertical workspaces, such as whiteboards, can facilitate students' thinking and improve their academic performance compared to working at desks. Meet Skye, an AI tutor designed to make math success accessible to every student. This voice-based platform leverages the same pedagogy and curriculum used in traditional tutoring, but with greater flexibility and affordability. By shifting from direct instruction to problem-solving, schools can create a low-stakes learning environment that encourages risk-taking and academic growth. Effective Problem-Solving Strategies To foster math success, teachers should employ problems worth solving, which are accessible, motivating, and allow students to apply multiple math strategies. These problems should be simple at first, increasing in complexity as students progress. By working together on these problems, students develop essential skills like communication, teamwork, and critical thinking. Example Problem: Arrays A milk crate can hold 36 bottles of milk. Can you arrange 14 bottles in the crate so that each row and column has an even number of bottles? This problem is a "problem worth solving" because it targets math and critical thinking skills needed to master arrays. Students can approach this problem from different angles, making it engaging and motivating. Once they complete this task, they can tackle more complex problems related to arrays. Collaborative Problem-Solving Approaches in Classrooms In the context of basketball, analyzing how boys collaborate during games can provide valuable insights into problem-solving strategies. If players were to compete in more than six rounds or even 57 rounds, their approach might change. However, this scenario is engaging due to its relevance and the skills required to solve it. Collaboration is a key aspect of thinking classrooms, where students work together to share knowledge and build upon each other's ideas. This approach enhances student engagement by encouraging reliance on peers and groups for clarification. By randomly selecting groups, barriers are broken, and knowledge mobility increases. In traditional math classrooms, desks are often arranged in rows, with teachers modeling problem-solving techniques before assigning tasks. In contrast, thinking classrooms focus on students working together to solve problems, with teachers facilitating the process. This approach empowers students to take responsibility for their learning, rather than relying solely on the teacher. Two common task structures in thinking classrooms are "I do," "we do," and "you do." The first involves the teacher presenting a problem, while students generate ideas; the second requires students to work together, with teachers circulating to observe and provide guidance. In the third approach, students receive a similar problem, follow the teacher's model, and then solve it independently. A conducive classroom environment is essential for collaboration. Using vertical non-permanent surfaces like whiteboards or sticky notes encourages teamwork by having all groups share the same workspace. Students can review each other's work, address errors, or seek assistance from more advanced problem-solving groups. For instance, a 3rd-grade class working on building unicycles could benefit from this approach. A set of 8 wheels needs to be combined into various cycle combinations. Students draw and write their work on a non-permanent surface. Each learner may use a different method, such as drawing bicycles or tally marks, to demonstrate the number of wheels. When one group gets stuck, they can review peers' workspaces and ask questions to stimulate critical thinking and math strategies. Easy access to classmates' thought processes encourages students to develop problem-solving skills. Non-permanent surfaces promote risk-taking and reduce math anxiety. In thinking classrooms, open-ended questions encourage independent thinking and move away from the teacher asking all the questions. Three types of questions are used: Proximity questions, Stop thinking questions, and Keep thinking questions. Teachers use keep thinking questions to enhance collaboration, develop metacognition strategies, and promote deeper understanding. For example, a group of second graders is given a problem. As they work through it, the teacher circulates and uses open-ended questions like "What have you done so far?" or "What other way could you approach this problem?" Students return to the problem using new approaches. Trained math tutors use open-ended questions in one-on-one tutoring sessions to promote deeper understanding and encourage critical thinking. Schools receive high-quality headsets for each student to ensure effective communication. After reaching a minimum threshold, groups debrief, and students take notes to their future self, capturing their work. When it comes to note-taking, learners don't just copy information from the board. Instead, they take notes that will help them solve similar problems in the future. This approach allows each student to have unique information on their page, but still be able to understand and use their notes effectively. In a thinking classroom, assessment is not about evaluating answers, but about understanding progress and providing feedback. The focus is on formative assessment, which looks at the process, not just the product. Students can present their work as a group or individually, using various tools like rubrics, videos, and posters to explain their thought process. The goal is for students to show how they think, solve problems, and reflect on their learning. This approach encourages collaboration, problem-solving, and critical thinking. By providing learners with real-world scenarios and allowing them to use manipulatives or draw, you can engage students in the learning process. Classroom routines and activities, such as creating a "thinking space," can help students quickly move into problem-solving mode. By using learner-centered experiences and real-world examples, you can make learning more relevant and effective. Surfaces are turned into collaborative hubs by using lockers, walls, and windows as workspaces, promoting teamwork and knowledge sharing among learners. Random group assignments foster diverse peer interactions, breaking down social barriers and teaching students to value each other's contributions. Open-ended questioning encourages explanations and reasoning, while real-time feedback supports skill development and practice. Consolidating learning through sharing or gallery walks ensures a clear understanding of the topic. Some strategies are universally applicable across grade levels: collaboration, grade-level problems, vertical workspaces, and consolidation. However, certain approaches can enhance thinking classrooms in schools with students of different ages: Lower elementary school focuses on building language skills using sentence starters and prompts while modeling good collaboration practices and pausing to notice progress. Upper elementary school engages older students with open-ended questions that require them to explain their thinking. Middle school supports teamwork by setting up vertical workspaces, encouraging feedback and questioning among groups. High school encourages in-depth explanations and presentations of processes and results in multiple formats. Implementing a thinking classroom requires perseverance and a growth mindset. Gradual changes, starting with small shifts such as adding vertical workspaces or adjusting tasks, can lead to a fully student-centered math class within a school year. Teachers must reflect on the impact of each change on class engagement with math. To maintain open-ended questioning, teachers can use a clipboard with keep-thinking questions and track their frequency to monitor its influence on students' work. Students may need support with language development in some cases. Building a thinking classroom in mathematics requires creating an environment that encourages problem solving, critical thinking, and collaboration among students. This can be achieved by providing visual supports for math vocabulary and sentence starters to help students articulate their ideas while building confidence in their math skills. A teacher-centered approach is essential, where educators model the desired skills and offer support to students as they navigate challenging problems. By doing so, a collaborative classroom setting emerges, fostering a sense of community and student engagement. Personalized math tutoring with dedicated online tutors can significantly enhance student learning outcomes, particularly for those requiring extra support. Utilizing AI-powered tools like Skye, which employs proven pedagogy and curriculum, can help bridge individual learning gaps and accelerate progress. Several studies highlight the importance of collaborative problem-solving practices and student reasoning in mathematics education, emphasizing the need to create an inclusive and stimulating environment that values diverse perspectives. Now for Free Resources, Sample Tasks, and Classroom Strategies.