STEMD²

Ne'epapa Ka Hana (NKH) 2.0 | Professional Development Program

Authentic Social Learning

An Inclusive Teaching Model to Support Diverse Learners in Hawai‘i

Module Three: Using the ASLM for Inclusive Mathematics Instruction

Lecture 6:

The ASLM Guidelines for Creating Inclusive Learning Processes and Assessments

Guideline 3: Creating Inclusive Learning Processes with the ASLM Strategies

The ASLM strategies were developed to create an inclusive math classroom where all students have access to complex problem-solving and can still experience success. Module 2 explained the ASLM strategies and how they relate to authentic problem-solving. This training module will focus on how you can use the ASLM strategies to differentiate instruction and create access to math for all learners. When your students are engaged in learning with the ASLM strategies, you have time to meet with each group to provide small group instruction and correct any misunderstanding or misconceptions. Students are more comfortable asking for help as a group, so you are more likely to be able to help your learners when you meet with the entire group. As your students are working, take the opportunity to walk around and meet with the groups. You will find that students will be more willing to admit their struggles and ask for guidance when you approach them instead of waiting for them to ask for help.

Students can still use the ASLM strategies without technology. Students can use social exploration and perform research if you provide the students with resources for them to use on hard copies. You could also consider adding other sources of information besides in-class texts and handouts. For example, the use of videos projected for the class can also provide students with research and information they will need to be successful with their projects. Students could

also access their libraries if they have one and reach out to other classrooms, non-teaching staff, and members of the community. Consider bringing in guests with expertise or having your students write a letter.

The remaining steps in the project can be completed with or without technology resources.

Strategies and Examples for Creating Inclusive Learning Processes with the ASLM Strategies

For this module and the examples that follow, the students will be working to solve a STEM problem based on a project from STEMworks about using sunflower for biodiesel. Students will learn about how Hawai‘i is using sunflowers as a source for biofuel at www.stemworkshawaii.org. Currently, it takes one acre of sunflowers to produce 600 pounds of oil. For this project, students are going to calculate how much sunflower oil it would take to power one household for a year. Then, students are going to develop a new way of growing sunflowers that will conserve land and water to produce more biofuel.

To begin this project, students would use *social exploration* to research energy needs per household, farming methods, and water conservation. During *social ideation,* students brainstorm new farming methods for land and water conservation to increase biofuel production. In *social experimentation*, the students narrow their ideas to one solution that is tested and revised to create a final solution. Then, in *social validation*, the students would present their solutions. For this project, students could create a video of their ideas and send them to STEMworks (if you arranged it ahead of time). They could also present their ideas to other energy engineers in Hawai’i. While your students are working in social learning networks to solve this problem, you have a great opportunity to differentiate for your diverse students. As you meet with small groups and individuals, you can meet the needs of all of your students. You can use the following strategies to provide differentiation for your students.

Inclusive Learning Processes Strategy 1: Monitor and guide learning as students use the ASLM strategies.

As you move around the room, stop and check-in with the groups to guide them along the process. In small groups, the students will be willing to ask you questions and you can help guide their learning. Ask questions to be sure they are on the right track and answer any questions they may have. You will find that using small groups will not only enable students to be comfortable asking for help, but it builds stronger relationships between you and your students.

> ***Example:***
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> For example, if students are using social exploration, ask them about the resources they are finding for farming methods and water conservation. Ask if they are having difficulty finding additional resources. During social ideation and social experimentation, you can

help students as they develop their ideas and solutions. For example, if students are using mathematical formulas incorrectly, or are using the wrong units, you have the opportunity to correct their mistakes so they are on the right track moving forward. It is much more valuable to students learning to correct a mistake at the time it is made than to find out later that they were incorrect.

Inclusive Learning Processes Strategy 2: Assign high-needs students a specific topic to research to help their group.

Students will often assign specific research topics to each group member. Most diverse learners, even high-needs students, can find credible and valuable research for their team. But some students who need extra reading support may not be able to take on an entire topic by themselves. Some research topics require students to analyze and integrate available information, such as researching ideas for creating new farming methods. To differentiate instruction, you can assign different research tasks to different group members.

