

Background & Learners' context

Students: 2nd graders with no special disabilities or mental disorders. They are aware of American style references and culture, for relevant contextualization **School:** American school in Pittsburgh, with 100% average SES in the class **Parents:** No special support in Math at home expected **Class context:** In-class, with 20 students.

Course context: 14-week course, 45 min a week. Conduct at starting 2nd grade

Subject importance in context

 \rightarrow Represent & Solve problems with addition & subtraction

 \rightarrow Understand/Apply addition & subtraction properties

 \rightarrow Work with equal groups of objects to gain foundations for multiplication

Contextualization: Time / Money / Measuring (recipes) / Data / Sport

Goals (Conceptual / Skills / Dispositions - Cog → MetaCog)

C.1 Identify numbers from 1 to 1000 C.2 Identify comparison relations btw umbers

C.3 Identify basic mathematical operation & properties

C.4 Know real-world examples of operations & data

MC.1 I evaluate my own understanding of umerical concepts

MC.2 I evaluate my lack of knowledge to ulfill a goal.

MC.3 I can say if I understood well the sic measurement units

MC.4 Seeing a lack of knowledge, I ask omeone a question

MC.5 When I have trouble mentally epresenting a concept, I use concrete bjects for visualization

MC.6 I can say what I did good during a ask to reach a goal.

MC.7 I know the upper limit of the umbers I can count until

S.1 Read, write, skip-count to 1000 S.2 Apply addition & subtraction to 1000 S.3 Use real-world objects to understand the alues/properties of numbers and operations S.4 Communicate with think-aloud while ngaged in numerical thinking

happening

MS.1 I evaluate my performance as valid and MS.2 Create a plan to evaluate the skills applied MS.3 I evaluate the correctness and meaning of ne applications' results. MS.4 If I read, write, skip count to 1000, explain e procedure & assess my performance

MS.5 If I need a step or a hint to apply the skills realize it and I seek help.

MS.6 When I count mentally, I can think aloud if sked for it and explain my thinking.

MS.7 I can tell if I followed the method for ddition, subtraction and multiplication. AS.8 I can seek help and offer help if I recogniz

thers' needs IS.9 After peer-listening, I know what was said

e effects of others' learning and their reaction

Typical performance tasks design for learning addition & subtraction in-context

	1	2	3	4	5	6	7	8	9	10
Learn the vocabulary of numbers and how to recognize them: Week 2 Approach: guided discovery & Feedback	11	12	13	14	15	16	17	18	19	20
	21	22	23	24	25	26	27	28	29	30
	31	32	33	34	35	36	37	38	39	40
Context: First lessons of the course, need to assess global level and individual	41	42	43	44	45	46	47	48	49	50
Directions: In groups, match numbers' names in letters with numbers in digits by manually	51	52	53	54	55	56	57	58	59	60
placing papers with numbers on the calendar with numbers.	61	62	63	64	65	66	67	68	69	70
You can see both the numbers with digits and the numbers written with letters.	71	72	73	74	75	76	77	78	79	80
Representations: calendars with numbers from 1 to 100, ordered in columns.	81	82	83	84	85	86	87	88	89	90
All numbers should be of the same color, except the 5's and 10's to focus on numbers' names	91	92	93	94	95	96	97	98	99	100
and distinctions between every 10's.	Calendars from 1 to 100									
Student actions & interactions: place the paper numbers on the corresponding number, interacting with peers to perform the task.										

Contact

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Operations & Algebraic Thinking for 2nd graders

By Baptiste Moreau-Pernet, Dec. 2020 Educational Goals, Instruction, and Assessment Instructors: Dr Sharon Carver, Dr Lauren Herckis

0.1 concentrated when counting

D.2 attentive to teachers/peers

D.3 interactive when a numerical play i

D.4 respectful of others & their point of

MD.1 I evaluate my lack of attention to others.

MD.2 When counting, I can regulat my own concentration.

MD.3 When listening to peers, I can identify their level of attention, evaluate it and interact in response

MD.4 When I see other children struggling, I ask if they need help.

MD.5 During a numerical play, can evaluate my degree of interactivity. monitor it towards the disposition go

MD.6 can recall the degree of interactivity and get the effects of my approach on the task

MD.7 self-evaluate my progress & how it affected my learning in genera

The guiding principles:

Alignment between goals, assessment, instruction, evaluation

How humans learn:

Activating & correcting students' prior knowledge

Fostering a sense of belonging

Increase and maintain students' motivation

Improve students' metacognitive abilities

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Assessment

A1.Performance Tasks, Formative assessment to understand what students know and how they make connections between tasks

A1.1 Pick 5 real-life objects you really know well. Then describe them using numerical vocabulary, with as many details as you can.

A1.2 Create your own cooking recipe for one person, listing the ingredients and the weights, and steps. Add a price to each item to purchase as in a real shopping list and sum the prices to get the final price.

A2.Performance Tasks, Summative informal assessments: A2.1 Draw multiple situations of you daily life representing all the numbers that appear in the situation (the time with a clock, the number of objects, the age of the characters, etc.) and draw them in the environment. Explain the examples of numbers you give and use additions to sum up all the numbers you found. Explain your drawing to your peers, ask questions about your peer's work.

