EMTH 355 Mathematics in the Inclusive Classroom
Template for Evaluation & Modification
of Mathematics Lesson Plan
Final Assignment Option

Created by Alyssa Mozel
Student ID: 200232906

Topic/Title of Lesson: Solving Linear Equations in the Form (x + a = b)	**Class Name and Level(s):** Grade 7	**Date:** November 12, 2024

Pre-teaching….

Adjustments to ensure equity:

Teaching Strategies: Direct Instruction, Partner or Group Work and Correcting, Individual or Small Group Instruction (if needed)

Visual Aids: Concrete Manipulatives, Drawn Representations

Auditory Elements: The Song

Kinesthetic Elements: Concrete Manipulatives

Other: Plenty of Teacher Monitoring, Less Questions Required to be Completed, More White Space on Paper for Showing Work, Plenty of Formative Feedback, Options for Students who Wish to Challenge Themselves

List Key Vocabulary for Lesson:

- Addition of Integers
- Subtraction of Integers
- Variable
- Integer

List and think about the Outcomes and Indicators:

P7.4 : Demonstrate an understanding of linear equations of the form x + a = b (where a and b are integers) by modeling problems as a linear equation and solving the problems concretely, pictorially, and symbolically.

a) Represent a problem with a linear equation of the form where a and b are integers and solve the equation using concrete models (e.g., counters, integer tiles) and record the process symbolically.
b) Verify a solution to a problem involving a linear equation of the form where a and b are integers.

(*Ministry of Education of Saskatchewan*, Grade 7 Mathematics Curriculum, 2007)

Lesson Opener…..

Comment upon the Strategies used to ***link prior knowledge/personal experience*** to this lesson:

1) Group Brainstorm for definitions of what integers and variables are and what they can look like.
    a. Keep these examples and definitions displayed on the board for students to reference later in the lesson, or have students create notes as you are doing the brainstorm.
    b. If students have a vocabulary list, the teacher should ensure that students have added these definitions and examples to their lists.
2) Review the rules surrounding the addition and subtraction of integers through examples done in a "We Do" format.
3) Could possibly review the method to verify the answer to a linear equation through examples done in a "We Do" format (if the students have already learned this; may have to quickly teach this if the teacher wants this to be a part of this lesson).

My Comments:

I think that the group brainstorm idea is great as long as you have a class that is willing and ready to participate. I have had a few classes that were quite quiet and unwilling to put themselves out there by answering, so the group brainstorm strategy can make reviewing prior knowledge difficult to accomplish. Although, you can simply ask students to look into their previous notes to find the answers and examples if they become quiet.

I think that the "We Do" format for reviewing the addition and subtraction of integers and how to verify answers is great. It gives students a chance to be guided in a couple of practice questions and promotes the remembering of the process through repetition.

One thing I would maybe add is a reference to the real-life application of linear equations. It is a bit early for this as they would be learning only the addition version of linear equations and would need to move to an ax + b = y format in order to fully understand most real-life examples, but it may be a good idea to show students what they are working towards. This link provides a few solid examples of real-life application: https://sciencing.com/use-algebra-real-life-5714133.html

I Do (teacher demonstration)

- The teacher goes through four examples of how to solve different linear equations that are in the form x + a = b. These can be written on the white board/SMART Board.
    - These examples should have a < 10 just to start off.
    - Two examples should have the answer becoming a negative integer.
    - Make sure **you** are showing and thoroughly explaining each step of the solutions. Additionally, point to mathematical reasons as to why those steps need to be done and ensure students either have or write down these reasons.

Students should either be given time to write down the equations or be given sheets of paper with the equations already printed out. If the pre-printed version is chosen, there should be plenty of white space between the equations to ensure students have enough room for the solution (The pre-printed form would also make it easier for accurate visuals to be incorporated in the notes if that is needed.)

We Do (strategies to encourage competence and peer to peer learning)

- Similar to the "I Do" step, the teacher will guide the class through solving 4 linear equations. Student input should be asked for and used as the primary method of solving each equation. These can be written on the white board/SMART Board.
    - The first two examples should have a < 10.
    - The last two examples should be ones where a > or = 10. The teacher can use these examples to determine who may struggle with integer addition and subtraction with two-digit numbers.
    - Two examples should have the answer becoming a negative integer.
    - Make sure **students** are identifying and explaining each step of the solutions. Add to explanations, prompt students, and give encouragement and praise where it is needed/when it is possible.

