

Meeting the Challenge of Language When Teaching Science and Mathematics in Lebanon

Ideas, Strategies and Resources ... at a glance



Dr. Tamer Amin & Dr. Rabih El-Mouhayar,

Science and Mathematics Education Center, Department of Education, American University of Beirut

The Challenge:

Science and mathematics are taught in a foreign language (English or French) in Lebanon, but many students and some teachers are not comfortable using these languages.

<i>Common Misconceptions</i>	DO use all of students' language resources strategically. Arabic has a place in the classroom even if we use a foreign language of instruction ... but planning is necessary.
<ul style="list-style-type: none"> ✗ <i>The main language challenge students face is with knowing the right technical terms in science and mathematics.</i> ✗ <i>The only way students' proficiency in the foreign language will improve is to use it in the classroom all the time.</i> ✗ <i>Mixing Arabic and English (or French) randomly in the classroom cannot be avoided.</i> ✗ <i>Teaching subjects like science and mathematics and teaching language are two separate things.</i> ✗ <i>Science and mathematics teachers cannot teach language as well.</i> ✗ <i>A good teaching strategy is to give definitions first and then present examples.</i> 	<ul style="list-style-type: none"> ✓ Students' native language (Arabic) is the language that allows them to best express their thoughts and make sense of what they are learning. ✓ Using English (or French) all the time will often prevent students from understanding and participating in class. ✓ Arabic can be used strategically; here are some options to choose from as needed: <ul style="list-style-type: none"> ✓ Preview and review in Arabic to provide meaningful context at the beginning and clarify main ideas at the end. ✓ Allow students to use all their language resources (including Arabic) during group work but they can be encouraged to formulate conclusions in whole class discussion in English (or French). ✓ Translate key words (including non-technical terms) into Arabic to support understanding. ✓ Arabic could be particularly important when introducing new ideas.

Some useful links to help make abstract ideas concrete:

Phet Interactive Simulations (Science and mathematics):

<http://phet.colorado.edu>

Virtual Chemistry Labs:

<http://chemcollective.org>

<http://onlinelabs.in/chemistry>

Chemistry Demonstrations:

<https://chemdemos.uoregon.edu>

Mathematics Interactive Simulations:

<https://illuminations.nctm.org/>

Mathematics videos:

<http://www.mathantics.com/>

Be considerate – reduce language demands and scaffold foreign language use by ...

- ✓ Using concrete objects and manipulatives, diagrams and pictures, and computer simulations and animations.
- ✓ Sequencing activities from concrete/hands-on to class discussion to writing, gradually increasing the demands on language.
- ✓ Adding non-technical words and genre features to your language objectives of your lessons.
- ✓ Using analysis of non-technical terms and genre features of your unit to prepare lists of useful words and phrases ("word banks") and worksheets that would prompt and guide students to use the language of science and mathematics.

Meeting the Challenge of Language When Teaching Science and Mathematics in Lebanon

Ideas, Strategies and Resources ... at a glance



What aspects of language can science and mathematics teachers focus on?

Non-Technical Terms

Examples from science: transitional, directly, distributes, functional, characteristics, connect, control, ducts, secrete, produce, extract, compare, frequently...and many others.

Examples from mathematics: respectively, with respect to, define, exact, determine, satisfies, condition, given, case, deduce, conclude...and many others.

The Genres of Science and Mathematics

Language is used in specialized ways in science and mathematics, such as lab reports in science or word problems in mathematics. Each has a typical way of using language; the structure is often the same and the words and phrases are similar.

An example in science – the lab report

Parts and their functions	Language elements
AIM: What were you trying to find out in this experiment? Why did you conduct this experiment?	“The aim of this experiment was to ...” “This experiment was important to conduct because ...”
METHOD: Describe in your own words exactly what you did.	“1. We first ...” “2. Then we poured ...” “3. This step was followed by ...”
RESULTS: Summarize your observations so that you can draw conclusions later. Don’t draw conclusions here though.	“As ... increases ... decreases.” “The graph shows ...” “The highest percentage corresponded to ...”
CONCLUSION: What did you discover in this experiment? Based on your results, what inferences can you make? What might explain your results?	“When we noticed that ... this made us think that ...” “One explanation for our results is ...” “Another possible explanation is ...”

An example in mathematics – the word problem

Rabih dropped a special rubber ball from a height of 128 meters. Each time the ball bounces to half of its previous height. If after 1 bounce the ball reaches a height of 64 meters. How high did the ball reach after the 6th bounce?

Parts and their functions	Language elements
THE STORY SET-UP: This part sets up the story context into which the mathematical problem will be embedded.	Character names: Rabih Actions: <i>driving, running, building, buying, bouncing</i>
THE INFORMATION: This part introduces the mathematical quantities that can be used to solve the problem.	Quantities with units: distance in meters; speed in km/hr; price in dollars.
THE QUESTION: Poses the problem to the reader indicating the quantity that needs to be determined.	Question about an unknown quantity; often “If ... what ...?” structure with crucial

Other science genres: explanation, classification, decomposition

Other mathematics genres: proofs, procedures, justification

This resource has been created as a component of the project “Science Education: A Key to University Access for Refugee Girls” implemented by the AUB Center for Civic Engagement and Community Service in partnership with the Kayany Foundation as part of the grant scheme of the HOPES project funded by the European Union, and implemented by the German Academic Exchange Service (DAAD) together with the British Council, Campus France and Nuffic.

Copyright notice: This document has been developed to support non-profit educational efforts in science and mathematics. Whenever used, a reference should be added stating that the material was developed by Dr. Tamer Amin and Dr. Rabih El-Mouhayar, Science and Mathematics Education Center, Department of Education, American University of Beirut. If utilized, it is requested that notification be sent about how it is being used to smec@aub.edu.lb. This document cannot be used for any material gain.

Questions about this document can be directed to Dr. Tamer Amin (ta08@aub.edu.lb) and Dr. Rabih El Mouhayar (re29@aub.edu.lb).