Course: Teaching of Mathematics (6409)
Semester: Spring, 2021

ASSIGNMENT No. 2

Q. 1 Discuss different methods of teaching fractions and decimals to elementary school students, provide examples to justify the effectiveness of the methods discussed.

A good strategy to introduce fractions is to connect to prior knowledge. In this strategy, you explain that we use fractions throughout our day, sometimes without realizing it! For example, ask students to think about dividing up a cake to understand what a fraction means.

There's one cake. We cut that cake into pieces or parts. We can describe how big our piece of cake is in relationship to the whole cake using a fraction. The fraction tells how many pieces we have out of all the pieces in the whole cake. In fractions, the pieces are usually the same size or cut into equal parts. This gives us an idea of how big our piece of cake is.

The denominator, or bottom number of the fraction, tells how many total equal parts we have. For example, if we cut the cake into 5 pieces, the denominator would be 5. After we have cut up the cake, we must decide how many pieces of the cake we want to give out. The number of pieces that we want to give out would be the numerator, or top half of the fraction. If we give out 2 pieces of the cake, for example, our fraction would be 2/5, because we gave out 2 pieces out of 5 possible pieces of cake.

Another technique to introduce fractions is to jot and share. Here's how to do it:

1. Write the fraction 1/2 on the board.

2. Ask and write, "Where have you seen the fraction (1/2) before?"

3. Record student responses on the board or chart paper.

4. Students have likely had experiences with fractions in their daily lives. Some students may have seen fractions on measuring cups or on a measuring tape. If they haven't, they'll hear about their peers' experiences and/or you'll create a hands-on experience later in the lesson.

5. Tell the students they will learn what 1/2 and other fractions mean. It's okay if they say they haven't seen the fraction before.

Elementary students are naturally concerned with fairness and getting the same size, or equal size, of a treat. This is an excellent place to start. Here's how to do it:

1. Break a piece of food or candy into two unequal (one large, one small) pieces. Hershey candy bars work well but you can use any food that is easily broken into pieces of the same size.

2. Ask, "Is this a fair share? How do we know if it's fair?" And make sure to not answer your own question.

3. Accept and record what students say.

4. Now ask, "How do we make it fair?"

5. Let some of the students try to break the item into a fair share while the others watch. Ask, "Do you agree that it is fair? How do we know it's fair now?" (It has to be the same size.)

6. Directly explain and write that "fair" or "same" means "equal."

A fair share is an equal part or a piece that is the same size as the others. If you have a fraction of a cake, you have an equal part of the cake. The numbers in the fraction tell how big your piece is and how many other pieces of cake are on the plate.

Another technique to introduce fractions is to use children's literature. There are many children's books that explore the concept of fractions. Students can choose which books they'd like to read with you. You can read one or all of the books with your students.

As you read, examine the examples and discuss, "How many fair shares or equal parts are there in the whole picture?" Continue to talk about how we know it's an equal part because the parts are the same.

The use of hands-on materials is a good way to teach fractions. Food, especially candy, is fun to use while exploring fractions. Make sure the food can easily be broken into equal or same size pieces. You can also use food that is already broken into equal pieces (M&M, Hershey kisses, beans, noodles, cereal, etc.).

Students can play a game, Make it Fair. Students decide how many people can fairly share their set of objects. They may come up with multiple ways or you might ask, "What if there were _____ people, how could they share it fairly?" Students can draw a picture of how the people shared the objects fairly. Prompt them to say and/or write, "Each person gets _____ equal parts out of _____ pieces altogether in the whole _____."

You can also use pattern blocks to explore fractions. One way to do this is to play the game, Make a Shape. Here's how to play:

1. Students use equal parts (all triangles or all trapezoids) to make a larger shape.

2. Then they say or write, "There are _____ equal parts in a whole _____."

3. For example if they made a trapezoid (red shape) out of triangles (green shape), they would say, "There are 3 equal parts in a whole trapezoid."

