Common Sense and Word Problems

Gohar Marikyan

Empire State University of SUNY, United States

Abstract

Research has been done on how students learn mathematics and how to teach them to solve problems. There are attempts how to teach mathematics using common sense. Such a methodology can be effective in teaching mathematics to pre-K, K, and elementary school children using their naturally existing common sense. Can this methodology be used to teach mathematics to adult learners? My research shows that some adults do not use their common sense in learning mathematics. Therefore, a similar methodology cannot be equally effective in teaching mathematics to that population of adult learners. This raises a few questions. How to teach introductory mathematics to adult students who do not use their common sense in learning mathematics? This can be summarized as a more general question. Do we use common sense to teach mathematics, or do we use mathematics to teach to use common sense? Moreover, can we use mathematics to develop analytical thinking? I conclude that one of the purposes of teaching introductory mathematics should be teaching students to use their common sense in solving problems. The habitual use of common sense will lead to the development of logical thinking. The net effect of such methodology will be the habitual use of their analytical thinking in solving all kinds of problems in mathematics, business, life, etc.

Keywords: *teaching mathematics, teaching methodology, adult students, learning processes, history of math education, common sense*

1. Introduction

My research topic is math anxiety and math education in general [9-13]. This research led me to another closely related research topic, the historical roots of teaching mathematics. I research the teaching methodology of Anania Shirakatsi, a famous Armenian mathematician of the 7th century [8]. Anania Shirakatsi's methodology of teaching arithmetic to children, described in the manuscript, does not use any fancy visual aids, does not require memorization, and eliminates learning by rote while building strong mathematical, long-lasting knowledge. Shirakatsi's methodology was adopted and successfully used in Armenia for centuries and in the entire former Soviet Union. It has been proven to be very effective. Shirakatsi's methodology can be adopted and effectively used by elementary school teachers in the 21st-century diverse classroom environment.

2. Common Sense in Learning Introductory Mathematics

Some research has been done on using common sense in teaching mathematics. Some authors incorrectly identified intuition as similar to common sense [5,6]. "Very often intuition means an elementary, common sense, popular, primitive form of knowledge, as opposed to scientific concepts and interpretations." [5]

According to the Cambridge Dictionary, intuition is "(knowledge from) an ability to understand or know something immediately based on your feelings rather than facts. Often, there's no clear evidence one way or the other, and you must base your judgment on intuition." Also, "intuition is a natural ability or power that makes it possible to know something without any proof or evidence: a feeling that guides a person to act a certain way without fully understanding why," according to the Merriam-Webster Dictionary. This contradicts definitions of common sense. Merriam-Webster Dictionary defines, "Common sense is sound and prudent judgment based on a simple perception of the situation or facts." https://en.wikipedia.org/wiki/Common_sense we read that "common sense is a basic ability to perceive, understand, and judge things, which is shared by ("common to") nearly all people, and can be reasonably expected of nearly all people without any need for debate." From these, I conclude that intuition and common sense are not the same as it is presented in Fischbein's research. Therefore, the drawn conclusions are about intuition in learning mathematics, not about the role of common sense in learning mathematics. In "The mental ability to cope with the challenges and opportunities of life," [1] Albrecht defines how common sense is used in life problem solving. It is interesting that Albrecht defines common sense as a "mental ability."

"School mathematics has historically attempted to mirror what has been seen as the abstract, context-free, universal nature of academic mathematics. Consequently, mathematics teaching has tended to concentrate on the promotion of skill in handling routine numerical, algebraic, and geometric operations divorced from meaningful contexts or realistic applications." [7] I have to disagree with the author, who believes that "academic mathematics" is not about understanding, but is a "skill in handling routine" operations "divorced from meaningful contexts." This teaching methodology results in learning mathematics by rote, not by understanding. Consequently, students get bored handling routine operations they do not understand. Joseph Casbarro expressed a similar opinion that the focus of teachers then becomes the coverage of content rather than teaching for understanding. "Teachers were converting classrooms into test prep centers." [3] and "the focus becomes developing skills to perform operations without understanding." [3]. Therefore, the above-mentioned teaching methodology cannot develop common sense. [10] Moreover, the net effect of such methodologies is that students stop using their naturally existing common sense in learning mathematics.

