

Essential Components of Any Effective Mathematics Lesson

- **Active investigation:** students learn better when they are doing instead of just listening. To make a good lesson, teachers should ensure that they have put together lessons that ask students to investigate, explore, and make inferences and conclusions. Frequently this will involve group work, and this will often involve the use of physical materials such as manipulatives. Teachers should always be observing the progress of each group and each student in order to make sure that everyone is participating.
- **Learning goals identified:** teachers should be very clear about what students are expected to do. This includes calling attention to the concepts that a lesson is targeting, as well as creating assessments that are open and let students know what they are expected to produce.
- **Multiple representations:** a method of explaining that makes sense to some students may not make sense to others. Teachers should ensure, whenever possible, that each concept is approached from multiple angles so that the lesson has the greatest chance to reach each student. Teachers can check how well this worked by asking students to briefly explain the concept back to them in their own words – this makes for a good homework journal assignment.
- **Alternative strategies allowed:** nearly every mathematical task can be approached in more than one way, and it is much more important use a method that works for you than to conform to a standard method for solving a problem. Students should be encouraged to use whatever strategy makes the most sense to them, although teachers must ensure that the alternative strategies are sound; a strategy that reinforces misconceptions should be revised as soon as appropriate.
- **Differentiation, equity, and support for struggling learners:** it is unlikely that all students in a given classroom are at exactly the same level of skill and background knowledge. Every good lesson needs to have a plan for making sure all students can participate. This might mean adjusting certain components of the lesson to make them easier or more difficult. It also means scanning the references to real-world objects and situations, to make sure that students who are from different cultural backgrounds will not be excluded. All students should be encouraged to bring their personal experiences into a lesson whenever possible. Teachers should constantly be watching each student, to make sure that nobody is being left out on account of their skill level or personal characteristics.
- **Discussion and questioning:** conflict builds confidence and understanding. When possible, students should be encouraged to share their ideas with each other and learn from one another. When students share ideas and answers, this should be an opportunity for that student to justify their thinking, communicate mathematical ideas by speaking, and an opportunity for other students to ask questions. Teachers can also ask questions that lead students to confront their misunderstandings or deepen their knowledge. Teachers must monitor all students to ensure that they have a chance to participate in the processes of sharing their ideas and reviewing other students' ideas.

- Formative assessment: students need feedback from their teachers in time to apply it to their learning. Assessment should be a part of every lesson, because waiting until the end of a unit to assess is waiting until it's too late to fix problems. When teachers can help students understand what they've done well and what they should focus on next, it can be a powerful motivator as well. Teachers should make sure to think about ways that students can use the feedback given to them; feedback is wasted if it isn't used.
- Concrete connections to real life: a good lesson should connect somehow to the world around us. Students need to learn to see mathematics as something that affects our lives every minute. If a lesson focuses merely on abstract concepts that have no significance to real life, the knowledge may be lost as soon as students see that they no longer need it. To support this process, teachers should encourage students to think about where they've seen a concept used in real life; this can make for good discussion, especially if your classroom includes foreign students.
- Connections to other mathematics: this is another strategy for helping students learn. It is well known that the more connections we make in our understanding, the better we can remember and learn new things. Teachers should explicitly point out how a lesson connects to previously learned material, and this should be done whenever possible.
- Open-ended tasks, not algorithms: mathematics is not a collection of algorithms, although algorithms are very important in mathematics. Teachers should choose tasks that really challenge students to think. A good task will not have an obvious method that produces a simple answer, but rather it should challenge students to figure out what methods will help produce a solution. Teachers should watch and make sure that students are reacting well to being assigned these kinds of tasks. It can also help to give students some sort of choice that lets them incorporate their interests into an open-ended task.
- Something fun: games, literature, and projects can all be ways to make math fun at the same time as reinforcing important skills. Activities like these, which are more lighthearted, can go a long way towards improving student dispositions toward math, and also towards reducing math anxiety. Math anxiety is something teachers must particularly watch for if every student is to benefit from their lessons.