

Enhancing Number Sense in Practice and Application—Take the Teaching Record of "The Numbers We Know" as an Example

Miaoli Lai^{1,*}

¹Wuzhou University, Wuzhou, China

*Corresponding author

Abstract: "The Numbers We Know" is a practical activity lesson that is an expanding activity that enables students to deepen their understanding of numbers after learning numbers within 100. Before this lesson, students knew numbers within 100 and had often been exposed to numbers within 100 in real life. Therefore, students have practical experience in using numbers to express and communicate. Although students already have some foundation in numbers, they do not have much feeling and experience about how to estimate the number of other items by using one item as a reference, so they need to accumulate experience through extension activities. In addition, students have a vague understanding that the same number can express many different things and has different meanings in different contexts. Teachers must arrange a series of mathematical activities from shallow to deep to help students accumulate activity experience and guide them to improve their number sense in conjecture and reflection gradually.

Keywords: Number Sense, Lesson Objectives, Practice and Application, Teaching Record, Estimation

1. Introduction

The cultivation of number sense is one of the core tasks of mathematics teaching, and it is also a hot topic in education in recent years. So, what is number sense? How do we cultivate students' number sense? The essence of number sense is a kind of perception, which includes the perception of numbers, quantity, the relationship between quantities, and the estimation of operation results. The significance of number sense is understanding the meaning of numbers in real life and understanding and expressing the quantitative relationship in specific situations. Students' understanding of number sense is enhanced by teaching the lesson "The Numbers We Know."

Students have known numbers within 100 and have been exposed to numbers within 100 in real life many times. Since students have the experience of expressing and communicating with numbers and can use numbers within 100 to solve some simple and practical problems in real life, students have a specific foundation of knowing numbers within 100. Although it will not be too difficult for students to use numbers within 100 to describe and communicate in simple language, students do not have much experience estimating the number of items by grabbing. Hence, they need to accumulate experience through extension activities. The core content of this lesson is to guide students to think deeply and communicate with each other in practical activities to enable students to develop a preliminary number sense and cultivate their consciousness and habit of applying mathematical knowledge.

Teaching equipment: little stars, candies, peanuts, soybeans, and recording sheets.

Teaching objectives:

(1) Use the numbers within 100 that have been learned to describe real things in life, understand the simple applications of numbers in daily life, and further understand the different meanings of numbers in different scenes to develop number sense.

(2) Cultivate estimation consciousness, improve estimation ability, and feel the connection between numbers and life.

(3) Accumulate activity experience, learn how to cooperate and communicate with others, improve interest and self-confidence in learning mathematics, and enhance the awareness of observing surrounding things and daily life from the perspective of mathematics.

Teaching focus: cultivate students' awareness of observing life from a mathematical perspective,

develop students' number sense, and improve students' estimation ability.

Teaching difficulties: according to the number of candies in a handful, the number of peanuts and soybeans in a handful is estimated[1-2].

2. Teaching process 1

2.1. Excitement import

Teacher: Children, look, what do I bring you today? (Show 100 little stars) Guess how many there are.

Provide appropriate guidance according to the figures guessed by students.

Teacher: The stars here are in a disorderly row. Counting them is difficult, so I line them up. (show a column with 10 stars)

Guidance: Let students count the stars shown in the courseware. One ten, two tens, ..., Ten tens.

Question: how many are 10 tens?

Students: Ten tens are a hundred. (show the courseware: 10 tens are a hundred)

Question: Now I want to give the stars to all the good students in the class. Do you think it is enough? Tell me your reasons.

Teacher: The numbers you guessed just now are all we have learned before. (show the hundreds table) Are these the ones? These numbers often come into our lives. Today, we will use them to have an interesting math lesson. (show the courseware: "The Numbers We Know")

Design purpose: This lesson starts with "counting the stars." It stimulates the children's interest by "guessing" how many stars there are. Then, it uses "counting the stars" to make the students review the numbers within 100, drawing out the hundreds table and revealing the topic of today's study.

2.2. Activity 1: Say a sentence using numbers within 100

Teacher: Numbers within 100 can be seen everywhere in our life. Look, these children are talking happily together. Let us listen to what they have said. (play audio)

Teacher: These children found some information expressed in numbers in their lives. Before this lesson, I asked you to collect numbers within 100 and use them to say a sentence. (Shown in Questionnaire 1) Now, please share the information you collected with your deskmate.

Questionnaire 1: Say a sentence using numbers within 100

Item and people	Number	Sentence
Book	53	This book has 53 pages in total.