In [15], there is a discussion on why some adults have stopped using their common sense. "The more we're trained to think one way (by our workplace, family, culture, etc.), the greater the chance that sometimes we allow sloppy or auto-pilot thinking to replace common sense. Common sense isn't a one-stop-destination; it's a way of thinking that needs constant nourishing and application." [15] I conclude that teaching mathematics using common sense cannot be effective in teaching mathematics to adults who are accustomed to not using their common sense. However, the same methodology can be effective for pre-K, K, and elementary school children who are not yet accustomed not to using their common sense. This methodology will teach children to use common sense and develop their analytical thinking.

One experiment on using common sense in learning mathematics is the textbook Common Sense Mathematics by Ethan D. Bolker and Maura B. Mast. "In Common Sense Mathematics, we rarely put things to remember in boxes, but the moral of this discussion deserves that treatment:

In linear growth, the absolute change is constant.

In exponential growth, the relative change is constant." [2]

On one hand, the authors try to encourage students to use their common sense. On the other hand, they make students memorize two simple concepts. A good, logical definition/explanation of linear and exponential growth will help students understand, therefore eliminating its memorization. The more students understand, the less they need to memorize.

"You can understand the numbers in a paragraph from the newspaper only if you understand something about the subject it addresses." [2]

If the person knows nothing about the subject, the numbers will make no sense. However, "understanding something about the subject it addresses" is not enough "to understand the numbers." Below, I discuss a few examples of problem-solving by adult learners that support my statement.

3. Examples of Problem-Solving by Adult Learners

Throughout the years of teaching mathematics at different colleges, I accumulated a number of examples of not using common sense in solving introductory level mathematics problems, in graduate level projects, by college professors, and in life. Below, I discuss a few examples. (Some of the below problems are taken from textbooks [4,14].) In addition, I showed how to make students think it through again by checking their answers before submitting them. For this purpose, I show my version of the word problems for each example. Using my versions in teaching mathematics will teach students to start using their common sense and develop analytical thinking.

Example 1. An automobile is sold for $16,400. The sales tax rate is 7%. The total cost of the automobile is ______.

The student arrived at $175,480 while trying to find the 107% of $16,400. The correct answer is $17,548. This shows that the student had memorized the technique of calculating the sales tax but most probably incorrectly converted the percent to decimal. Having some knowledge of sales tax didn't prevent the student from submitting a ten-times larger answer.

My version. An automobile is sold for $16,400. The sales tax rate is 7%. The total cost of the automobile is ______.

Before submitting your answer, check it by performing the following calculations (using your answer).

If the total cost ($16,400+tax) of the automobile is $______ (provide your answer), and it was sold for $16,400, then the sales tax amount is $______. The sales tax amount should be (check one)
— greater than the cost
— less than the cost.

If the total cost ($16,400+tax) is $______ (provide your answer), and knowing that the car was sold for $16,000, then the sales tax amount (total cost - $16,400) is $______. Then the tax amount is ______% of $16,400. Compare with the given tax rate.

Example 2. If you can drive your car 58 miles using 2.5 gallons of gas, how many gallons of gas do you need to drive 1 mile?

The student's answer was 145 gallons. (The correct answer is 0.04 gallons.) On average, the gas tank capacity in cars is 16 gallons. Even not knowing that gas tank capacity is considerably less than 145 gallons, it had to be obvious that 145 gallons of gas is too much for driving just one mile.

My version. If you can drive your car 58 miles using 2.5 gallons of gas, how many gallons of gas do you need to drive 1 mile?

Before submitting your answer, check it by performing the following calculations (using your answer).

The gas you need to drive 1 mile should be (check one)
— greater than the gas you need to drive 58 miles
— less than the gas you need to drive 58 miles.

If you use ______ (provide your answer) gallons of gas to drive 1 mile, then you need ______ gallons of gas to drive 58 miles. Compare with the given number.

Example 3. George earns a salary of $38,417.60 per year. If George is paid biweekly, his gross paycheck would be ______.

The student wrote

Biweekly = (Every 2 weeks) = 26 weeks, and came up with the answer of $998,857.60. (The correct answer is $1477.60.) From the student's answer follows that George will earn close to 1 million dollars working just 2 weeks, while working the entire year George earns much less, just $38,417.60. The student failed to notice that $998,857.60 is too high for a biweekly paycheck if the annual salary is $38,417.60. The biweekly pay is 26 times more than the annual salary. After calculating that George is being paid 26 times in a year, the student has multiplied (instead of dividing) George's annual salary by 26.