4. Students should trace their shapes to record what they did.

5. In addition, students can look at fraction strips and physically cut them apart and put them back together. Ask, "How many equal parts in the whole strip here?" Students need to say and/or write, "There are _____ equal parts in the whole."
6. Fractions are used to represent smaller pieces (or parts) of a whole.
7. The parts might make up one thing, or more than one thing. Either way, altogether, they make up what's called a whole.
8. It's important to note that a whole can mean more than one thing. It's useful to think of a sweet shop as an analogy. For sharing a singular whole amount, you can think of a chocolate bar, a cake bar, or muffin. For grouping an amount into fractional parts, you can imagine a bag of sweets – there are lots of sweets in the bag, but you need all of them to make up the whole bag.

A fraction has three parts. They are:

The numerator which is the number above the bar.

The denominator which is the number below the bar.

The vinculum which is the bar separating the two numbers.

Q. 2 Explain the concept off geometry and its importance in mathematics. Provide list of strategies to teach geometry at elementary level.

Geometry is an area of mathematics that lends itself well to visual and kinesthetic activities. In this lesson, we discuss strategies and techniques for teaching basic geometry.

Geometry is the mathematical study of shapes and patterns. When you're first introducing basic geometry to your students, you're introducing shapes, patterns, and analysis to very young minds, as well as setting the foundation for many years of growth and development in middle and high school.

At the basic level, your students need to know shapes at the visual level, which means they should be able to visualize a shape in their mind, recognize it when they see it, draw a reasonable representation, and know the name of the shape (circle, square, etc.). In addition, you want to introduce **relational analysis**, where students begin to understand how shapes can be related to and compared to one another. You want them to understand that shapes can be above, below, behind, in front, larger, smaller, etc., and how groups of them might look in relation to each other. For example, when introducing younger students to circles, you could provide them with the following scenario:

"Oh, no! Spot has stolen one of the circles that make up Ralph the Snowman! Hurry, someone go find me a circle that's just the right size to put Ralph back together!"

You also want to introduce patterns, or the ways that shapes, numbers, and other symbols can be meaningfully arranged, and **fundamental reasoning**, which means if one thing is true, what else must be true, and what things might be true, or will not be true? Finally, you want them to begin to understand problem solving, as it relates to shapes and patterns. For instance, the circle will not fit into the square hole in the block. What kinds of things might I change to make it fit?

All strategies for meeting these objectives should involve several areas of the students' minds because this reinforces their memory connections as they're learning. Lasting impressions are formed in the human mind, especially the young one, through the use of reinforcing sensory impressions. You want to appeal to as many **learning styles**, such as visual, auditory, or kinesthetic, and **intelligence types**, such as language, music, art, or mechanical knowledge, as possible.

Combining drama with visual (meaning picture-based), auditory (meaning based on language, sounds, or music), and **kinesthetic** (meaning based on movement and physical position) components can create a memorable experience for your students. For example, any popular children's story can be retold and enacted using shapes for the main characters. You can tell the tale of how Queen Circle captured the poor Princess Triangle and imprisoned her in the large square with a small star-shaped door that only a Star Prince can go through.

It can be pretty useful to have and use appropriate background music, active voices, and visual support by way of large drawn, labeled, and colored images for the set and for each of the actors and actresses to wear. At key moments in the story, you can ask for clarification from the audience: "Watch what Queen Circle is doing. Is she above or below Prince Star? Does that mean she can drop things on him?"

Games played while sitting in a circle and bouncing a ball can be powerful memory aids for establishing and reinforcing patterns and sequences. It's actually pretty valuable to remember that loud, happy sounds are particularly memorable, as are vivid, large images, so props and loud singing or shouting can help in these exercises.

Spatial relationships are important even for young children, because it helps them understand their place in the world. It teaches them to determine how large a room is, how far away a desk is or which way to move. Geometry allows students to connect mapping objects in the classroom to real-world contexts regarding direction and place.

Understanding of spatial relationships is also considered important in the role of problem solving and higher-order thinking skills. Kindergarten specialist Edward Schroeter emphasizes the importance of stocking a classroom with objects and ideas that can reinforce spatial learning. “Since young children learn best by working with concrete objects and through stories, educators should stock their classrooms with picture books that model building and design, spatial vocabulary, spatial gestures, and spatial and geometric concepts,” he writes.

Puzzles, blocks, shape sorters and building toys are fun and engaging elements that inspire young students to learn more about shapes. Paper folding tasks, like origami and airplane making, help students with the tactile aspect of learning geometry.