Let students communicate with their deskmates and designate a student to present.

Teacher: A student said during the communication, "There are 55 students in our class." "55" is the number of students. I have also collected a lot of "55" in life.

Courseware presentation: 55 small checkerboards, 55 synchronized assignments, and pictures of a 55-meter-high building.

Question: Students, look at this "55." Does it mean the same thing?

Teacher: I can use the same number, "55," to represent the number of different objects. It can represent not only the number of people and the number of words but also the height of trees and so on. Look! Are the numbers in the kingdom of mathematics incredible? If you observe, you will find more numbers in your life.

Design purpose: By saying a sentence using numbers within 100, students are guided to find things within 100 in their familiar life, express them mathematically, and communicate with classmates. Such

activities not only help students understand the practical significance of numbers in different situations and cultivate students' awareness of the application of numbers but also improve students' ability to observe and express daily life phenomena from the perspective of numbers.

2.3. Activity 2: *Guess the age*

Transition: In fact, you always have a number in you. It is our age. Who can tell me how old you are this year?

Student 1: I am 7 years old.

Student 2: I am 8 years old.

Teacher: You all know your age. Do you care about the age of your family? Before this lesson, I asked you to investigate the ages of your families. (Shown in Questionnaire 2) Now, please take out this questionnaire and the picture of your family, and then communicate with your deskmates.

Questionnaire 2: Survey age

Myself	Father	Mother	Grandpa	Grandma	Grandfather	Grandmother

Designate three students, show their pictures by projection, and list the ages reported by these students on the blackboard.

Teacher: What do you find by comparing the age recorded on the blackboard?

Student 1: The grandparents of these students are about the same age.

Student 2: I found that the parents of the three students are in their thirties, and by comparison, our ages are the youngest.

Teacher: You have made many discoveries! The parents of the three students are in their thirties, their Grandparents are older, usually in their sixties, while the three students are the youngest, less than 10 years old.

Teacher: Now I want to test you to see who is more intelligent. Please look at the screen. (show the picture of Chi-bi Maruko's family) Here is a picture of Mariko's family. A person in Chi-bi Maruko's family is 64 years old. Who may this person be? Please tell me your reasons.

Student 1: I think it should be grandpa because Chi-bi Maruko's grandpa is the same age as my grandpa.

Student 2: I think it may be Chi-bi Maruko's grandparents because they are all around 60 years old.

Teacher: What you said is very reasonable. The age of Chi-bi Maruko's grandparents is about the same as that of your grandparents, probably 64 years old.

Extension: Children, grandparents are the oldest at home, so we should pay more attention to the elderly and learn to respect them daily. Do you know?

Design purpose: Ask students to tell the age of everyone in their family so that students can further feel the practical significance of "age" combined with life experience and make students receive the education of respecting their elders and loving life. Meanwhile, requesting students to guess who the 64-year-old person in the picture may be according to the Xiaoming family's life scene provided in the textbook will help students further consolidate their understanding of "age" and cultivate their good number senses within 100[3-5].

3. Teaching process 2

3.1. Activity 1: *Grab candies*

Transition: Children, we just guessed the age. Do you want to continue to guess now? Then go to the candy house with me.

Teacher: Today, I have brought some candies. I grab them with my hand wide open. How many candies are there in my hand now? Let us count together and record the result. (the result shown on the blackboard: 15)

Teacher: Guess what, if you grab candies with your hands wide open like me, will you grab more candies than me? Or less? How many candies are you likely to grab? Please tell me what you think.

Student 1: I may grab nine candies by myself, and the number will be less than yours.

Student 2: I guess I will grab less candies than you. Maybe I will grab seven candies.

Teacher: Some of you guessed that they would grab fewer candies than me, while others guessed that they would catch more candies than me. Now, I'd like one of you to try it.

Designate a student to come up and grab candies, then fill the data in the table after counting.

Teacher: You see, I grabbed 15 candies, and this student grabbed nine candies. Why do we grab the same candies with so much difference?

Export: The teacher has a big hand, and she grabs more candies, while the children's hands are relatively small, so they grab fewer candies.

3.2. Activity 2: Grab peanuts

Teacher: Now, please have a look. What is this? (peanuts) Is peanut much smaller than candy? Now, I ask the student who just grabbed the candies to grab a handful of peanuts with his hand wide open. How many peanuts do you think this student has in his hand?

Student 1: I guess he might grab 36 peanuts.

Student 2: Maybe he will grab 50 peanuts.