My version. George earns a salary of $38,417.60 per year. If George is paid biweekly, his gross paycheck would be ______.

Before submitting your answer, check it by performing the following calculations (using your answer).

George's annual earnings should be (check one)
— greater than his biweekly earnings
— less than his biweekly earnings.

If George's gross biweekly paycheck is ______ (provide your answer), his annual salary will be ______. Compare with the given number.

In Examples 2 and 3, the students multiplied instead of dividing. This shows that they learned about multiplication and division without understanding. That is why they are unsure when to multiply or divide, and they choose the operation arbitrarily. These students failed to use the following:

If $a \times b = c$, then $a = c \div b$, and $b = c \div a$.

Example 4. The value of B in the equation B-16=27 is ______.

The student's answer was 11. (The correct answer is 43.)

Similar to Examples 2 and 3, Example 4 shows that the student did not understand addition and subtraction and how the two arithmetic operations are related. That is, the student failed to use the following:

If $a – b = c$, then $a – c = b$ and $c + b = a$.

My version. The value of B in the equation B-16=27 is ______.

Before submitting your answer, check it by performing the following calculations (using your answer).

B should be (check one)
— greater than 27
— less than 27.

______ (provide your answer) - 16= ______. Compare with the given number.

Let us discuss a few examples from open book tests of elementary Mathematics for Business course.

Example 5. A $1,000.00 bond with a price of 102 ¼ sells for ______.

The student's answer was 300. (The correct answer is $1,022.50.) This problem can be solved by performing one operation with percent. It is unclear what calculations were done to the given numbers 1,000 and 102 ¼ % and how the student arrived at the answer 300. This shows that the student was fully lost. Understanding that the answer has to be greater than 1,000 because 102 ¼ % is larger than 100% could prevent the student from submitting the incorrect answer.

My version. A $1,000.00 bond with a price of 102 ¼ sells for ______.

Before submitting your answer, check it by performing the following calculations (using your answer).

102 ¼% of $1,000.00 should be (check one)

— greater than $1,000.00

— less than $1,000.00.

If 102 ¼ percent of $1,000.00 is ______ (provide your answer), then the price of the bond is ______. Compare with the given number.

Example 6. Wilson paid $14,560.00 interest on 3.5 year 13% simple interest loan. The principal of the loan was ______.

Having some knowledge of principal and interest didn't prevent the student from submitting the answer of $1,892.80. (The correct answer is $32,000.) In this problem, the product (I – interest) and the two factors (R – rate and T – time) are given, and it is required to find the third factor (P – principal) using the formula I=PRT. Similar to Examples 2 and 3, I see a lack of understanding of the meaning of multiplication and division and how the two arithmetic operations are related. The student failed to use the following:

If $a \times b \times c = d$, then $a = d \div (b \times c)$, $b = d \div (a \times c)$, and $c = d \div (a \times b)$.

My version. Wilson paid $14,560.00 interest on 3.5 year 13% simple interest loan. The principal of the loan was ______.

Before submitting your answer, check it by performing the following calculations (using your answer).

The interest paid in a year is $14,560.00÷3.5=$4160, which is 13% of the principal. The interest paid in a year at a 13% rate should be (check one)

— greater than the principal

— less than the principal.

If the loan's principal was ______ (provide your answer), then the interest earned in 3.5 years at a 13% rate (use the I=PRT formula) is ______. Compare with the given number.

4. Solving More Complex Problems

In Section 3, I showed that students are having trouble understanding the use of basic arithmetic operations (+, -, ×, or ÷). Can they be successful in solving more complex word problems? Students, being accustomed to performing just one basic arithmetic operation to solve word problems, get confused when the solution requires performing more than one arithmetic operation. Let us examine a few more examples from the elementary Mathematics for Business [4] course that support my above statement.

Example 7. ______ is the compound interest on $2,460.00 at 8% compounded quarterly for 2 years.

The student's answer was $5116.80. (The correct answer is $422.28.) This problem can be solved by performing two operations using a number from a provided table. The student failed to understand that if the interest compounded in 2 years is more than twice the principal, then the interest rate should be around 100%.

My version. ______ is the compound interest on $2,460.00 at 8% compounded quarterly for 2 years.

Before submitting your answer, check it by performing the following calculations (using your answer).

