

Mathemagical Sub-terfuge

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Tell me and I forget, teach me and I remember, involve me and I learn.

—Benjamin Franklin

Sub: (noun) Short for substitute. (verb) Act as substitute.

Substitute: (noun) Person acting or serving in place of another. (verb) Put instead of another, used instead of.

Subterfuge: (noun) Artifice, skilled handicraft or ingenuity adopted by a wise, prudent person or statesman.

Would you like to be able to walk into a class of kids you have never seen before and have them eating out of your hands? Substitute teachers, who are in a new situation during a limited time, can actually make kids warm up to them and bolster their enthusiasm. Many students who have become jaded with the regular procedures will welcome a new face, style and technique. The fact that the kids don't know you can be used to your advantage, and you will be judged with a clear slate.

Before I explain my tactics, let me discuss some qualities that kids like in a teacher. Teachers who genuinely take an interest in people and like to share something of themselves are liked by students.

I once had a teacher who would bring interesting things to class, like scuba diving gear, and show us how they worked. Sometimes he would get us into a discussion about cameras or calculators (novelties

at the time) and end up teaching us some interesting points. I remember him saying, "Never take pictures of subjects with snow behind them because the light meter will give an incorrect reading due to the reflection of light from the snow."

Maybe what he taught during those moments wasn't part of the curriculum, but we became more interested and attentive. He became known as one you could "talk to." Students warmed up to him easily and were not afraid to ask questions in class.

What has all this to do with making an effect on kids as a substitute teacher? A substitute teacher must sometimes employ out-of-the-ordinary tactics to keep things running smoothly. As a substitute, I usually bring something fun to the classroom to "break the ice" at the start of the class, such as remote control answering machines or magic tricks or puzzles. Kids appreciate a sense of humor and like to discuss topics that are current or interesting. For example, ask them if they saw the movie about the deaf entitled "Children of a Lesser God," and offer to show the kids how to say hi in sign language.

I explain to the kids that if they finish all their homework in class, or if they at least make a good effort, I will show them something neat at the end of the class. This sounds like a bribe, but believe me, you are giving something of yourself and you can't have a relationship without an investment of yourself in some way.

After a while, you won't have to bring things in to class—they will bring things in to share with you! That is the real secret. Once the kids see that you can do something more than just teach, they will feel more relaxed and attentive around you, which makes the lessons smoother. I firmly believe that if kids like you as a person, they will be more willing to listen to what you have to say. If the things you share with the kids are interesting, and if these things help to

build a positive relationship with the students, you will have an impact on them that they will never forget.

The teacher's enthusiasm is vital to the students' progress.

What are some interesting things that can turn on students? Here is an example of how a simple trick, dressed up like an apparent feat of mind reading, never fails to cause wonder.

Before class, find a large dictionary and look up the first word at the top left side of page 1,089. Let's assume that this word is poodle. Write this word on the bottom edge of the blackboard in small letters behind a chalk brush. After you have introduced yourself to the class, tell them that you have something interesting to show them before you start the lesson.

Ask someone nonchalantly to lend you a large book that you have not seen before. Explain that something like a dictionary would do fine, and point to the dictionary at the back that you have secretly looked at before. Ask someone to bring it forward. When you receive it, flip through it several times and explain that this is a fast way of memorizing all the words. Then slam it shut and put it down. Ask for a volunteer who is good at adding and subtracting to come up to the blackboard to help you do a little bit of math. Tell the other students that they can do this at their desks. Inform the students not to say out loud any of the numbers on the blackboard because you are not supposed to know what they are. Now stand with your back toward the blackboard so you can't see what your volunteer is writing.

Ask the student at the board to think of any three digit number (all the numbers must be different) and to write it on the board. Let us assume the number was 416. Ask him to find the reverse of the number. (The reverse of 416 is 614.) Ask the student to write this reversed number on top of the first number if it is larger than the original number; otherwise, write it below the first number. For example, 614 would be written on top of 416. If 835 was chosen, 538 would be written below 835. Instruct the students not to voice any of these numbers.

Ask the student at the board to subtract the smaller number from the larger number and to reverse the answer and add it to the answer again as follows:

$$\begin{array}{r} 614 \\ - 416 \\ \hline 198 \\ + 891 \\ \hline =1,089 \end{array} \quad \text{or} \quad \begin{array}{r} 835 \\ - 538 \\ \hline 297 \\ + 792 \\ \hline =1,089 \end{array}$$

No matter which three digit number the students pick, they will always end up with an answer of 1,089! Ask the students at their desks to watch the person at the board to make sure that an addition or subtraction error is not made.

When everyone has done this, tell the student at the board to pick up the dictionary and hold it. Ask another student to stand in front of the chalk brush that has the word written behind it. Explain that you made a prediction before class today. Ask the student with the dictionary to look at the final answer on the board (1,089). Tell the student to turn to that page in the dictionary and read off the first word at the top left hand side of the page. After they do this, ask the volunteer to read the word on the board. When the students hear that the words are the same, they will be amazed. Explain that this trick is really due to the magic of numbers and that any three-digit number will always give you an answer of 1,089 once it has gone through this process. Show that this is due to the properties of 9s as follows:

$$\begin{array}{cccccc} 9 & 18 & 27 & 36 & 45 & \dots \\ 9=9 & 1+8=9 & 2+7=9 & 3+6=9 & 4+5=9 & \dots \end{array}$$

I also mention to them that if you pick any two-digit number with different digits and perform this process, the answer will always be 99:

$$\begin{array}{r} 73 \\ - 37 \\ \hline 36 \end{array} \quad \begin{array}{r} 36 \\ + 63 \\ \hline 99 \end{array}$$

I conclude by telling them that the number 9 has almost magical properties since you can tell that a number is divisible by 9 if the sum of the digits is divisible by 9. For example, 7,236 is divisible by 9 since $7 + 2 + 3 + 6 = 18$, which is divisible by 9. This is confirmed to be true since $7,236/9 = 804$.