For older students questioning the importance of geometry, ask them to consider the example of moving into a new house. Deidra Alexander at Bright Hub Education spells out the many ways in which this ordinary life situation requires knowledge, planning and applications of geometry.

"What are the specs of your living room space? Do you know whether an oversized sofa, a lamp, three large tables, and a dinette set will all fit in there? Did you remember to take the measurements of the door leading into the living area?", she writes as examples in a lesson plan for middle school math.

These questions could be used as a group exercise to get students thinking about the critical daily applications of geometry. It helps them understand that their family likely uses geometry in daily life. This makes geometry lessons more meaningful and easier to remember.

Q. 3 Highlight the scope and significance off information handling in mathematics. Suggest ways to teach information handling at secondary level.

Mathematics is a fundamental part of human thought and logic, and integral to attempts at understanding the world and ourselves. Mathematics provides an effective way of building mental discipline and encourages logical reasoning and mental rigor. In addition, mathematical knowledge plays a crucial role in understanding the contents of other school subjects such as science, social studies, and even music and art. The purpose of this TSG is to investigate the role of mathematics in the overall curriculum. Due to the wide range of possible issues that could be addressed in this TSG, we plan to organize the papers and accompanying discussions into three key strands. Firstly, we ask the question: why does mathematics hold such an important and unique place among other subjects? That is, what is the significance of mathematics in the overall school curriculum? As a point of departure we offer a few thoughts on why mathematics should be treated as an important subject in overall curriculum. Mathematics has a transversal nature. If we reflect on the history of curriculum in general, then mathematics (geometry and algebra) were two of the seven liberal arts in Greek as well as in medieval times. This historical role supports the notion that mathematics has provided the mental discipline required for other disciplines. Mathematical literacy is a crucial attribute of individuals living more effective lives as constructive, concerned and reflective citizens. Mathematical literacy is taken to include basic computational skills, quantitative reasoning, spatial ability etc. Mathematics is applied in various fields and disciplines, i.e., mathematical concepts and procedures are used to solve problems in science, engineering, economics. (For example, the understanding of complex numbers is a prerequisite to learn many concepts in electronics.) The complexity of those problems often requires relatively sophisticated mathematical concepts and procedures when compared to the mathematical literacy aforementioned. Mathematics is a part of our human cultural heritage, and we have a responsibility to develop that heritage. Secondly, since mathematics provides foundational knowledge and skills for other school subjects, such as sciences, art, economy, etc., the issue of how mathematics is intertwined with other school subjects deserved to be addressed. In some curricula, mathematics is offered independently to support the study of other school subjects as an 'instrumental subject', and in other curricula, integrated courses which combine mathematics and other fields are offered. Thirdly, we may wish to reflect on the number of hours (proportion of hours) and/or courses allocated to mathematics when compared to the other school subject in the curriculum of each country. In addition to this quantitative analysis, information about the qualitative description of school mathematics in relation to other subjects also needs to be

gathered. Although this comparison won't show us the whole picture of why different countries attach the importance that they do to mathematics, the comparison may nonetheless provoke further discussion.

Assessment should enhance mathematics learning and support good instructional practice.

This principle has important implications for the nature of assessment. Primary among them is that assessment should be seen as an integral part of teaching and learning rather than as the culmination of the process.[1] As an integral part, assessment provides an opportunity for teachers and students alike to identify areas of understanding and misunderstanding. With this knowledge, students and teachers can build on the understanding and seek to transform misunderstanding into significant learning. Time spent on assessment will then contribute to the goal of improving the mathematics learning of all students.

The applicability of the learning principle to assessments created and used by teachers and others directly involved in classrooms is relatively straightforward. Less obvious is the applicability of the principle to assessments created and imposed by parties outside the classroom. Tradition has allowed and even encouraged some assessments to serve accountability or monitoring purposes without sufficient regard for their impact on student learning.

Studies have documented a further complication as teachers are caught between the conflicting demands of mandated testing programs and instructional practices they consider more appropriate. Some have resorted to "double-entry" lessons in which they supplement regular course instruction with efforts to teach the objectives required by the mandated test.[4] During a period of change there will undoubtedly be awkward and difficult examples of discontinuities between newer and older directions and procedures. Instructional practices may move ahead of assessment practices in some situations, whereas in other situations assessment practices could outpace instruction. Neither situation is desirable although both will almost surely occur. However, still worse than such periods of conflict would be to continue either old instructional forms or old assessment forms in the name of synchrony, thus stalling movement of either toward improving important mathematics learning.