Example:

High-needs students may need extra assistance in finding resources. Students often struggle with research because they do not know how to effectively use keywords to get valuable results. As you walk around the room, check-in with your high-needs students to see if they need assistance. As you are working with students, you can give them a list of keywords to help them learn how to improve their research results. For other students, you can give them a list of websites that they can use. For students who need even more intervention, you can assign them as a research partner for another student. Understanding how much input or intervention is needed is based on several factors, such as eagerness to ask questions, their affinity for the activities, and their interest in engaging with you and/or other students and their specific IEP accommodations. Your expertise and knowledge of the student will help you determine which interventions to use. Their research partner could give them specific topics to research and they can work together to compile the information. For your higher-achieving students, talk to them and help them analyze their research.

Inclusive Learning Processes Strategy 3: Use technology resources to help learners be successful.

If you have students who have difficulties with reading or other academic areas, there are many free resources available to help them if you have access to technology. This training does not endorse any particular resources, but those listed below are a sample of resources that can be used to help students.

Example:

- Read&Write – free Google Chrome extension that can be added to any computer to read website text aloud.
- Voice Instead – free Google Chrome extension that reads text aloud with a human-quality voice
- Mercury Reader - free Google Chrome extension that removes ads and distractions to help students focus
- OpenDyslexic - free Google Chrome extension that converts a webpage into a font that is easier to read
- High Contrast - free Google Chrome extension that changes colors to create more contrast
- Visor - free Google Chrome extension that highlights one line at a time to help students stay on track when reading

Inclusive Learning Processes Strategy 4: Teach or reteach math concepts to individuals in small groups.

The most difficult part about teaching an array of diverse learners is providing individual instruction to students who need extra help. Often, this difficulty is not because teachers are unwilling or unable to provide the instruction, but because the students do not want to be singled out to receive help. First, because students are more comfortable getting help from peers, their peers may reteach the concepts in their groups without realizing that is what they are doing. To ensure individuals are getting the help they need, walk around and listen to their discussions. Listen for any misconceptions or misunderstandings so you can correct their mistakes early. You can reteach the concept to the group without singling out any individuals. Reteach the concept to the group in the context of their authentic learning task. The students will probably not realize you are reteaching; they will only see it as help on their problem-solving task.

Example:

For a project, students need to research how much energy the average annual household needs. Then, students will need to extrapolate that data to determine how much sunflower oil is needed to create that much energy. They will also need to calculate how many sunflowers it would take to create that much oil and how much land is needed to grow those flowers. In this example, if students calculate the annual household energy incorrectly, all of their calculations after that will also be incorrect. You have the chance to intervene throughout the process to ensure the students are arriving at viable solutions. First, ask the students to explain how they arrived at their answers. If their process or thinking was wrong, ask questions to help them find and correct their mistakes. If your discussion shows that the students did not understand a specific concept or how to perform one of the calculations, take the time to teach the concept to the group and help

them correct their mistakes. In this way, you are providing instruction for students who need it, but not for students who do not.

Guideline 4: Creating Inclusive Learning Outcomes with Formative Assessment

Inclusive lessons and assignments are something that most teachers consider when planning their lessons. But assessments, while being a major focus at some schools, are often not considered part of inclusion practices. There is not a lot you can do to make state and district-mandated testing more inclusive other than follow the testing accommodations for each student. However, you have a lot more freedom to create inclusive assessment practices in your classroom. The ASLM utilizes formative assessments to create inclusive assessments. Formative assessments extend far beyond standard quizzes. Not every formative assessment has to be recorded for a grade, but they can be. There is an endless array of formative assessments, some of which are provided at the end of this section.

Assessment is a crucial part of the learning process; it drives learning when it is appropriately aligned with the educational objectives. Planning assessments should occur simultaneously when you plan your lessons and assignments. Lock and Johnson (2015) stated that for each component of a lesson or project, you should consider how your students will demonstrate their understanding. The ASLM encourages you to teach mathematics through authentic learning tasks which can be difficult to assess with traditional assessments. Assessment of authentic learning tasks can be completed through performance assessments.

Using Performance Assessments for Inclusive Assessment

Performance assessments are a category of formative assessments in which your students perform a task to show their understanding. Performance assessments are open-ended and require your students to show their process and thinking rather than just provide an answer. Since the ASLM focuses on complex real-world problems using a variety of math skills and concepts, performance assessments are perfectly suited to assess the objectives.

Performance assessments do not have to be performance-based like skits or presentations. The goal of performance assessments is for your students to show that they have learned and can apply math concepts. A performance assessment can be your students explaining to you how they arrived at an answer. Authentic learning allows your students to apply math standards in real-world contexts. You can insert performance assessments throughout your authentic learning projects to make sure the students are mastering the concepts. The final product or presentation

serves as a summative performance assessment. The following table lists some ways that performance assessments can be used in the ASLM.