I thank them for watching me and tell them that they can try this trick at home on a brother or sister. The kids usually work well after this in the hopes of seeing another trick.

If the class I am teaching has a reputation for being rowdy, I often say, "I'd like to do something

else at the end of the class, but that depends on you.” If one student tries to cause trouble, remind him or her that one person can ruin the chances of the whole class seeing another trick. That class will hear about the trick from another class who saw it and feel they missed out. This places tremendous peer pressure on the ringleader not to ruin the fun for everyone else.

As an alternative, have the noisy student finish his/her homework out in the hall while you show the trick to the rest of the class who will eventually mention it to him/her later.

Of course one doesn't have to be a pro magician to have fun with the kids—any area of interest or skill the teacher has can be used to advantage. Also, one does not have to take up class time to do something interesting for the students. Usually one finds a willing audience in the hallways at lunch or after school.

The magic is believing in you.

—Doug Henning

An idea, by the well-known magician David Copperfield, called “Project Magic” uses magic as a therapeutic aid. Teaching physically or mentally handicapped children how to perform simple magic tricks lets them do something that everyone else can't do. As a result, they develop self-confidence and a good feeling about themselves. Additionally, learning a magical illusion can aid in increasing problem solving skills, visual skills and coordination. Here is an example of an amusing magic trick I call the linking paper clips.

Fold a dollar bill in thirds and place a paper clip around the first and second folds and another clip around the second and third folds (see Figure 1). As you are folding the bill, place a rubber band around the dollar and position it within one of the folds. If you pull the upper corners of the bill away from yourself in a quick motion, the paper clips become linked and will end up attached to the rubber band (see Figure 2).

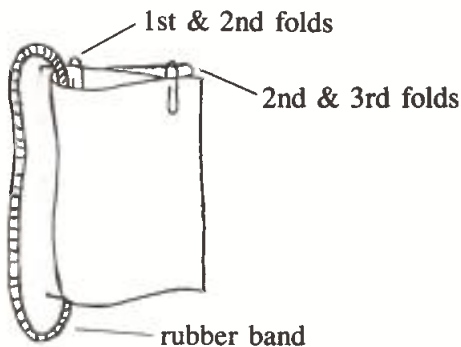


Figure 1

Abracadabra

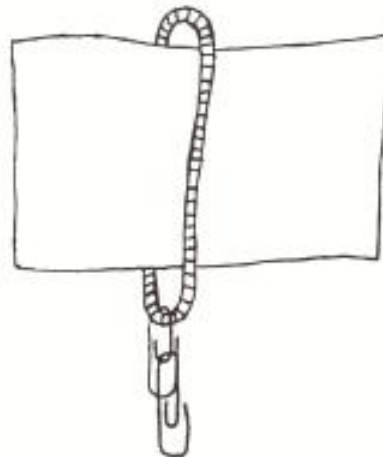


Figure 2

Here is another example of an interesting mathematical trick that seems to be a paradox and will challenge the smartest students to guess why this works. I narrate as follows: “No one should underestimate the power of mathematics. Recently, a math professor related to me how he earns extra money. (1) He deposited \$50 into a new bank account, then promptly withdrew \$20 leaving a \$30 balance. (2) The following day he withdrew \$15 leaving a balance of \$15. (3) Later that week, he withdrew \$9 leaving a balance of \$6. (4) He returned later that same day to withdraw the remaining \$6 which left his account empty. The next week, however, he returned to the bank and withdrew another dollar. How?” As you say this, write the following on the board:

Deposit of \$50

	Withdrawal	Balance
(1)	\$20	\$30
(2)	\$15	\$15
(3)	\$ 9	\$ 6
(4)	\$ 6	<u>-0-</u>
	\$50	\$51

Tell the kids, “When you subtract the withdrawal column from the balance column, you see that the bank owes him \$1. By using this special form of mathematics, he persuaded the manager that they still owed him \$1. Challenge the smartest students in the class to explain how this is possible. If no one figures this out, explain that the balance column readings have nothing to do with the actual balance in the

account. For example, if the man withdrew \$10 five times, the balance column readings would add up to \$100!

Happy are those who dream dreams and are ready to pay the price to make them come true.

Conclusion

- Remember that you are there to teach and not to babysit.
- If students are kept busy, they will not have time to get into trouble, so always have something extra on hand.

- Keep things consistent with the regular teacher by consulting a reliable student before class regarding the regular teacher's procedures.
- When subbing for a teacher who left unexpectedly for an emergency and has left no lesson plans, always be prepared with lessons, puzzles, work sheets and time-tested projects.

A teacher affects eternity; he can never tell where his influence stops.

—H. Adams