From the perspective of the learning principle, the question of who mandated the assessment and for what purpose is not the primary issue. Instruction and assessment—from whatever source and for whatever purpose—must be integrated so that they support one another.

To satisfy the learning principle, assessment must change in ways consonant with the current changes in teaching, learning, and curriculum. In the past, student learning was often viewed as a passive process whereby students remembered what teachers told them to remember. Consistent with this view, assessment was often thought of as the end of learning. The student was assessed on something taught previously to see if he or she remembered it. Similarly, the mathematics curriculum was seen as a fragmented collection of information given meaning by the teacher.

Assessment can play a key role in exemplifying the new types of mathematics learning students must achieve. Assessments indicate to students what they should learn. They specify and give concrete meaning to valued learning goals. If students need to learn to perform mathematical operations, they should be assessed on

mathematical operations. If they should learn to use those mathematical operations along with mathematical reasoning in solving mathematical problems, they must be assessed on using mathematical operations along with reasoning to solve mathematical problems. In this way the nature of the assessments themselves make the goals for mathematics learning real to students, teachers, parents, and the public.

Mathematics assessments can help both students and teachers improve the work the students are doing in mathematics. Students need to learn to monitor and evaluate their progress. When students are encouraged to assess their own learning, they become more aware of what they know, how they learn, and what resources they are using when they do mathematics. "Conscious knowledge about the resources available to them and the ability to engage in self-monitoring and self-regulation are important characteristics of self-assessment that successful learners use to promote ownership of learning and independence of thought."

Q. 4 Describe the measures of central tendency and also elaborate each measure by providing examples.

A measure of central tendency is a summary statistic that represents the center point or typical value of a dataset. These measures indicate where most values in a distribution fall and are also referred to as the central location of a distribution. You can think of it as the tendency of data to cluster around a middle value. In statistics, the three most common measures of central tendency are the mean, median, and mode. Each of these measures calculates the location of the central point using a different method.

Choosing the best measure of central tendency depends on the type of data you have. In this post, I explore these measures of central tendency, show you how to calculate them, and how to determine which one is best for your data.

Locating the Center of Your Data

Most articles that you'll read about the mean, median, and mode focus on how you calculate each one. I'm going to take a slightly different approach to start out. My philosophy throughout my blog is to help you intuitively grasp statistics by focusing on concepts. Consequently, I'm going to start by illustrating the central point of several datasets graphically—so you understand the goal. Then, we'll move on to choosing the best measure of central tendency for your data and the calculations.

The three distributions below represent different data conditions. In each distribution, look for the region where the most common values fall. Even though the shapes and type of data are different, you can find that central location. That's the area in the distribution where the most common values are located.

As the graphs highlight, you can see where most values tend to occur. That's the concept. Measures of central tendency represent this idea with a value. Coming up, you'll learn that as the distribution and kind of data changes, so does the best measure of central tendency. Consequently, you need to know the type of data you have, and graph it, before choosing a measure of central tendency!

The central tendency of a distribution represents one characteristic of a distribution. Another aspect is the variability around that central value. While measures of variability is the topic of a different article (link below), this property describes how far away the data points tend to fall from the center. The graph below shows how

distributions with the same central tendency (mean = 100) can actually be quite different. The panel on the left displays a distribution that is tightly clustered around the mean, while the distribution on the right is more spread out. It is crucial to understand that the central tendency summarizes only one aspect of a distribution and that it provides an incomplete picture by itself.

Mean

The mean is the arithmetic average, and it is probably the measure of central tendency that you are most familiar. Calculating the mean is very simple. You just add up all of the values and divide by the number of observations in your dataset.

$$\frac{x_1 + x_2 + \cdots + x_n}{n}$$

The calculation of the mean incorporates all values in the data. If you change any value, the mean changes. However, the mean doesn't always locate the center of the data accurately. Observe the histograms below where I display the mean in the distributions.

However, in a skewed distribution, the mean can miss the mark. In the histogram above, it is starting to fall outside the central area. This problem occurs because outliers have a substantial impact on the mean. Extreme values in an extended tail pull the mean away from the center. As the distribution becomes more skewed, the mean is drawn further away from the center. Consequently, it's best to use the mean as a measure of the central tendency when you have a symmetric distribution.

