Evaluating the Utility of Maths Worksheets

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'Corona, ma'am,' responded a seven-year-old when I asked for real-life examples of the three-dimensional shape 'sphere'. The entire class burst into laughter. I could not help but admire the child for coming up with such an obvious yet unusual example of the concept.

I teach at the AIMEE International School, a private school based in Vijayawada, Andhra Pradesh. The school is affiliated to Cambridge International Education and follows an inquiry-based approach to learning. As we began planning to welcome our first batch in June 2021, we drew up a bridge-course plan to identify where each of our learners were. Consequently, we decided to spend one month working on the 'number system and basic operations' with classes IV to VII and 'understanding counting and sequence' for classes I to III. Our school initially operated in the online mode for the months of July-October. The offline classes were officially started for all the students after the Dussehra break and the online classes were completely suspended.

As a school, we aim to inculcate a spirit of inquiry in our students. Our general approach to the learning of maths is to first establish the need and relevance for learning any concept. We do so by exploring real-life scenarios, inviting applicability of the concept being taught and then moving to the specifics of the concept. We follow a Concrete-Pictorial-Abstract path of learning of concepts. Hence, worksheets play a significant role in shaping the learning experience of our students. This article explores the kind of worksheets I have used in the last six months, how I used those worksheets and why I find some of these very useful but others not so much.

Different worksheets, different purposes

While exploring the publicly available support material on the internet, our team came across a gamut of printable worksheets mapped with grade-specific learning objectives. (A list of resources is provided at the end.) There are many more resources that can be helpful if one wants access to the worksheets. But with time I learnt that, ultimately, the strategy of implementation makes a lot of difference to the impact of these resources.

I have used several worksheets at different stages for different purposes:

a. *To generate curiosity:* Our learning approach focuses on establishing the need of learning any concept. Rather than telling a child that they will use a given concept when they grow up, we aim to highlight the relevance of maths in their life now. For example, to discuss odd-even numbers with class III, we provided them with a home environment-based worksheet. This was done also because this topic was discussed during online classes, and we intended to use their homes as a learning lab. The worksheet required children to explore different parts of their home (kitchen, bedroom, living room) to count a few objects and then decide whether the number of objects was odd or even. They were also expected to talk to their parents and find out the number of family members and cousins. This worksheet was to be completed partly at home and the 'checking by pairing' aspect was to be done in class. It was designed to generate excitement about the concept and hence was used as a warm-up exercise at the beginning of the lesson.

b. *To facilitate the transition from concrete to abstract:* We actively use the concrete learning material available at Jodogyan (https://jodogyan.org/) to provide hands-on experience to our learners. For example, the base-10 system was introduced to primary grades through blocks. Students played with the blocks as they learnt how to count in steps of constant size: 2, 3, 5 or 10. In no time they realised that counting in tens helps them to count easily and quickly. This discovery was followed by the introduction of the place-value system which was appropriately facilitated through the base-10 system worksheet. As the worksheet has pictures of blocks being bundled as tens and hundreds, it helped the learners move seamlessly from what

they could see and touch (the blocks) to what they had to eventually imagine and use (the numbers). This experience extended to upper primary classes also as the students learnt fractions first through cut-outs of shapes and then with the help of a worksheet consisting of pictorial representation of fractions.

c. *To consolidate learnings from different concepts:* Classes I to III learnt about different shapes (2D, 3D, prisms and pyramids) by working with the *Jodo* straws. They had fun while putting their imagination to work in making different kinds of shapes. The straws also allowed them to examine and understand the different properties of the shapes that they were learning about. This was particularly useful for 3D shapes. At the end of each session, a worksheet was provided with crosswords and riddles that required the students to apply their understanding. This helped in tying up loose ends and providing a recap of the different concepts learnt.