Teacher: It seems that you have different ideas. Now, the leader of each group takes the recording sheet. You can guess a number first and write it on the recording sheet. Let us verify it. Later, I will ask each of your groups to grab a handful of peanuts. How it works exactly? First, we see the demonstration process of grabbing peanuts on the screen. (play demo video) Have you seen how it works? Let us see which group operates in the most disciplined manner. Now, let's begin. (teacher walks around)

(The teacher takes the recording sheets of six groups for projection and writes the results of one group on the blackboard)

Teacher: Let us take a look. Group 1 grabs ... peanuts, group 2 grabs ... peanuts, ..., and group 6 grabs ... peanuts. I found that the students in the six groups grabbed more peanuts than candies just now. Why is that?

Specification: Peanuts are bigger than candies, so the students grab less. If peanuts are smaller, they will grab more.

3.3. Activity 3: Grab soybeans

Teacher: (show soybeans) Soybeans are smaller than candies and peanuts. Compared with the experience of grabbing peanuts just now, if you grab a handful of soybeans, will you grab more or less soybeans than peanuts?

Students: I think I will grab more soybeans than peanuts because soybeans are bigger than peanuts.

Teacher: Now listen to my request. The leader of each group guesses a number first and records it. The operation is the same as that of grabbing peanuts just now. Then, record the results in the table. Now, let's begin.

(after the operation, the teacher writes the results of a group on the blackboard)

Teacher: Let us look at the records of group 1 first. They counted ... Peanuts and ... Soybeans. What do you find?

Students: The number of soybeans is more than that of peanuts.

Teacher: Let us see if group 2 is the same.

Guidance: Similarly, the number of soybeans is more than that of peanuts.

Questions: Look at the other group. They grabbed more soybeans than peanuts just now. Why is that?

Students: Because peanuts are bigger than soybeans, they grabbed less, and soybeans are smaller than

peanuts, so they grabbed more.

Teacher: Look at the number of soybeans grabbed by six groups. Group 1 grabbed ... soybeans, group 2 grabbed ... soybeans, ..., and group 6 grabbed ... soybeans. Why did six groups grab different numbers of soybeans?

Students: Each hand is different in size. A big hand can grab more things, and a small hand can grab fewer things.

Teacher: Just now, our classmates grabbed a handful of candies, a handful of peanuts, and a handful of soybeans. Please observe and compare the data in the Table 1. What do you find?

Student 1: I found that the size of the candies is significant, and the number of candies grabbed is minimal.

Student 2: I found that soybeans are the smallest, so the number of grabbed soybeans is the most.

Student 3: I found that candies are bigger than peanuts, and peanuts are bigger than soybeans. The bigger the thing is, the fewer things will be grabbed.

Specification: Grab things with the same hand. The bigger the thing is, the fewer things we can grab. The smaller the thing is, the more things we can grab.

Summary: What we just said about "Guessing" can also be "estimating," an essential mathematical skill. We should not estimate blindly. First, we must observe and compare, then estimate according to the facts.

Extension: (show the title) If you grab the least things with your hands, what do you think you might grab? (soybeans, walnuts, pistachios)

Students: It would be Walnuts because walnuts are the largest.

Summary: Because the number of things we grab by hand is the least, we must choose the biggest. The bigger the things are, the fewer things we can grab. The smaller the things are, the more things we can grab.

Table 1: A handful of candies, a handful of peanuts, and a handful of soybeans

A handful of peanuts (number)		A handful of soybeans (number)	
Guessing	Counting	Guessing	Counting

Design purpose: Estimation is a kind of qualitative thinking that is very valuable in cultivating students' number sense. "Number sense" requires students to be able to estimate the operation's results and reasonably explain the results.

4. Teaching process 3

4.1. Activity: Count the number

Transition: Numbers surround us, and many numbers are hidden in our school.

Teacher: Have you carefully counted the steps of the Book Mountain Staircase in our school? Now, let us count the steps following two classmates. Let us look at the screen. (play the video of two students walking on the Book Mountain Staircase)

Teacher: The two students had just walked a part of the Book Mountain Staircase. This is the overall view of the Book Mountain Staircase. (show the overall view of the Book Mountain Staircase) Could you estimate how many steps there are on the Book Mountain Staircase? Which answer do you choose? (A.20, B.45, C.100)

Student: I chose B 45 because 20 is too few and 100 is too many.

4.2. Summary of the lesson

Mathematics knowledge is everywhere, and mathematics is inseparable from our lives. You see, there are many numbers in our school and our lives. Let us enjoy them together. (As shown in the pictures) You should have a pair of eyes that are good at discovering and observe life with the eyes of mathematics.

