Instructional Design Plan

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Among the students I tutor, several concepts in mathematics repeatedly emerge as problem areas: integer operations, order of operations, converting between fractions, decimals and percents, and word problems. The Instructional Design Plan is based on Gagné's nine events of instructions. The two objectives detailed in the plan are associated with the order of operations problem area.

Objective 2.2: The learner will accurately explain PEMDAS.

Design Sequence	Description	Objective(s)	Time	Instructional Strategy	Media (Technology, Worksheets, etc.)
Gain Attention	Pre-instructional Strategy	2.2	1 min	The instructor will show the Khan Academy video located at https://www.khanacademy.org/math/pre-algebra/pre-algebra-arith-prop/pre-algebra-order-of-operations/v/introduction-to-order-of-operations which presents a basic math expression, and the dilemma of knowing how to solve it. Stop the video at 00:31. The math expression presented is 7 + 3 x 5.	Computer with Internet, video, instructional handout
Inform Learners of Objectives	Pre-instructional Strategy	2.2	1 min	Present the objectives as a pretest. (The instructor will ask the following questions, but the learners are *not* expected to answer them at this point in the instruction): • Why do we need to know the order of operations? • What is an easy way to remember the order of operations? These questions will also be displayed on a PowerPoint slide.	Computer, PowerPoint
Stimulate Recall of Prior Learning	Pre-instructional Strategy	2.2	1 min	Since the learners have completed elementary school, they have experience with whole number	Instructional handout

				addition and multiplication. The learners will answer the following questions: • "What does 7+3 equal?" • "What does 3x5 equal?"	
Present Stimulus Material	Initial Presentation	2.2	2 min	The instructor will explain, "'When a mathematical expression contains more than one operation, its value may depend upon the order in which the operations are performed. To avoid confusion, mathematicians have agreed to perform operations in a certain order' (Kaplan, 2015, p. 124). This is called the order of operations." Show the video located at https://www.youtube.com/watch?v=ZzeDWFhYv3E that describes the order of operations and the mnemonic PEMDAS: "Please Excuse My Dear Aunt Sally" for Parentheses, Exponents, Multiplication or Division, Addition or Subtraction.	Computer with Internet, video
Provide Learner Guidance	Initial Presentation	2.2	8 min	The instructor will do a step-by-step review using PEMDAS for both of the math expressions presented in the "Present Stimulus Material" video above (since the video went through them quickly.) The math expressions are • $8 \div 2 - 2^2 + (2 \times 4)$ • $4 - 9 \div 3^2 + (2 \times 6)$	Instructional handout, white board, markers, eraser

Elicit Performance	Generative Strategy	2.2	8 min	The learners will practice saying the PEMDAS mnemonic ("Please Excuse My Dear Aunt Sally") and will explain what each letter represents. They will include the "left-to-right" rule associated with multiplication/division and with addition/subtraction. The learners will verbally explain why the order of operations is important. The learners will use PEMDAS to determine the answer to the initial problem: 7 + 3 x 5.	Instructional handout
Provide Feedback	Generative Strategy	2.2	5 min	The instructor will check the learners' answers to determine their understanding of PEMDAS, and will praise the learners for their active participation in today's lesson. The instructor will show the remainder of the Khan Academy video located at https://www.khanacademy.org/math/pre-algebra/pre-algebra-arith-prop/pre-algebra-order-of-operations/v/introduction-to-order-of-operations to show what happens when PEMDAS is not followed compared to when it is. Start the video at 00:31. Stop the video at 04:00. If any learners still have questions, the instructor will answer them.	Computer with Internet, video, instructional handout

Assess Performance	Post-Instructional	2.2	5 min	The learners will individually answer the pretest questions: • Why do we need to know the order of operations? • What is an easy way to remember the order of operations? The instructor will collect the learners' answer sheets.	Instructional handout
Enhance Retention and Transfer	Post-Instructional	2.2	4 min	The instructor will say, "Today we have learned about the order of operations, why it is necessary, and a way to remember it." The instructor will ask the learners to share in their own words what they learned today. The instructor will answer any questions the learners may have.	
Total Time			35 min		

Objective 2.4: The learner will compare three solutions and determine which one is correct following the order of operations.

Design Sequence	Description	Objective(s)	Time	Instructional Strategy	Media (Technology, Worksheets, etc.)
Gain Attention	Pre-instructional Strategy	2.4	3 min	The instructor will ask the following questions and will let the learners respond: • Who has Facebook? • Who has seen the math puzzles with pictures, and people are supposed to figure out the answer based on the items in the picture? • Does anyone have a short story about what they've seen happen based on the answers people give for those puzzles? After the learners have answered, display a screenshot of a sample puzzle from Facebook with people's answers and comments.	Computer with Internet, projector
Inform Learners of Objectives	Pre-instructional Strategy	2.4	1 min	Present the objectives as a pretest. (The instructor will ask the following questions, but the learners are *not* expected to answer them at this point in the instruction): • How can we use the order of operations? • What happens when the order of operations is not followed?	Computer, PowerPoint

				These questions will also be displayed on a PowerPoint slide.	
Stimulate Recall of Prior Learning	Pre-instructional Strategy	2.4	4 min	The instructor will review what PEMDAS is with the learners and will ask why it is used.	
Present Stimulus Material	Initial Presentation	2.4	2 min	The instructor will present a picture of a math puzzle that depicts different objects, mathematical operations, and their resulting values, which will be similar to the one shown in the "Gain Attention" step. The instructor will inform the learners that they will be able to solve this puzzle after practicing with standard order of operations problems (with numbers, not objects).	Computer with Internet, projector
Provide Learner Guidance	Initial Presentation	2.4	15 min	The instructor will distribute a worksheet with ten order of operations problems. The instructor will provide guided practice with the learners for problems 1 – 4, and 8.	Instructional handout, white board, markers, eraser
Elicit Performance	Generative Strategy	2.4	8 min	Using the picture from the "Present Stimulus Material" step, the instructor will explain what each object is and demonstrate how to find the first object's value. The learners will participate in determining the values of each of the remaining objects. Using the objects, a mathematical expression will be presented along with three possible solutions, but only one solution is correct. The learners will examine each of the	Computer with Internet, projector, instructional handout, white board, markers, eraser

				solutions and follow the step-by-step operations provided to determine which solution is correct based on the order of operations, and the learners will identify where the error occurred in the other two solutions.	
Provide Feedback	Generative Strategy	2.4	7 min	The instructor will review the math puzzle from the "Elicit Performance" step with the learners. With each step, the learners will share their ideas and results. The instructor will provide corrective and remedial feedback and will answer any questions the learners have. The learners will be praised for their diligent work today.	Instructional handout, white board, markers, eraser
Assess Performance	Post-Instructional	2.4	15 min	On the worksheet provided in the "Provide Learner Guidance" step, the learners will complete problems 5-7 and 9-10 independently. They will also be given another math puzzle to solve independently. The instructor will collect the learners' worksheets.	Instructional handout
Enhance Retention and Transfer	Post-Instructional	2.4	5 min	The instructor will say, "Today we practiced using the order of operations with standard numeric problems and picture-based math puzzles. We determined the answers to the questions: • How can we use the order of operations?	Computer, PowerPoint

				• What happens when the order of operations is not followed?” The instructor will ask the learners to share in their own words their answers to the above questions and what stood out to them today. The instructor will answer any questions the learners may have.	
Total Time			60 min		

References

Kaplan GED test mathematical reasoning prep 2015. (2015). New York, NY: Kaplan Publishing.