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**ACTION RESEARCH ON CONTENT-BASED STEAM CURRICULUM  
FOR ELL'S**

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This article is will demonstrate how a high-school TESL/TEFL teacher in the greater-metro New Orleans area of Louisiana used content-based pedagogies to implement STEAM (Science, Technology, Engineering, Arts, and Math) curriculum to engage ELL's (English Language Learners) through task-based learning. This action research was used to determine how teachers of ELL's can maintain their learners focus with whom are coming from academic backgrounds that are delayed and/or interrupted. The results of the action research indicates successful implementation of how the TESL/TEFL teacher integrated the STEAM-based curriculum, and how the ELL's used the task-based learning objectives to demonstrate results that indicated competent knowledge of the desired STEAM-based curriculum.

This article is will demonstrate how a high-school TESL/TEFL teacher in the greater-metro New Orleans area of Louisiana used content-based pedagogies to implement STEAM (Science, Technology, Engineering, Arts, and Math) curriculum to engage ELL's (English Language Learners) through task-based learning. This action research was used to determine how teachers of ELL's can maintain their learners focus with whom are coming from academic backgrounds that are delayed and/or interrupted. The results of the action research indicates successful implementation of how the TESL/TEFL teacher integrated the STEAM-based curriculum, and how the ELL's used the task-based learning objectives to demonstrate results that indicated competent knowledge of the desired STEAM-based curriculum.

The action research was conducted on high-school students that immigrated to the United States from Latin American and Asian-Pacific countries in a span of one to three years. All students that were participants in the action research had

varying degrees of delayed or interrupted academic learning from their native countries, and they ranged in ages from fourteen to twenty years. The ELL high-school participants ranged from high-beginning to high-intermediate levels of English comprehension in reading, writing, listening, and speaking.

The STEAM-based curriculum was carried out for one school year and determined by two Louisiana based non-profit organizations; the Louisiana Chapter of the United States Green Building Council (LA USGBC) and the National World War II (WWII) Museum of New Orleans, Louisiana. The LA USBC invites Louisiana teachers and their students to participate in a Green School Challenge; whose mission is to transform the way buildings and communities are designed, built and operated, making Louisiana a healthier place to live, work, and learn. The Green School Challenge engages students in low-or no-cost green projects that empower teachers and students to make positive changes to their own surroundings while reducing school costs. The education department of the National WWII Museum offers a service-learning project for teachers and students called Get in the Scrap that teaches how children during the WWII era were an integral part of their communities and by ‘scrapping’, AKA recycling, that helped win the war for the United States. Through various lessons on American History, recycling and energy conservation, teachers and students are learning how to create and sustain natural resources and protect the environment. The content-based curriculum from both organizations require students to learn STEAM content through project-based tasks that bring learning out of the classroom and into real-world scenarios.

The action research focuses on three distinct ideas; how a teacher implements the STEAM-based curriculum, how the ELL’s interpret the project-based learning tasks, and what results were produced by the ELL’s content-based instruction. Overall, the research is depicted through a top-down learning process that models and scaffolds thinking for ELL’s to understand their outcomes and objectives from the start of each STEAM-based lesson. These lessons will then use sensory-motivated learning to produce outcomes that show competent knowledge of the content and learning objectives.

TESL/TEFL pedagogy uses a variety of modeling and scaffolding techniques to engage student learning through the use of graphic organizers that help students create background knowledge on learning objectives that include key vocabulary, reading strategies, and note-taking skills. The teacher from this action research used a variety of graphic organizers to lead teacher-directed and student-directed discussions on STEAM-based curriculum; KWL, main idea and details, word meaning maps, web wheels, venn diagrams, and topic webs. The use of these graphic organizers enabled top-down processing for ELL’s because it allowed their thinking processes to then be stimulated from sensory details that were activated by the STEAM-based curriculum that included a variety of nonfiction and fiction texts, documentaries, and cooperative learning project-based tasks. The use of graphic organizers are an essential part of any TESL/TEFL class, and their use is a brainstorming and prewriting process that enables ELL’s to use their meta-cognitive skills to organize their thoughts, opinions, and ideas that they would like

to use when writing and speaking to show their competency of the course objectives.