The interest on $2,460.00 at 8% compounded quarterly for 2 years should be (check one)

— greater than the principal

— less than the principal.

If the annual interest is 8% compounded quarterly, then the rate per period will be ______%. The interest for the 1st quarter will be $______, and for the 2nd quarter will be $______. After comparing interests for the 1st and 2nd quarters, do you think that the interest on $2,460.00 at 8% compounded quarterly for 2 years can be $______ (provide your answer)?

Example 8. A machine costs $24,900.00 and has a salvage value of $1,000.00. If the estimated useful life is 50,000 hours, the unit depreciation would be ______.

The student's answer was $6000. (The correct answer is $0.478.) This problem can be solved by performing two operations. The student failed to estimate that if the machine depreciates by $6000 per hour, then after 4 hours, the cost of the machine will be less than the salvage value. That is, the machine's useful life is less than 4 hours, while it is given that the estimated useful life is 50,000 hours.

My version. A machine costs $24,900.00 and has a salvage value of $1,000.00. If the estimated useful life is 50,000 hours, the unit depreciation would be ______.

Before submitting your answer, check it by performing the following calculations (using your answer).

If the machine depreciates by $______ (provide your answer) per hour, then the depreciation amount in 50,000 hours should be (check one)
— greater than the cost of the machine
— less than the cost of the machine.

If the depreciation amount is $24,900.00 – $1,000.00 =$23,900.00, and the machine depreciates by $______ (provide your answer) an hour, then the useful life of the machine will be ______ hours. Compare with the given number.

Example 9. An office employs 157 people. It is estimated that each person will use 2 pencils every week. How many pencils will be used in the office each year?

The student performed just one operation, that is, multiplied the number of people by the number of pencils used in a week, and came up with the answer 314 which is the number of pencils that will be used in the office in a week, not in a year. (The correct answer is 16,328.) The student failed to see that each person per year will use 52×2=104 pencils. Therefore, 157 people in 52 weeks will use much more than 314 pencils. This example shows that students are accustomed to solving problems with just one operation.

My version. An office employs 157 people. It is estimated that each person will use 2 pencils every week. How many pencils will be used in the office each year?

Before submitting your answer, check it by performing the following calculations (using your answer).

If each person will use 2 pencils every week, then 157 people will use ______ pencils in a week. The number of pencils that will be used in the office in a year (in 52 weeks) should be (check one)
— greater than the number of pencils that will be used in the office in a week
— less than the number of pencils that will be used in the office in a week.

If each person will use 2 pencils every week, then each person will use ______ pencils each year (in 52 weeks). The number of pencils that will be used in the office in a year (in 52 weeks) by 157 people should be (check one)
— greater than the number of pencils that each person will use in a year
— less than the number of pencils that each person will use in a year.

If in the office each year will be used ______ (provide your answer) pencils, then ______ pencils will be used in the office each week. Knowing that the office employs 157 people, then each person will use ______ pencils every week. Compare with the given number.

Example 10. Betty's Bakery sells 3 times as many loaves of bread as homemade pies. Bread sells for $2 a loaf and pies sell for $7.50 each. If sales were $1,701.00, the total amount of bread sold was ______ loaves.

The student's answer was 6,378.75. (The correct answer is 378.) The fact that the answer was not a whole number (6,378.75 loaves) did not prevent the student from submitting the incorrect answer. This shows that the student did not use any common sense while solving this problem. Furthermore, the student failed to understand that the sales from more than 6,000 loaves at $2 each will be more than $12,000 which is 7 times larger than the sales ($1,701.00).

My version. Betty's Bakery sells 3 times as many loaves of bread as homemade pies. Bread sells for $2 a loaf and pies sell for $7.50 each. If sales were $1,701.00, the total amount of bread sold was ______ loaves.

Before submitting your answer, check it by performing the following calculations (using your answer).

The sale from ______ loaves at $2 each should be (check one)
— greater than the total sales
— less than the total sales.

If Betty's Bakery sold ______ (provide your answer) bread loaves, then ______ homemade pies were sold. The sale of bread was $______, and the sale of pies was $______. The total sale was $______. Compare with the given number.

Example 11. Jim's Small Appliance Store ordered 80 toasters costing $1,800.00. The four-slice toaster costs $24.00 and the two-slice costs $20.00. The total number of four-slice toasters ordered was ______.