Median

The median is the middle value. It is the value that splits the dataset in half. To find the median, order your data from smallest to largest, and then find the data point that has an equal amount of values above it and below it. The method for locating the median varies slightly depending on whether your dataset has an even or odd number of values. I'll show you how to find the median for both cases. In the examples below, I use whole numbers for simplicity, but you can have decimal places.

In the dataset with the odd number of observations, notice how the number 12 has six values above it and six below it. Therefore, 12 is the median of this dataset.

As you can see, the median doesn't change at all. It is still 46. Unlike the mean, the median value doesn't depend on all the values in the dataset. Consequently, when some of the values are more extreme, the effect on the median is smaller. Of course, with other types of changes, the median can change. When you have a skewed distribution, the median is a better measure of central tendency than the mean.

Mode

The mode is the value that occurs the most frequently in your data set. On a bar chart, the mode is the highest bar. If the data have multiple values that are tied for occurring the most frequently, you have a multimodal distribution. If no value repeats, the data do not have a mode.

In the dataset below, the value 5 occurs most frequently, which makes it the mode. These data might represent a 5-point Likert scale.

Typically, you use the mode with categorical, ordinal, and discrete data. In fact, the mode is the only measure of central tendency that you can use with categorical data—such as the most preferred flavor of ice cream. However, with categorical data, there isn't a central value because you can't order the groups. With ordinal and discrete data, the mode can be a value that is not in the center. Again, the mode represents the most common value.

Q. 5 Explain the importance of planning in teaching of mathematics. Also highlight the important methods used for teaching of mathematics.

Math teachers have a nuanced job. They must teach the building blocks of math, such as number sense and operational skills, as well as boost students' ability to think about problems. They need to incorporate aspects of language, including reading and writing, into their subject and provide direct instruction on methods of exploration. Additionally, math teachers must motivate students to try and teach them to persevere when problems are challenging. Let's look at some of the best methods and strategies for a quality math program.

When we talk about a **method** of instruction, we mean how content is being taught. This runs the gamut from style of instruction—for example, lecture vs. hands-on—to materials used. Here are some tried and true methods for teaching math:

Use Visuals

Many students need to see a lesson in addition to hearing it. While explaining an operation or skill, use a visual or graphic to help get the point across. This can be as simple as showing the lesson on a document camera or as savvy as using a video or other technology tool.

Note that children do best when instruction is paired with a visual; using a visual as a stand-alone teaching device isn't always effective. Vary your usage to keep students engaged.

Make Connections

Our brains are machines that thrive on connections. In fact, long-term memory is a complicated web of neurons, or brain cells, banded together. To help students make sense of concepts, provide them with connections to the real world or previously taught lessons. Always begin a new lesson with a reminder of the last. For example, you might say, 'Yesterday, we learned about the numerator in fractions. Today, we'll take a closer look at the other part of a fraction: the denominator.'

Also, pay close attention to how students react to the connections you make. For example, one group might understand best when you use board games as an example, while another group might react better to an example connected to sports.

Use Assessments

Math is typically a progression-based subject. Skills build one upon another, and the order in which they're taught is predetermined. Because of this, a math teacher doesn't have to think much about what to teach when,

but it is necessary to use assessments to determine student understanding. **Formative assessments**, or informal assessments meant to check in on student learning and drive future instruction, should be used frequently. This can help teachers identify students who struggle and allow additional small group or one-on-one instruction.

Formative assessments aren't usually taken for grades. Students need to feel comfortable with their exploration of a subject without fear of their performance being used for grading.

Focus on Strategies

As we'll talk about later, math is all about problem-solving using strategies. Sometimes, there's only one way to solve a problem, but many times there are multiple avenues to the answer. When teaching, model several strategies for understanding and exploring a concept. Encourage students to apply high-level skills when given problems and focus on the thought process involved in the solution. Although math usually only has one right answer, being able to reason through the steps to find the answer is the most important part of being a successful math student.

As we discussed earlier, we want our students to be mathematical thinkers. This means they need to think strategically about solving math problems. A **strategy**, then, is a way teachers instruct for maximum benefit. Teachers use strategies to help students learn math as well. Thinking about how to best deliver a lesson is foremost in quality teaching.

