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ETEC 533 – Design of a TELE

**STEM 4 ELL**

Second Language Inquisition in ELL Science/Math Classrooms

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# Problem Area

More than often, English as a Second Language(ESL) students or English Language Learners(ELL) from different grades struggle with the English vocabulary used in classrooms for different subjects because they weren’t initially taught the same terms in English but were taught in their Native language instead. Students may have learned the concepts and vocabulary already, and may have excelled in their studies, but when they are placed in an English classroom, this excellence may be hard to maintain, as their abilities to communicate or demonstrate their understandings would diminish greatly due to the unfamiliar terms in English.

ELLs spend a lot of time strengthening their vocabulary so that they can express themselves better.  This can be easy while hard at the same time.  This puts many ELLs at a disadvantage in second language classrooms. ELL must work extra hard to keep up with their studies in a second language, and even so Fry (2007), states in his research that English language learners still fall behind in their math and reading skills.

To provide more support to ELLs in classrooms, educators and learning facilitators can employ different strategies to help ELL students achieve these learning goals and help them improve academically.  Educators look at developing more creative, and successful lesson in literacy class while math and science classrooms gets less attention. Math and Science classrooms have ELLs as well, and they struggle to express their thoughts and demonstrate their abilities in those classrooms just as much as they would in regular literacy classrooms. Word problems for math class and science experiment instructions can ELL students’ headaches just as much as a story retelling task.  So, it is important to put some attention at integrated ESL STEM classes.

​Kim & Chang (2010) also stated in their research about “Computer games for math achievement of diverse students” that though ELLs don’t show significant effects in math games at first, continuous exposure of the math games to the students, yield better results in their math performance when compared to non-ELLs.   Freeman (2012) also recommends the use of programs like the HELP Math program to help students closer the gap between the performance differences of English speakers and non-English speakers in Math classrooms that was previously caused by language barriers.

So to help ELL student improve and better succeed in their classes, educators and facilitators should be create opportunities to do more hands-on learning, skill practices, and even use more digital supports to help building stronger understandings and stronger vocabulary that will in turn help ELL students do better in assessments.

# Design of a Learning Experience

**Matter Lesson**

**Subject:** Science

**Lesson Topic:**  Matter and Changes in States of Matter

**Target Audience:**  Elementary School ELL students and/or Non-ELL Upper elementary students

**Lesson Length:** 60 mins

**Lesson Outline:**

Using Little Alchemy game, have students try out and brainstorm chemical reactions that occur around us. Then, have students look discuss and think about what they observed from the game, and why they think such changes were caused.

After discussion, watch the Chemical Change video as a class.  ELL Students should make note of unfamiliar terms they hear from the video, for further discussion and word wall after.

Proceeding the video, review what was learned from the video, facilitator can use the matter simulation from PHET to look at matter changes caused by temperature.

Have students work in pairs to go on a scavenger hunt to find objects that can be used to demonstrate matter changes. This can be documented by photos, a video or actual object for in class demonstration.  This assignment can be done within class time, or over the course of two or three lessons. The main component is to have students explain their understanding to the class for the objects they've chosen for demonstrating the change. Students need to be able to both explain what happened that caused the change. Each pair's item(s) can be reviewed by facilitator first, before actual demonstration and presentation. Facilitator can also use printables for individual reviews and assessment. ​

**Pedagogical Goals for this lesson:**

This lesson is designed to be an inquiry-based learning experience, similar to Anchored Instruction and LfU experiences.  Students get to problem solve by having to think about what they observed and then replicate or create the same outcomes. By allowing the students to see possible outcomes in the form of a game first, students have to back track and attempt to re-engineer what they saw in real life using the same basic tools, and in this case the ground, water and fire elements. From a ELL teaching strategy perspective, the lesson would allow the students to use and think about basic simple elements that they would most likely have had exposure to, at home or in their native education. This would make it easier for the students to think of combinations of the elements, and focus on only the English expression and vocabulary aspects of what they know.

**ELL Component:** Speaking practice through explanations and presentation, vocabulary building, and writing in personal assessments.

**Resources:**

PHET Simulations, Videos, and Printables

**Magnet Lesson**

**Subject**: Science

**Lesson Topic**:  Magnet

**Target Audience**:  Lower Elementary School ELL students and/or Non-ELL Lower elementary students

**Lesson Length:** 60 mins

**Lesson Description:**

Lesson is designed for lower grade students learning about magnets for the first time. They get a chance to interact with a compass and a magnet, physically and digitally through the simulations. Games are also used to engage the students. Students will discover the parts of a magnet, learn about electromagnetic fields, and learn to manipulate the magnets to complete tasks given as review assignment and assessment. ELL students would build their vocabulary list by learning and using new terms taught in this lesson.

Assignment for this lesson would be to build a simple obstacle course/maze using magnets and a metal ball in a box for peers to try out. If facilitator wants to also integrate Art into this lesson, assignment for this lesson could also be Magnet Art, using magnetic sheets and iron filings.