Examples of performance assessments:

Objective	Possible Performance Assessment
Solve problems involving scale drawings	Students create a scaled model of the classroom. The model must fit on their desk. The students set their scale, build the model and explain why they chose that scale for their model.
Calculate irregular areas	Students calculate the square footage of a non-rectangular building they design (irregular area). They have to show all of the measurements for each area of the building. They have to show the formulas and calculations they used. Lastly, the students justify why their formulas were appropriate.
Circumference of a circle	Students use various circles in the classroom to measure the circumference and the diameter. The students have to derive pi from their circles and prove the formula works based on their observations.

Strategies and Examples for Creating Inclusive Outcomes with Formative Assessment

No matter what type of formative assessment you use, to be effective, formative assessments should be embedded, ongoing, diverse, and used to guide instruction. As you plan your assessment, consider whether all students will have the opportunity to be successful in that assessment. You can even use different assessments for different students in the same lesson to help all learners to be successful. The goal is to determine whether your students learned the desired outcome. Effective formative assessments provide access for all students and are a great tool for assessing learning outcomes.

Inclusive Learning Outcomes Strategy 1: Embed your inclusive formative assessments in your instruction daily.

Teachers often feel that they do not have time to assess their students while they are trying to teach math concepts. Some teachers fear that they have to cover the curriculum and taking time for assessment stalls their progress, so they feel that they must move on quickly. Without time to reflect on and interact meaningfully with new information, your students are unlikely to retain much of what is taught. Formative assessments should not be an addition to your curriculum but embedded within it. You can use formative assessments to gather data every day. Try to check-in with your students daily to monitor their progress and ensure they are on the path to mastery.

Think of formative assessment as part of your lessons, not as something extra that has to be done. The improved understanding, engagement, and relationship-building created by formative assessments are well worth your time.

Example:

When you are walking around the classroom helping students as they are working in their social networks, you are using formative assessment. Formative assessments can easily be implemented in the ASLM. You can quickly assess understanding by listening to collaborative group discussions or asking questions to the group or individual. For example, you could give your students an authentic problem that requires them to use a specific formula, such as the volume of a cylinder. As you walk around to the groups you can assess their ability to use and understand the formula simply by asking questions to the group members. You could ask one group member to explain why that particular formula gives you the volume of a cylinder and how it relates to the area of a circle. You could ask another group member the process they used to find the volume of the cylinder. You could ask another group member how they know their answer makes sense. This is a great way for you to use inclusive practices by allowing students to answer questions at their level of understanding. If a student is not progressing as they should, provide guidance or instruction to help that student get back on track. You can allow the students to help one another if that meets your assessment goals. By asking these questions, you are assessing their understanding of the formula, how to use the formula, and determining reasonable answers all without having to find the time to give a quiz.

Inclusive Learning Outcomes Strategy 2: Provide options for formative assessments to promote inclusion.

Providing students with options in their lessons creates a sense of autonomy that increases engagement and motivation. Similarly, providing students with options to show their understanding increases the likelihood that your students will be successful. You have the opportunity to increase autonomy in assessment also. Every student has a different set of strengths and weaknesses. Some students are strong writers and would prefer to explain their work in writing rather than aloud. Other students are verbal and would prefer to explain their work to you. To ensure that all of your students have the same opportunity for success, design your formative assessments to be diverse and individualized. Of course, you will occasionally want your students to work outside their comfort zones to promote growth, but probably not during assessments.

Example:

If you are assessing your students' ability to use sample data to make predictions about a population, you can give your students a list of options that they can use to choose how they would like to show their understanding. Students can pick the method they are most

comfortable using which increases their confidence and motivation. Some possible options for your assessments are listed below.

1. Ask 15 classmates about their favorite color and record your data. Use that data to predict how many people in a school of 400 students would prefer each color. Allow the students to represent their work in tables, graphs, charts, or diagrams.
2. Find an article online that reported data from a sample of the population. Use that data to predict how many people out of 5000 would give the same information. Be sure to cite your source. Allow the students to represent their work in tables, graphs, charts, or diagrams.
3. Roll a number cube and spin a colored spinner. Record your number and color. Repeat this 15 times and record your data. Use your data to determine how many times you would expect to get each combination if you repeated the experiment 250 times. Allow the students to represent their work in tables, graphs, charts, or diagrams.
4. Look at the lunch choices of 20 random students in the cafeteria and record your data. Use your data to predict how many of the 175 students at the next lunch would make those choices. Allow the students to represent their work in tables, graphs, charts, or diagrams.