You Do (strategies to encourage independence)

- Students will be given worksheets with 10 linear equations.
    - Half should have a < 10, and the other half should have a > or = 10.
    - Additionally, close to half of the answers should be negative integers.

- Students will be encouraged to work with a partner or group of three, but can choose to work alone. Correcting/checking work will have to be done in pairs or groups of three (may not happen that same day).

Comment upon anything you see that promotes (or could promote) *positive attitudes* in the lesson plan….

The part in the "We Do" section about praise and encouragement can really help to promote positive attitudes toward the lesson's math. Even saying something like "Good guess!" or "That's almost correct. You're just missing a small part" can encourage students to keep trying. The teacher should also be expressing confidence in the kid's abilities throughout the entire lesson and work period. This can be implemented when the teacher is going over the fundamental skills at the beginning of the lesson: the act of which can also help reduce math anxiety for the main parts of the lesson. Explicitly acknowledging that the math concepts and skills are difficult to understand and master can also help students to feel like the teacher is on their side and is willing to do whatever they can to help the students succeed. The knowledge that they have someone who is willing to put in the work to ensure they succeed can cause students to see mistakes as the learning opportunities they really are. Further, creating an environment where mistakes are celebrated and used as learning opportunities in positive ways will help to reduce any math anxiety that some kids may have. Although, this must be implemented prior to this lesson. The safe space that is created through these practices makes students' complete frustration harder to come by, and it can almost eliminate the possibility that students will see their math teacher as an adversary (someone who is actively working against their success).

I could have added something in "We Do" section saying to not call on specific kids, especially those who you know or suspect may struggle with the concepts and skills. Calling on those specific kids without them putting their hands up, for example, could cause them anxiety. If we want to promote positive attitudes in the students that struggle, trying to answer a question in front of the whole class is something that the students themselves should choose.

List *and* comment upon Instructional strategies used.

Instructional Strategies Used: Direct Instruction, Partner or Group Work and Correcting, Individual or Small Group Instruction (if needed)

Direct Instruction is something that we learned can help students with math difficulties and is often their preferred method of learning math. Explicitly explaining every step and the reason why it is done in that specific way can help students with math difficulty to understand the rules and logic of mathematics that much easier. With what I have learned, this method of instruction seems to be incredibly crucial to the learning of students with math difficulties and needs to remain in this lesson.

Partner/Group Work and Correcting can allow students to help each other better understand the math concepts and skills being taught as well as expose them to different ways of understanding that math. It can also help students with math difficulty to pick up and then use the strategies of other students. The option to work in partners can also make the experience of learning math more fun and rewarding. The benefits of this instructional strategy can help to promote positive attitudes, teamwork, and decrease math anxiety in a math class. Positive attitudes, decreased anxiety, and a sense of comradery can allow students to be more ready and willing to learn math instead of hating and avoiding it.

Individual or Small Group Instruction can be done if an individual or a group of students did not quite pick up on a particular rule or concept during the whole-class direct instruction. This help would only be given as needed and could be used to go through a couple more examples with students who are struggling and/or have math difficulties. This strategy would help to ensure that those students are not left behind in their understandings of math. (This instructional strategy is emphasized below.)

How explicit the instruction is for the content.…does it seem appropriate?

Since this would be the first time the concept and skill would be introduced, I do believe that the level of explicitness is appropriate. I especially believe this in regard to the reviewing of foundational skills. It may seem a bit excessive, but I would want to make sure that the students have, and are reminded of, those foundations. The concept of linear equations is incredibly difficult to understand without a good grasp on those foundational concepts, and I have seen plenty of students get stuck on linear equations and fall behind their peers due to an inadequate review of foundational skills.

How does this lesson accommodate students with MD (Math Difficulties) ***AND*** accelerated learners: (How effectively does it meet a diversity of needs in the mathematical classroom? Why or why not?)