The student's answer was 1200. (The correct answer is 50.) 1200 is 15 times larger number than the total number of toasters ordered. Using common sense the student could notice that if the number of ordered toasters is 80, then the number of ordered four-slice toasters cannot be 1200.

My version. Jim's Small Appliance Store ordered 80 toasters costing $1,800.00. The four-slice toaster costs $24.00 and the two-slice costs $20.00. Out of the ordered 80 toasters ______ were four-slice toasters.

Before submitting your answer, check it by performing the following calculations (using your answer).

The number of ordered four-slice toasters should be (check one)
— greater than the total number of ordered toasters
— less than the total number of ordered toasters.

If the number of four-slice toasters ordered was ______ (provide your answer), then, knowing that the store ordered 80 toasters, the number of two-slice toasters ordered was ______. The cost of four-slice toasters was $______, and the cost of two-slice toasters was $______, then the total cost of ordered 80 toasters was $______. Compare with the given number.

Below are two examples from a Statistics course [14].

Example 12. Here is a probability distribution for the number of candy bars sold at a house by a child.

x	P(X=x)
0	0.3
1	0.15
2	0.2
3	0.25
4	0.1

How many candy bars should a child expect to sell at a house?

The student's answer was 10 (The correct answer is 1.7.), although the total number of candy bars the child had and could sell was 4. Similar to Example 11, using common sense the student could notice that the child cannot expect to sell at a house 10 candy bars if the child has only 4.

My version. Here is a probability distribution for the number of candy bars sold at a house by a child.

x	P(X=x)
0	0.3
1	0.15
2	0.2
3	0.25
4	0.1

At a house, the child should expect to sell ______ of her/his 4 candy bars. The number of candy bars the child expects to sell should be (check one)
— greater than the number of candy bars the child has
— less than the number of candy bars the child has.

In Examples 1 – 8, I see why students did not arrive at the correct answers, while in Examples 9 – 12 it is obvious that the students were fully confused. This proves my above statement, that solving more complex word problems is more challenging for students, than word problems that require performing just one arithmetic operation.

Here are two examples from life without comments.

Example 13. On the first day of one of my classes, we were discussing the syllabus when one of the students sitting in the classroom, in the first row, said, “Professor, I didn’t know that the class is going to be online.”

Example 14. Manhattan M15 bus runs on First Avenue from south to north, crossing all the streets from 1st to 126th. One day, I was on the M15 bus going to 43rd Street. Because I was reading, I hadn’t paid attention to how close I was to my destination, and asked a middle age Manhattanite, “Where are we?” She responded, “On First Avenue.”

Example 15. Years ago, two college professors asked me to read their article and share with them my thoughts. One of them had a Ph.D. degree in business, and the other professor had a Ph.D. degree in social sciences. They together were in a foreign country, teaching at a university with high tuition, located in the largest city of the country, and it was required to have a master’s degree to be admitted to that university. The two professors had put together a questionnaire and asked their students to respond. The results of the survey they had generalized to the whole country. After I read their article my question was, “Your students were 22- to 30-year-old wealthy men and women with master’s degrees from the largest city in the country. Have you surveyed the elderly, children, middle-aged, uneducated, villagers, poor people, etc? Your results are from a sample, which does not represent the whole population. How could you generalize the results of the survey for the entire country?” Needless to say that they were not happy to hear my feedback. How much knowledge in statistics do the two professors need to have for understanding that it was wrong to generalize those results? I think just a bit of common sense could help to understand that the 22- to 30-year-old wealthy educated city habitats cannot represent the whole country.

Examples 13, 14, and 15 are just three of numerous similar cases showing that some people do not use common sense not only in learning mathematics but also in their everyday lives.

5. Conclusion

From these examples, I conclude that students had learned about addition and subtraction, multiplication and division, without understanding, and hadn’t learned how these arithmetic operations are related. That is why they are not sure which operation to perform, addition or subtraction, multiplication or division. They choose the operation arbitrarily. That is, students are having trouble understanding the use of basic arithmetic operations.

Without a basic knowledge of mathematics, learning more complex topics becomes challenging, and understanding becomes almost impossible. The use of common sense will help students to avoid providing meaningless answers.

Moreover, students, besides not using their common sense while solving mathematical problems, they are also lacking an understanding of how large or small the numbers are. That is, students do not estimate the numbers, to check the correctness of their answer. This is another proof that students were taught mathematics by memorization and rote, not by understanding. Consequently, students form an opinion that thinking is not required in learning mathematics. This reminded me of the reaction of two students (from different colleges) to my efforts to help them to understand math topics. They both said, “Please, don’t make me think.”