Inclusive Learning Outcomes Strategy 3: Use formative assessment to provide feedback to improve student achievement.

The goal of formative assessment is to gather evidence that helps you lead your students to mastery. Therefore, assessment data should be shared with your students immediately so they can make the necessary adjustments to achieve mastery. Feedback can only make a positive change when it is done while the students are still learning a concept, so feedback should be given immediately when the mistakes are occurring. Cornelius (2014) explained that monitoring student work to make instructional adjustments and provide feedback helps you be more effective. Lock and Johnson (2015) stated that "feedback needs to be timely, specific to the learning task outcomes, and demonstrate analyses for possible opportunities and challenges". Specific and immediate feedback is the only way your students will know what skills they need to improve or what changes they need to make to move toward mastery. Students cannot make corrections if they do not know what needs to be changed. Feedback can be provided by helping a student find their mistake in a math problem or asking guiding questions to help their thinking. The ASLM provides the ideal environment for shared data and discussion through small group and individual meetings. When you meet with groups or individuals, focus on the positive growth of your students. Focus on how improving specific skills will improve the students' understanding and performance. If you view feedback as an opportunity to help your students improve, they will view it the same way. Strive to make your assessments and feedback a

comfortable and natural part of your classroom. When your students feel like you want to help them, they will be more willing to ask questions when they need help.

Example:

If students are learning to solve equations, they will likely repeat the same error until the teacher intervenes and corrects misconceptions. In traditional classrooms, the teacher provides instruction, models some examples, and gives the students an assignment. Sometimes, due to circumstances beyond the teacher's control, the assignment might be graded and given back several days later. In that case, the student will have continued making the same error every day; when the student gets the assignment back with a low score, he still may not know why he scored low. Instead, while your students are working on solving equations, walk around and check their work as they complete it. If a student makes an error, make an effort to correct it right away. Point out their mistake, explain what they did wrong, and allow them to fix it. The student will be much more successful because the correction was made immediately. In another example, if students are solving complex authentic learning tasks with multiple steps, provide feedback at regular checkpoints along the way. Allow the students to correct their errors before moving to the next step. This will create a much stronger final presentation.

Inclusive Learning Outcomes Strategy 4: Use formative assessment to guide and differentiate instruction.

The goal of assessment is to guide instruction, so use your assessment as the basis to differentiate your instruction. Guskey (2007) suggests that for assessments to become an integral part of the instructional process, teachers need to change their approach in three important ways. Use the results of your formative assessments to differentiate instruction for your students. Once you have assessed learners, there may need to be an action as a result of your assessment. You can use the results to group students who may need small-group instruction to reach mastery. Use formative data to determine which students are struggling and need a different approach and which students are ready to be challenged at a higher level. You can provide different assignments for different levels of students based on your formative assessments. These ability groups are not the same as social learning networks; the ability groups are designed for you to provide targeted instruction to the students who need it. You may have a group that needs reteaching, a group that needs additional practice, and a group that has mastered the concept and needs more challenging material.

Example:

In any lesson, you may have a small group of students who are struggling with the concept. These students will need to be retaught with a different approach. One way you can help these students is to work with the small group while their classmates are working on more challenging problem-solving applications of the concept. You can also

provide them with technology resources so they can access the information in a new way. After you have re-taught the lesson, give the students the opportunity for reassessment to show that they have mastered the concept. For the group of students who did well on the assessment, but missed some questions, you can give them additional, slightly more challenging questions on solving equations. It is helpful to allow these students to work in social networks to help one another be successful. You should check in with them to ensure they are being successful and see if they have any questions. You may have another group of students who have mastered the concept; these students can benefit from a deeper understanding through challenging authentic problem-solving tasks. It is beneficial to allow these students to work in social networks to challenge one another. You can ask the students to find different applications for solving equations. For example, firefighters have to calculate the amount of water they need to fill their truck water tanks. You can also give these students extension activities from the NKH 2.0 materials that they can work together to solve. Challenge them to always justify their answers in a different way than they originally solved the problem. Using formative assessment to differentiate instruction allows you to create inclusive classrooms that meet the needs of all of your students.