The lesson, without the add-ons mentioned below, meets some of the needs of students with math difficulties. There are multiple examples given through direct instruction, and there are multiple examples where students with math difficulties can try to solve linear equations alongside the teacher by suggesting answers out loud or working through it in their head. The many examples should promote some understanding through repetition, and the explicit explanations should help to add to students' understanding of linear equations. Additionally, the progression of difficulty is slower, which should accommodate the students with math difficulty who need more examples and more time to grasp a math concept. The option of pre-printed notes with equations already down should help the students who have trouble with taking notes. Individual/Group Instruction, done after whole-class Direct Instruction, should help the students who need a little bit more repetition and time with the teacher to fully grasp linear equations. As mentioned above, working with a peer can also help students, especially those with math difficulty, to pick up more helpful strategies and maybe adopt a peer's way of understanding the math that is easier to understand than the teacher's method. Pre-Printed notes, a slowly increasing difficulty, more examples and in-depth explanations, direct instruction, repetition, group/peer work, and extra instruction from the teacher should help to accommodate difficulties with note-taking, memory, accurate strategy finding and using, and accommodate many students with math difficulty's need for extra time to grasp new math concepts. All of these aspects included in the lesson would likely meet some of the needs of students with math difficulties in any class.

However, there are still plenty of needs that students with math difficulties can have that are not being accommodated in the lesson above. What about physical and visual aids/strategies that can help these students? What about regular monitoring and more formative feedback?

Accelerated learners are not accommodated at all in this lesson. The material itself could be challenging enough for some of them, but there may be a kid that needs more of a challenge. What could be added to ensure that this student is challenged with this form of linear equation?

Now, ADD in THREE Differentiation Ideas Tucker, Singleton & Weaver (2013) & Gurganus 2017

1. Broaden Lesson Development…
    - Connect concepts to real-word
    - Wide array of examples & non-examples
    - Laboratory approach
2. Visual Input
3. Kinesthetic Activity
4. Communication (Co-op Learning, Peer Tutoring)
5. Monitoring
6. Implicit in 2 & 3 is CRA (which we will spend an entire lesson on)

First Tucker, Singleton & Weaver (2013) Strategy

1) CRA with concrete manipulatives, drawn representations, and abstract representation.
    a. Students' understanding can stay at the representative level due to the indicator requirement, but you should encourage students to get to the abstract stage. (The abstract stage could be used to challenge accelerated learners during this first lesson.)
    b. Concrete manipulatives can be used and reset fairly easily and without teacher involvement for this lesson/concept.
    c. Students will likely need to work in pairs or small groups depending on how many manipulative sets there are.

The concrete manipulatives should be introduced at the "I Do" stage and used throughout the rest of the lesson. The teacher should simultaneously teach and model the use of concrete manipulative while representing the numbers on the board with tallies/drawn blocks. The abstract representation should be written up alongside the drawn representation to ensure that students understand that the blocks and written numbers represent the same thing. Students with math difficulty can continue to use the concrete manipulatives throughout the worksheet, while the rest can use the manipulatives but will still be expected to draw blocks or tallies. Students with math difficulty may need to use the manipulatives for an extended period beyond this lesson.

Second Tucker, Singleton & Weaver (2013) Strategy

2) There should be plenty of examples during Direct Instruction, and there should options to choose from during practice.
    a. Teachers should try to 'read the room' during direct instruction to figure out whether or not students need more examples at the "We Do" stage. Teachers can also just ask students if they want to go through another example or two to make them feel more comfortable with moving to a more individual practice.
    b. Extra questions on the worksheet with "a" being a single digit number can help ease students with math difficulty, and students who are struggling, into the concept of linear equations.
    c. Extra questions on another worksheet with double- and triple-digit numbers in the "a" spot could be used to challenge accelerated learners. Extra questions with "a" numbers having decimal places could also be used to challenge accelerated learners.

Accelerated learners may need a quick small group, mini-lesson for some of these extra questions, but the lesson would likely take no more than 5 minutes if they have truly grasped the general rules of solving $x + a = b$ linear equations.

Third Tucker, Singleton & Weaver (2013) Strategy

3) Teachers should be continuously monitoring students for understanding during direct instruction, working time, and the correcting period. Teachers should be able to recognize when extra help is needed and give that extra help to the ones who are struggling and/or deal with math difficulty.
   - **a.** As mentioned by Tucker, Singleton, and Weaver, students who struggle the most should be identified and should be prompted to attempt the easiest versions of the chosen problems first.
   - **b.** The teacher should attempt to monitor the students with math difficulty the closest during the worksheet period and attempt to catch any misunderstandings early. If the student continues to make that mistake, the teacher will know they need to give some extra help to or re-teach the concept and skill to them.