Design purpose: Let students leave the classroom, choose some things in the school, and try to express them in different quantity forms. The determination of the number of these things involves not only simple counting but also simple measurement. Such activities are conducive to students' feeling of the characteristics of things in terms of numbers from different angles, which is conducive to students' further understanding of numbers' actual meaning and value.

5. Conclusions

5.1. Establish number sense in life scenes

Mathematics teaching activities are carried out in real-life situations so that students are no longer unfamiliar with mathematics and understand that mathematics is everywhere. Before this lesson, the pre-investigation is conducted: "Investigate the situation of using numbers within 100 to describe the things in your life," "Investigate the ages of your family," and "Count the things that interest you in the school or your life." The counting activities are conducted in the class: count 55 students and 55 chairs in the classroom. The teaching courseware shows pictures of "the height of 55 exercise books," "the height of 55 small checkerboards," and "the height of the building in the community is about 55 meters." Students are requested to intuitively feel that the same number of books with different thicknesses has different heights, and the same number with different units has different heights. These numbers are all tangible, visible, and countable around students so that students can use mathematical knowledge to explain mathematical phenomena in real life. Number sense cannot be realized by simple classroom teaching. It is important to let students perceive, experience, and explore by themselves. This lesson starts from the familiar environment of students and cultivates students' number sense by extracting mathematical knowledge from life.

5.2. Form number sense in practical exploration

Piaget, a psychologist, pointed out that "activity is the basis of cognition, and wisdom starts from practice." Therefore, practice is an important form of activity in mathematics teaching. In this lesson, students are provided with sufficient opportunities for mathematical practice activities so that students can actively participate in mathematical learning activities. Students can experience and form number sense in practical exploration. Three teaching practice activities are conducted, as shown below. Activity 1: grab candies. Let students grab a handful of candies and count the number of them. Activity 2: grab peanuts. With the perceptual knowledge of the number of candies in a handful, students are first guided to guess how many peanuts there are in a handful and then verify it by counting. In general, the volume of peanuts is much smaller than that of candies, so students can estimate that the number of peanuts in a handful is much more than that of candies. Whether students can correctly determine how many more peanuts are actually in a handful of peanuts than in a handful of candy requires good intuition about the practical meaning of numbers. The activity arrangement of guessing before counting is conducive to students' establishment and improvement of such intuition. Activity 3: grab soybeans. With the perceptual knowledge of the number of candies and peanuts in a handful, students are guided to guess how many soybeans there are in a handful to cultivate students' awareness and ability of number estimation. With the practical activities mentioned above, students are guided to estimate numbers using the established mathematical experience. The teaching activities in this lesson are progressive, constantly enriching students' perception of the practical significance of numbers within 100[6-7].

5.3. Deepen number sense in practical application

Mathematics originates from life, and its value can be highlighted only when mathematics knowledge is applied to real life. It is necessary to deepen students' number sense by letting them understand and apply mathematical knowledge in real life. Teachers should create all kinds of opportunities for practical activities and all kinds of situations that enable students to apply what they have learned to real life. Students are encouraged to leave the classroom, feel number sense outside the classroom, improve number sense, and bring number sense to life. For example, in the last part of this lesson, the teaching perspective is put on the Book Mountain Staircase in the school. The Book Mountain Staircase is the only way for students to enter the school and is the most familiar scene. Students are asked to estimate how many steps the Book Mountain Staircase may have, and students are guided to choose the correct option for the question. In addition, some pictures of numbers in life are shown so that students can observe life with mathematical eyes and experience the practical significance of numbers. Students can

apply what they have learned in real situations to reconstruct their understanding of life and mathematics to deepen their number sense. In this lesson, many teaching parts require students to make judgments by estimation to solve problems. Estimation accuracy is also an evaluation standard of students' number sense. Improving students' estimation ability is conducive to cultivating students' number sense. In mathematics teaching, teachers should create application scenes of estimation, encourage students to think and solve practical problems by estimation, help students feel the connection between mathematics and life, and let students deeply feel the value of mathematical knowledge and methods in practical application.

In conclusion, number sense is an internal perception, and its cultivation is a process from initial establishment to gradual development. Teachers should create real situations consistent with students' life experiences so that students can learn to observe, analyze, explore, and apply mathematical knowledge in real situations. It will enable students to feel the practical value and charm of mathematics. With the gradual development and deepening of number sense, students' number sense experience can be enriched.

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