A Small Sample of Formative Assessments

Formative assessments can be done in a variety of ways. The following list is just some general ideas for assessing math content and processes. Your formative assessments should be ongoing daily, but should not be the same every day. Based on their learning styles and academic strengths, different students will prefer different assessment types. While it is good to provide a menu of options when you can, you also want to expose your students to different assessments. This list is not exhaustive and you are free to be creative and find assessments that fit your needs and the needs of your students.

Summaries and Reflections

Ask your students to stop and reflect on what they learned and write a summary of their understanding. Require that your students use content-specific language. For example, your students could write a reflection providing an example or explanation of why numbers are not rational, in their own words.

Lists, Charts, and Graphic Organizers

Your students can organize information, make connections, and note relationships through the use of various graphic organizers. For example, you can use organizers to

help students chart weather patterns and plant growth for a math project or create a Venn diagram of two math concepts.

Visual Representations of Information

Ask your students to use both words and pictures to define a word or show a solution. Visual representations can help your students make connections and remember concepts, facilitating retrieval of information later on. This dual-coding helps address your classroom diversity and different learning styles. For example, your students can demonstrate their geometrical understanding and application of the Pythagorean Theorem in real life through a photo scavenger hunt. Ask students to take digital pictures of real-world applications of math concepts.

Creating Models

Your students can construct models to illustrate their understanding of mathematical concepts. For example, your students could fill various objects with water and then calculate their volumes by measuring their dimensions and comparing their findings with actual volumes using measuring cups.

Exit Cards

One of the easiest formative assessments is the exit card. Exit cards are index cards (or sticky notes) that your students hand to you, deposit in a box, or post on the door as they leave the classroom. On the exit card, your students write their names and respond to a question, solve a problem, or summarize their understanding after a particular learning experience. Read the responses and use the data to inform instruction. You can use exit cards to form needs-based math groups that need re-teaching of the concept differently. You can also use them to identify which students are ready to be challenged at a greater level of complexity.

Checklists

An easy way to observe and assess student growth is to walk around the classroom with a clipboard or sticky notes. As you notice the acquisition of a new math skill or confusion and struggle with a skill, record the student's name and jot down a brief comment. Use the data to focus on the needs of individual students through discussion with each child or group.

Spreadsheets

Another way to keep track of the data is to use a spreadsheet. The spreadsheet functions the same as a checklist on a clipboard but can show progress over time. You can use a system of check-minus, check, and check-plus or the numbers 4, 3, 2, 1 to indicate student proficiency with the skill.

Checkpoints on Lengthy Assignments or Projects

Your students can easily get off track during long assignments. As suggested in the authentic learning section, set due dates for certain parts of the project to be turned in at different intervals for early feedback. This allows you to help your students correct any errors in understanding and allows the student to make adjustments to ensure a successful finish to the project. Provide feedback to help your students complete a successful project.

Guided Questioning

The easiest way to assess student progress is to simply have discussions with your students and ask them clarifying or guided questions. By asking questions you can quickly assess the level of understanding of an individual or a group. Asking guiding questions serves to assess your students, strengthen relationships, and provide immediate feedback on their progress. Guiding questions also help the students use self-assessment.

Social Technology

Peer-assessment is easily implemented through online collaboration tools, blogs, and discussion boards. Students can provide feedback to one another through social technology. Social technology used for assessment and feedback is effective in connectivist classrooms and creates an environment of support and collaboration.

Possible Pitfalls to Avoid in Implementing the ASLM Guidelines for Teaching Inclusive Mathematics

Do not think of formative assessments as an extra task added to your lesson.

Your formative assessments should be part of your lesson. If you try to add it as an extra task, you may become overwhelmed and frustrated. If you look at your current practices, you are probably already using formative assessments, but you just have not thought of them as assessments.

Do not **reteach the same way you taught the concept the first time**.

> If you have students who need to be retaught a particular concept, you have to approach the lesson in a new way. If they did not understand it the first time, teaching it the same way again will not have different results. Use websites, videos, or manipulates to vary your teaching methods. Ask other teachers if they have other strategies for teaching that particular concept.

Differentiated instruction does not mean you have to create completely different lessons for every student.

> Differentiated instruction simply means you are providing each of your students with strategies that allow them to achieve success. The strategies of the ASLM are designed to differentiate instruction. Often just allowing students to access their social networks and technology provides the differentiation your students need. As you build relationships and get to know your students you will learn what they need to be successful.

Formative assessments do not replace summative assessments.

> Formative assessments are used to ensure that your students will achieve mastery on summative assessments. When you incorporate formative assessments and provide valuable feedback, your students should be more successful during their summative assessments.

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