Once the aims and objectives are in place, it is important to make sure that the planned lesson is understandable by the students. The teacher should prepare different explanation methods for the students to understand the topic easily. The methods could include giving real-life examples or creating a hypothetical situation related to the topic. Moreover, showing videos related to the topic may also assist in better understanding. Including activities related to the lesson is helpful for students to remember the topic being taught.

The key is time management. A teacher has to time all the activities during the class hours to finish the lesson according to the plan. Everything including explanation, examples, and activities have to be timed in a manner that the lesson is not extended for the next class.

Assessments to check student understanding of the topic

To check the understanding after the planning and learning activities, it is important that the teacher drafts questions in different ways to check the knowledge and understanding of the topic. The teacher decides to check the understanding orally or in writing. For this question-answer session, time is required. The questions have to be preplanned. The teacher should be aware of what she planned for the students to learn so that questions can be drafted accordingly. Also, activities can be planned to check the knowledge and understanding of the matter.

Effective ways to plan a lesson

1. **Lesson planning outline** - Plan out lessons using existing templates made available on Microsoft word or PowerPoint to get started on ideas for creating lesson plans. Take what others have done and add details to make them your own to make sure you are on the right track. Everything is available online

and so you just need to make sure all effective components such as warm-up, introduction, lesson delivery, guided practice, assignments and closing statements are included in your plan.

2. **Using folders to save lessons -** Create a structured document in your computer or use a portable external drive. Save all your lessons one-by-one so you can save time every year when you are covering content with minor improvements and changes. This way you can use old conten with minor tweaks to make it more improved and effective.
3. **Time each lesson component** - Timing helps organise the lesson but it can always be adjusted as per the needs of learners. Sometimes no matter how much teachers plan, lessons do not go as planned and parts need to be repeated as per learners' understanding. Keeping it old school, with a small timer helps. You can also download one from the internet and keep a log of activities. A typical time for each component of a lesson varies, but can go something like this for a 1-hour lesson:

- Warm-ups: 5 minutes
- Introduction: 2 minutes
- Presentation: 18 minutes
- Checking for Understanding: 7 minutes
- Guided practice: 23 minutes
- Closing & assigning homework: 5 minutes

Check understanding - You can get clear picture of what the class understood from your lesson by checking for understanding. During this phase you can be sure of how much each student has understood. It is better to catch mistakes at initial level before any assignments or quizzes are circulated. For a virtual classroom, strategies such as misconception check, collaborating and learning, creating a word cloud, rating understanding and opinion charts are used to identify need for support for student learning.

2052046592. **Incorporating activities -** To make learning fun and engaging, activties are used to make lessons interactive. Using learning approaches such as small projects, games using technology, role-play, group presentations and hands-on work to help learners learn more and share plenty of ideas.

Benefits of lesson planning

"By failing to prepare, you are preparing to fail." - Benjamin Franklin

Thus, an organised teacher will always be able to deliver the lesson within the given time frame (during the limited class timings). With the additional time saved, a teacher can give additional attention and time to students that require additional help. Also, there will be a sense of control and direction while teaching. Even if there is confusion amongst the students, the teacher will be able to guide them effectively as the teacher will be well versed with the subject matter and will be able to cater for the questions without any stress.

A teachers' most important trait is confidence. Lesson planning can help the teacher to be well prepared and be aware of what he/she intends on teaching the students. To meet your student's expectations, one must have a good lesson plan. To create one, you need to do the Effective Lesson Planning course. It can help the teacher to

focus more on the basic knowledge first then take the students towards the next step. The teacher will never stammer or mumble during the lecture because of the timely preparation of the lesson.

Furthermore, a teacher is one of the first few inspirations of a student. Setting a good example of pre-planning can always assist a teacher to become a good inspiration and the confidence with which the teacher delivers the lesson will make the student realise the importance of planning ahead of time and adopt this habit for other disciplines of life.

The learning capacity of each student varies from one another. Lesson planning can minimise this understanding gap if the teacher plans the lesson effectively. This can be done by taking the first step that is, start teaching from the core so that nobody is left behind and that every student is on the same page and then the teacher moves ahead with the topic.