The use of the graphic organizers allowed the ELL's to understand their goals for the project-based tasks associated with the STEAM-based curriculum from the LA USGBC and the National WWII Museum. There were a multitude of project-based tasks accomplished throughout this action research observation, but the most notable are the uses of renewable energy through the construction of a solar cooker, the publication of a summary from an article that discussed issues of recycling or energy conservation that demonstrated the academic writing process, and the use of technology by using a PowerPoint presentation to demonstrate how to implement a high school recycling program.

At the moment, renewable energy resources are an integral part of world wide political and social discussions, and it was important for the ELL's to understand the key concepts of Earth Science through a project-based learning task that asked students to work in cooperative learning groups to construct and cook with a solar cooker in order to demonstrate the power of an alternative, renewable energy source. This particular STEAM-based activity had the ELL's hone in on their process skills to observe, measure, predict, collect data, interpret data, communicate and draw conclusions.

The academic writing process is a challenge for most ELL's, but when graphic organizers are modeled and scaffold properly during a teacher-directed instruction, all students can have success. The second notable project-based learning task was to publish an academic writing piece that summarized a newspaper or magazine article in print or online that analyzed the text by using a 4-step summary writing process. The students were allowed to choose from multiple articles that dealt with concepts of recycling and energy conservation, and in turn, used a 4-step summary graphic organizer to publish an academic writing piece. When the teacher models and scaffolds the use of this particular graphic organizer, they are able to show the metacognitive processes that are necessary when trying to brainstorm and/or pre-write an academic writing piece. The graphic organizer located in the Appendix shows how the teacher modeled the process with their own example and scaffold the thinking into four different parts with the final section of the 4-step process demonstrating how to draft the ideas into a cohesive paragraph. This academic writing process allows students to internalize their thoughts, opinions, and ideas and use the top-down thinking process to demonstrate to their reading audience that they are conscience citizens who are aware of the ecological problems that human society is grappling with daily.

The final STEAM-based task observed the 'how to' process of creating a PowerPoint presentation that demonstrated how a student would create their own recycling program that would be implemented in their very own high school. This project-based activity included a specific list of requirements that asked students to look deeply into their research that led up to the implementation of their own recycling program; a baseline measurement of resources or awareness that were established at the beginning of the project, document the steps taken to create the recycling program, a one-page project report summarizing the project, the use of a

video/digital presentation to share the goals and results of the recycling program, and show an on-going effort to communicate and foster the project's objectives with the school community. The specific project requirements allowed the students to pick and choose their best pieces of published work and research that would show their expert knowledge in the subjects of the STEAM-based learning that was ongoing throughout the school year. This accumulative piece of student work demonstrated the cognitive and meta-cognitive processes that are associated with SLA (second language acquisition) such as, teacher-directed instruction using differentiated modeling and scaffolding techniques and methods, therefore; the students were able to take control of their own individualized learning and publish a piece of work that clearly showed valid and reliable data that demonstrated they were knowledgeable and able to teach and inform their audience of prominent recycling and energy conservation concepts.

Overall, the STEAM-based learning projects were a great success because the students' work demonstrated that higher levels of learning and acquiring new English language skills were constant and sustained. The ELL's enjoyed coming to class and using technology that required them to take a hands-on approach to learning that required them to work individually or in collaborative groups. The group of students that were studied for this action research project also won second place out of one hundred and fifty participating Louisiana high schools, where the students received \$1000 that was later used for an ecological field trip and the balance from their winnings were donated to two non-profit ecological organizations that helped in the ELL's environmental learning process throughout the school year.

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**ЭКСПЕРИМЕНТАЛЬНЫЕ ИССЛЕДОВАНИЯ АЭРОДИНАМИЧЕСКОЙ  
ХАРАКТЕРИСТИКИ ВЕТРОТУРБИНЫ ПРИ РАЗЛИЧНЫХ КЛИМАТИЧЕСКИХ  
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*Article is devoted to a research of wind power installation with dynamically changeable form of a surface for small speeds of wind. Experimental tests of skilled installation of the wind turbine in natural wind at various climatic conditions are carried out. Dependences of force of draft of the wind turbine on air temperature at various values of speed of wind are received. Results of an experiment have shown that at high speeds of wind change of density of the environment plays a large role.*