Utility of worksheets in post-pandemic world

The COVID-19 pandemic has resulted in a learning loss in children across the globe. A study conducted by the Azim Premji University in January 2021 revealed that, on average, 82 percent of the students have lost at least one foundational ability in maths from the previous year across all classes. The students in our school are no exception. Half of our class VI learners struggle to perform basic mental calculations and our class II learners are actually at class I.5 (if only there was a grade like that). Some of the students have managed to stay at their expected level of learning, mainly through online learning, but this number is a mere one or two in a class of ten. Consequently, as a teacher, I am required to cover the basics before I begin working towards grade-appropriate learning objectives. Again, I am supported by the available resources in multiple ways.

a. I used some of the worksheets meant for students of class III for my class VI learners. This is because their fundamentals are not strong as a result partly of the pandemic and partly owing to the memorisation (rote-learning) of fundamental concepts prior to the pandemic. Since the worksheets do not mention the grade level, it is possible to use them without hurting the pride of students.

b. Some of my class II students do not enjoy writing as much as they enjoy playing games online. These worksheets help a lot in ensuring learning without compromising on the fun element.

c. One of the biggest advantages of using worksheets is that they allow scope for differentiated instructions. Since my class has students of diverse learning levels, using standardised learning material would mean some of them will be either left out or will be bored. Hence, I try to prepare two levels of worksheets for a given concept where possible. This helps me keep most of my learners productively engaged.

What works, what does not

In the last few months, I have explored hundreds of worksheets and used many of them. While some of the worksheets have been quite engaging, there is a particular kind that I do not find useful. I try not to use the worksheets that are a replica of the textbook. Worksheets which do nothing but mention a few numerical problems for children to solve are useful only for a revision class or short assessment. Otherwise, the same kind of exercise can be easily done by the students in their notebooks. These worksheets hardly support actual learning and are purely focused on practice.

In contrast, a worksheet that I really found useful for my class VI students was about 'investigating circles'. This worksheet invites students to work independently or in a group and examine the circumference and area of any circle. The worksheet on graph paper contains three circles with different radii. Students are expected to find the circumference of each of these circles by using a thread to measure the boundary of these circles. They are required to note the observations in the space given in the worksheet. The students estimate the area by counting the number of squares it takes to make the circle. As they work around it, I notice how many different ways they adopt to count the squares. Some stop after counting each complete square, others count complete squares first and then try to mentally combine incomplete squares to estimate the closest possible answer. One student was able to visualise the circle as four quarters and went on to count the squares in one quarter before he multiplied the number by four to find the total number of squares. This kind of brainstorming is essential for developing mathematical thinking.

Conclusion

With the schools being reopened after months of closure, the onus lies on the teachers to go the extra mile and support the learners who suffered due to the lack of adequate learning support at home. Fortunately, there are plenty of resources available online that can help teachers in ensuring the learning of these students. While I enjoy designing my own learning material, it helps to have guidance from experts who have been working in this domain for a long time. The availability of such material allows me to spend my energy in helping the learners use the material effectively and create a space for them where they get to experience the *Aha!* moment more often.

Grade - 3	**Subject:** Mathematics	**Topic:** Odd and Even Numbers
Learning Objective: To recognize even and odd numbers in context of real-life scenario.		

Task	Simon says….	How many are they?	Are they even or odd in number?	Time for a quick drawing. [Check your answer by making their pairs.]
A	**Go to your kitchen.**			
	Count the number of cups.			
	Stay in the kitchen. Count the number of plates, now.			
	One last thing, count the number of spoons.			
B	**Explore all the rooms in your house.**			
	Count the number of chairs you have.			
	Also, count the number of tube lights you have.			
C	**Go to your bedroom.**			
	Count the number of toys you have.			
	Count the number of footwears you have.			
D	**Discuss with your parents and recall**			
	How many members are there in your entire family?			
	How many cousins do you have?			

Worksheet designed by author

Resources

Interactive Games and Worksheets
1. https://www.mathgames.com/
2. https://www.turtlediary.com/
3. https://softschools.com/
4. https://www.topmarks.co.uk/

Printable worksheets
1. https://www.education.com/
2. https://www.twinkl.co.in/
3. https://www.liveworksheets.com/
4. https://www.mathsisfun.com/

Simulations (supportive for online classes as well)
1. https://illuminations.nctm.org/
2. Interactives.ck12.org
3. https://www.mathlearningcenter.org/apps
4. https://www.coolmath4kids.com/

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