**Pedagogical Goals for this lesson:**

This lesson is designed to be an inquiry-based learning experience, like T-GEM and Chemland experiences.  Students get to experience interactive learning through digital lessons, games and activities then is given a physical real-world task to complete to assess their understanding. Through speaking and writing tasks, students can practice verbal and aural skills to strengthen their English language abilities. Reading exercises done through the interactive programs, that is of interest to the student would intrinsically motivate the student to succeed and practice the language as well. Having students build on what they’ve learned and create a product would also help them better understand and present their learnings. These activities would also give the students the opportunity to work with non-ELL students and practice their language skills.

**ELL Component:** Speaking practice through explanations and presentation, vocabulary building, and writing in personal assessments.

**Resources:**

PHET Simulations, Videos, and Printables

# Pedagogical Goals of TELE

These lessons are designed to be mostly inquiry-based learning experiences. Through the help of science simulations and digital resources like videos and review games. ELL students get an opportunity to practice their language skills that would eventually lead to better success in their education. Having inquiry-based, and problem-solving lessons planned for students, ELL or non-ELL, gives the students a better learning experience, that is more student centred and focused. The students are also more motivated to answer their own questions then the ones set out by the educator. Educators’ task would then switch from educating to facilitating classroom tasks and be the source of asking “right questions” instead of being the traditional source of giving the “right answers”. These lessons would allow the students to use and think about what they know already, and instead of forcing them to re-learn concepts they might already know, it would help them focus on more language development, and focus on only the English expression and vocabulary aspects of what they know.

# Artefact/Materials

**Games**

<https://littlealchemy.com/>

<http://www.esolhelp.com/science-games.html>

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

**Worksheets**

<https://en.islcollective.com/> (Free Account required)

<https://www.superteacherworksheets.com/matter.html> (Account required)

**Online Science Aids**

ELL Teacher Pros - <http://www.ellteacherpros.com/science/>

Chemistry Solutions: Featured Simulations - <https://teachchemistry.org/periodical/simulations>

Virtual Chemistry Experiments - <http://www.chm.davidson.edu/vce/index.html>

PHET Simulations - <https://phet.colorado.edu/>

ChemCollective - <http://chemcollective.org/sims>

**Online Math Aids**

HELP Math Program - <http://www.helpprogram.net/home.htm>

IXl Math - <https://ca.ixl.com/math/>  
Khan Academy - <https://www.khanacademy.org/>

**ELL Strategies**

Strategies to teach ELL- <http://www.csun.edu/science/ref/language/teaching-ell.html>

How to Enliven Your ESL Classes with Interactive Science Lessons

<http://www.fluentu.com/blog/educator-english/esl-science-lesson/>

**Videos**

Basic math ESL vocabulary lesson - <https://www.youtube.com/watch?v=4AOW3B1RKD4>

(ELL) Using Targeted Interventions When Teaching Mathematics - <https://www.youtube.com/watch?v=U6lrnAZxjiQ>

Top Five Math Strategies for Teaching ELLs - <https://www.youtube.com/watch?v=sQqvH-YsG_o>

# Annotated Bibliography

Kim, S., & Chang, M. (2010). Computer games for the math achievement of diverse students. *Educational Technology & Society, 13*(3), 224-232.

Kim & Chang states in their study that Computer games when used as an academic tool for learning can have different effects on diverse groups and gender. Though there is still not enough data from the study for the writers to definitely say the effects of computer games in classrooms are positive, they emphasized a need for future studies in this area. They did see that male ELL students performance better in classes with daily math computer games

Freeman, B. (2012). Using digital technologies to redress inequities for english language learners in the english speaking mathematics classroom. *Computers & Education, 59*(1), 50-62. doi:10.1016/j.compedu.2011.11.003

This article looks at the examination of the question “What is the impact of a digital math intervention on secondary ELL students’ mathematical capabilities and perceptions of their future possibilities?” (Freeman, 2012) Using qualitative data collected from ELL Hispanic students over the course of half a year, students’ math abilities were observed as they interact with digital math technologies.

Fry, R. (2007). How Far behind in Math and Reading Are English Language Learners? Report. *Pew Hispanic Center*.

In this article, Richard Fry analyzes results collected in his study into individual testing programs administered in American states about the status of ELL students. His report contains figures and charts of his findings. The data reconfirms NAEP’s revelation that ELL students struggle in math and reading skills when compared to white students.

Strategies for Teaching Science to English Language Learners. (n.d.). Retrieved August 13, 2017, from <http://www.csun.edu/science/ref/language/teaching-ell.html>

The article on this website, presents important and useful strategies that teachers can use to teach science to ELL students. It focuses on the need for these strategies due to the complex vocabulary that students, ELL and non-ELL, struggle with. It contains various skill building strategies and examples of tools that educators and/or facilitators can use.