It may also be helpful for this lesson's worksheet be formative instead of summative. Collecting the peer-corrected sheets would allow for an increased level of monitoring and feedback for all students. This will also allow for the teacher to conduct an error analysis on the students who are struggling with these linear equations or point out something that a student may have missed or misunderstood. With the data gathered by doing all of these things, teachers can determine the next steps they need to take to ensure that students do not fall behind their peers.

Now, ADD In THREE Strategies from SHMER (Bender 2010)

- Songs
- Humour
- Emotional Tie-in to Learning
- Movement in the Classroom
- Repetition

First SHMER Strategy

1) Linear Equations Song to Training Season by Dua Lipa

Are you (pause) the math that I make a graph with?
Or just the pattern that I'm drawn to?
It can be hard to figure out these applications.
There are, different variables in there.
Anything else?
Some integers there.
And yea, I don't need to learn this lesson twice.

But if I really need a refresh,
I should know that,

These equations need to be balanced, do to both sides the same thing.
Addition and Subtraction first, Multiply or Divide last.
When I graph it all, use calculator for help,
It's going into overload, got me feeling undefined.

Can you really see the straight line?
Plot the coordinates to prove it.
Is slope positive or negative?
'Cause that's important too, yea.

The song follows the beat from the very beginning of the song to the end of the first chorus. It includes everything that I could remember about linear equations, and I hope I did not miss something important. Some words are a bit rushed, but I did my best to ensure that it was at least somewhat easy to sing despite that.

This song can be introduced either at the beginning of this lesson, or when the students are learning about or reviewing graphing linear equations or slope prior to this lesson. With regular repetition over the course of a week or two, this song could be one that they use to remember/memorize most of the qualities and properties that linear equations can have.

Second SHMER Strategy

2) Use Partner Learning/Work Buddies.
    a. While working with a partner or small group is already mentioned in the above lesson, peer learning is slightly different than just putting their heads together to solve problems. Partner Learning "has students complete problems on their own and then explain to a partner how they did so" (Bender, 2010, p. 5).
    b. This structure can ensure that students with math difficulties or who are struggling are learning from peers that do not struggle as much. There would be many opportunities where students with math difficulty can pick up strategies or new understandings from those peers, for example.
    c. Working with a trusted buddy can help to minimize a child's fear of and anxiety caused by math. It can show students that they are not the only ones who struggle with math. Doing math with a partner could be at least one small thing that a struggling student can look forward to, or it can make math a fun and enjoyable experience.

Partner Learning will not work for every student. Some students may dread partner work, because they may feel that their "weaknesses" or "faults" are out for display/visible to that partner. A lot of students may fear that bullying will come out of this practice. Teachers must do their best to ensure that the partner can be trusted not to do that, and/or create an environment among the students that is accepting of and welcoming to differences in abilities.

Third SHMER Strategy

3) To make math less demanding and less stressful for students with math difficulty, the teacher should decrease the number of questions the student is required to answer.
    a. The teacher should also ensure that the worksheet has a sufficient amount of white space for drawn representations.
    b. This strategy can be even more effective when paired with increased monitoring and feedback. This would lead to short assignments, a faster marking turnaround, and therefore more regular and consistent feedback. Consistent feedback can help a student with math difficulty also become less stressed and anxious about math by showing them how much progress they are making.
    c. This strategy is also one that minimizes math anxiety and can make math more fun. The less questions there are, the less pressured the student with math difficulty will feel. If the student needs extra time to think in order to answer these questions, especially since they are based on a newly introduced concept, there is no reason for them to be stressed out about completing everything within the class's time limit. Teachers should want quality answers and understandings more than they want a certain number of questions completed.

This decrease in questions would happen during the "You Do" phase. The teacher could tell the student with math difficulty to only do 5 of the questions, the first 5 with drawing the representation, the first 5 with only concrete manipulatives, or some other combination. It would all depend on where the student is at in their understanding and ability. If the teacher feels the student with math difficulties can achieve it, they can encourage the student to do more than 5 questions but still only require 5 to be done. Once again, it all depends on that individual student and their abilities.