A3. Other Evidence, Formative assessment:

A3.1 Questions during class and during activities, about the Knowledge, and ask for the children to perform the activities and show you their procedural skills: A3.2 Observations during in class activities to test dispositions in context specifically: A3.3 Question of the day each morning to the class. This is used to reflect on what they learnt from the previous class content. It is a morning routine:

A4. Other Evidence, Summative informal assessments: A4.1 Think-aloud when practicing tasks that need strategy and planning: A4.2 In group summative assessments when doing activities: trying to get what they learnt from the class:

A4.3-Class summative assessment, 3 times throughout the course. Assess individual progress with summative tasks like 4.1 or 4.2:

A5.Student Self-Assessment / Reflection

A5.1 Provide informal feedback on students' work and emphasize progress since past classes

Learn addition & subtraction with real-world data, week 5

Approach & Context: guided discovery. Students learn the properties of addition with a bicolor dice: there are multiple ways to add up numbers to reach a certain number.

Directions: In groups of 4, roll a bicolor dice 12 times (vary the number of rolls) and note how many times each color comes up and add the number for both colors; observe that it always add up to 12, this is a property of addition. Dices with two colors: blue and red. Students take a paper and draw 12 squares: Then they draw a point in the next empty slot in blue or red depending on the color obtained with the dice, one for each roll:

Representations: bicolor dice gives a pair of random numbers adding up to the total number of rolls. Resources: Bicolor dice, pen & pencil to note results

Student actions & interactions: Roll a dice, add "one" to the corresponding color until you rolled the total number of times **Feedback from the teacher:** Ask students to self-explain their understanding of this property of addition

Reference

1. Interview of Holly Blinzman, kindergarten teacher at the Children's School. 2. <u>https://www.weareteachers.com/second-grade-math-games/</u> 3. Turns Out, Counting on Your Fingers Makes You Smarter, October 23, 2016, Wall Street Journal

- 5. <u>https://www.education.com/magazine/article/Math_for_Second_Graders/</u>
- 6. Common Core State Standards for Math: CCSSI_MathStandards.pdf

Big Ideas

- How to implement educational design:
 - vide natural critical learning environment
 - nvert students into high-level thinkers
 - nieve transfer of learning
 - vide valid and reliable assessment for
 - ve students practice self-evaluation
 - e assessment as an instructional technique
 - fer active learning



- Bicolor dices example

belonging)

Class norms: Set them during first classes (raise your hand if you have a question, be polite, listen to peers, ask for help...). Emphasize reasons. **Class design features:**

First, hook students' interests (Week 1) with an overview of what students will perform during class (using cool objects, writing a recipe, drawing real-life numbers). Second, include formative assessment at class's start about past class's content. Include explanations of the instructional activities and targeted feedback. Mix levels in groups to foster peer interactions (feedback & learning by teaching). If the lesson contains new content, add an informal assessment of class's prior knowledge before instruction. Finally, prefer group tasks in class and move around giving feedback, providing support and assessing, mainly informally. Instructional activities & informal assessment: (example with C.1, week 1)

- numbers from 1 to 100 and their features.
- muddy points) as an instructional technique.

Evaluation Research: impact of ten frames

Research Question(s):

Do ten frames improve students' understanding

of addition and subtraction?

Hypotheses & Related Predictions:

Better learning of addition & subtraction when students practice with ten frames rather than unifix colored cubes where one only cube represents hundreds/tens/units depending on its color.

Experimental Design:

Dependent variable: students' improvement between pre-test and post-test on addition & subtraction with/without carry. Randomly assigned experimental and control groups with half class in each. Calculate each sum or difference



- 4. Why a Colorado Researcher Believes Preschoolers Should Learn--and Play with--Math, July 14, 2017 Chalkbeat

7. STEM starts early: Grounding science, technology, engineering, and math education in early childhood, Elisabeth R. McClure, Lisa Guernsey, Douglas H. Clements, Susan Nall Bales, Jennifer Nichols, Nat Kendall-Taylor, Michael H. Levine, 2017



Instruction

Classroom climate: Group activities in 4 to 5 students. Children can move in class & access objects for learning and playing (change the groups regularly to foster a sense of

Direct Instruction: Week 1, identify numbers from 1 to 1000 (C.1). Show the names of

Facilitation through Instructional activities: Group activities using calendars (1 to 100) to learn number names. Use informal formative assessment (asking questions on

Coaching through feedback: Provide group, progress-focused feedback.



per & pencil addition & subtraction tasks nilar paper & pencil exercises	$\frac{80}{\pm 12}$	87 _27	$\frac{76}{\pm 23}$	$\frac{83}{-13}$
he end of the class (rapid ~ 12 questions)	62 -39	22 +10	51 -36	$\frac{19}{+38}$
ducts operations with ten frames, in group operations with unifix blocks, in groups of	os of 4. 4.			
s on paper & pencil operations				