6. Which Came First Chicken or Egg?

The more general question is the following: Do we use common sense to teach mathematics, or do we use mathematics to teach to use common sense? This question is similar to the question “Which came first chicken or egg?” This has vexed philosophers since the Greeks. I believe the chicken was created first. One answer is for sure; we need both. We need a sufficient number of chickens to make the necessary amount of eggs that will produce enough chickens, etc. Similarly, both using common sense and learning mathematics are equally important. We need to develop the habit of using naturally existing common sense while learning mathematics. Studying introductory mathematics using common sense will develop analytical thinking. Students with better analytical skills will have a far better experience learning upper-level mathematics.

Common sense and analytical thinking skills are essential not only in learning mathematics but also in solving real-life problems. “Reflex or associative thinking. This is reactive thinking that is based simply on what we’ve learned through life, reenacting learned models and applying them to each new situation as it appears, without modifying the thought processes being applied. This type of thinking leads to errors in thinking because we refuse to push beyond standard associations formed in our mind about how things “should be”. When we apply what we know to a present situation by reference to a similar past situation by merely applying our mind’s template without adjusting for the context, we’re overriding common sense. Even where this template is a bad fit, the insistent or biased mind just ignores the parts of the template that don’t fit by trimming them off mentally and only seeing the parts that “match”. Hence, we have our problem solved without thinking it through. This type of thinking tends to make us easily swayed by current popular theories and fads, such as the current tendency in some societies to control social opinion through inflating fears of germs, criminals and terrorists, and job unavailability.” [15] Therefore, developed common sense will help to stop judging the same way about almost all situations. It will “push” the mind away from associations formed by prior life experiences, thus preventing to make mistakes in life problems, enriching life experience with new, correctly solved life problems. That is, learning mathematics through understanding will develop analytical thinking skills, and will prepare them for solving more complex real-life, business, and mathematical problems.

REFERENCES

[1] Albrecht, K., “Practical Intelligence: The Art and Science of Common Sense”, Pfeiffer Publishing, 2007.

[2] Bolker, E. D., Maura B. M., “Common Sense Mathematics”, http://www.cs.umb.edu/~eb/qrbook/qrbook.pdf, 2015.

[3] Casbarro, J., “Test Anxiety & What You Can Do About It: A Practical Guide for Teachers, Parents, and Kids”, Dude Publishing, Port Chester, NY, National Professional Resources, 2003.

[4] Cleaves, C, Hobbs, M., “Business Math, Complete”, 7th Ed., Prentice Hall, 2004.

[5] Fischbein, E. “Intuition in science and mathematics: An educational approach”, Dordrecht: Reidel, 1987.

[6] Freudenthal, H., “Revisiting mathematics education: The China lectures”, Dordrecht: Kluwer, 1991.

[7] Kilpatrick, J., “Developing Common Sense in Teaching Mathematics. http://math.coe.uga.edu/OLIVE/EMAT8990FYDS07/Keitel%20Festschrift.pdf, 2005.

[8] Marikyan, G., “Anania Shirakatsi’s Tvabanutiun: World’s Oldest Manuscript on Arithmetic, Part 1: Addition”, New York, 2011.

[9] Marikyan, G., “The Interrelation between Mathematical Logic, Math Education, and its History.” All About Mentoring, 44: 57–60, 2013.

[10] Marikyan, G., “Development of Logical Think among Students”, ATINER's Conference Paper Series, No. MAT2013-0474, New York, pp. 5–10, 2013.

[11] Marikyan, G., “Notes on Mathematical Model of Decision-Making Process”, Revisiting Boyer 1: 75–78, 2011.

[12] Marikyan, G,. “Notes on Math Anxiety Among Students: Cause-and-Effect, Pro-and-Con.” The International Journal of Learning 16, pages 211–221, 2009.

[13] Marikyan, G., “Math Anxiety and Adult Students.” All About Mentoring 33 (Winter): pages 79–88, 2008.

[14] Sullivan, Michael III. 2004. Fundamentals of Statistics. Prentice Hall, 2004.

[15] WikiHow, “How to Develop Common Sense”, http://www.wikihow.com/Develop-Common-Sense, 2016.