**Lesson Plan: Optics is all around us!**

Subject: Science

Strand: E. Physics: Light and Geometric Optics

Grades: 10, Academic

Time: 75 min

*Rationale/Student Background Information*

This lesson plan was designed for a grade 10, academic science class. It was intended for the introductory class to the physics unit. The majority of the class consisted of students who had completed grade 9, academic science in the previous academic year. In addition, there was a student who had attempted to complete the course twice but was unsuccessful and a student who completed the applied level class in the last academic year. About one third of the class had English as a second language. These students were Chinese, Japanese or Arabic. Many of the students had only been in Canadian schools for one year, maybe two.

The students’ proficiency in English was moderately weak. Their writing and speaking skills were at the beginner level. Their verbal comprehension and ability to read was at the intermediate level. That being said, understanding science concepts and instructions for laboratories was a challenge. For this reason, I began with a vocabulary activity to assess knowledge of concepts that would have been taught in previous years. This is critical because the ESL students may have not been taught the Ontario curriculum last year. Therefore, if they have any trouble with this information, they can get clarification immediately prior to learning the new concepts. I continued into a lecture on the new terminology being added for this topic. This was done primarily using a visual based presentation. Following this, the students were given the opportunity to use the new concepts to ensure and assess understanding. Further, there was a follow up activity for the next class day that would revisit the previous day’s material to help consolidate their learning. This activity was student lead.

This lesson includes many demonstrations, visuals and everyday concepts that intimately incorporate optic theory. All the students will be able to relate the concepts discussed in this lesson with their everyday lives, regardless of their culture. Therefore, students will be able to grasp the concepts at a basic level and add to this with greater understanding of the terminology. This lesson functions as an excellent hook for the rest of the unit while addressing some of the expectations outlined in the curriculum.

I taught this class five days a week and would include accommodations within my lesson plans to help these students better understand the classroom material. There are overall accommodations that I will apply to every lesson, regardless of what is planned. I also include specific accommodations that address specific activities. They were also attending the English Language Learner class five days a week to increase their English comprehension.

To meet the needs of the ESL students in the class, I integrated the Canale and Swain communicative competency approach into my science lesson plan. This approach helped to identify key skills that ESL students can acquire through this lesson.

I have incorporated the communicative competency approach within my lesson plan to assist students who have English as a second language. This means that some of the whole class methods that I used as well as all the accommodations I applied to teach the introductory class for optics reflect this theory. I used this approach to build proficiency in English related to science, thus, increasing understanding of the concepts presented. The measurable outcomes below describe what is expected from the students who have English as a second language and can be demonstrated in either oral or written formats, depending on the activity.

*Overall Program Goals*

By the end of this lesson, students will be able to describe different methods of producing visible light and discuss their uses. They will be able to compare and contrast different forms of visible light from various sources. Lastly, students will be able to think critically about which television is best between a LCD and plasma screen, and convince their peers of their choice.

*Measurable Outcomes*

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| *Linguistic/Grammatical Competence* |
| Students will be able to use scientific vocabulary when discussing the methods/sources of light production and optics in general. These terms include, bioluminescence, incandescence, fluorescence, phosphorescent, chemiluminescence, electric discharge, electroluminescence, light emitting diode (LED), organic light emitting display (OLED), liquid crystal display (LCD), and plasma.  |
| *Sociocultural Context* |
| Students will be able to identify the past and current effects of the different sources of light on the environment and on humanity. They will be able to discuss how different methods of light production have evolved to reflect the current societal need.  |
| *Discoursal Competence* |
| Students will be able to discuss the multiple methods from which visible light can be formed and the need of these sources in different aspects of everyday life. |
| *Strategic Competence* |
| Students will be able to use of technology, a dictionary or peer collaboration effectively to make sense of various terms.  |

*Overall Accommodations*

* Promote literacy with various tasks.
* Approach students who have English as second language during a task to scaffold instructions.
* Make content relevant to students’ lives.
* Create many opportunities for social interactions.
* Remember to take frequent pauses during each concept to allow for increased processing time.
* Provide less dense text and more hands on learning through demonstrations, visuals and lab activities.
* Student who have English as a second language have a journal in which they can indicate concepts they did not understand. They can come see me to discuss these.
* Provide students who have English as a second language with a copy of the notes.

*Lesson Plan*

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| *Big Ideas/Essential Question* |
| Light has characteristics and properties that can be manipulated with mirrors and lenses for a range of uses. |
| *Ontario Curricular Overall Expectation* |
| E2. Investigate, through inquiry, the properties of light, and predict its behaviour, particularly with respect to reflection in plane and curved mirrors and refraction in converging lenses. |
| *Ontario Curricular Specific Expectation* |
| E2.1 Use appropriate terminology related to light and optics, including, but not limited to: angle of incidence, angle of reflection, angle of refraction, focal point, luminescence, magnification, mirage, and virtual image. |
| *Materials* |
| Glow sticksGlow in the dark materialsChart paperSmart BoardMarkers and pencil crayonsYouTube videoCell phone/MP3 playerFluorescent materialFluorescent light detector Old style light bulb |
| *Motivational Hook* *5 minutes* |
| * As students arrive, have the video playing. The video is of bioluminescence while surfing. (<http://www.youtube.com/watch?v=uUbIWqiynBY>)
* As a title at the top of the slide containing the video: “What is going on here?”
* Use this video to introduce optics. Briefly address the video. Ask students to describe what they noticed and what is occurring in this video. Likely, they will not know that this is called bioluminescence. Just tell them that there are many cool real life situations in which you encounter concepts from this unit, such as this video.
* Tell them that this topic will be discussed today!
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| *Open* *15 minutes* |
| * Refer to the ***word wall***, which is already set up for the optics unit with terms that would have been acquired in previous years. Provide each group of 2 students with a term and a ***Frayer diagram*** (paste the term given in the middle of the diagram). Each group will complete the diagram and informally tell the class what they wrote. If it is wrong, another student or I will provide the correct description of the term.
* The students will then make any corrections and the Frayer diagrams will be posted on the word wall on the bulletin board.
* While this is occurring, circulate through the class and have a discussion with the students who have English as a second language. Have a talk about the previous terminology encountered and their familiarity with it. Assess (by observation) their oral fluency with this vocabulary as well as written by looking at their Frayer model afterwards.
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| *Body* *45 minutes* |
| Lecture: 25 minutes |
| * Provide students with a handout (attached at the end of the lesson plan). They are to take notes on this during the lecture component. Remind them that they will be handing it in before beginning the activity and it will be returned next class to use as study notes.
	+ This will scaffold and organize note taking for the students.
	+ Helps identify concepts that have not been understood
* Differentiate between natural and artificial forms of light.
	+ Use a flow chart to do this, using only key words.
	+ Explain bioluminescence by making reference to the video.
* Explain the difference between incandescent light and fluorescent light using a demonstration.
	+ Bring two light bulb, one of each to show students what incandescent and fluorescent light looks like in everyday life.
	+ Show students how other forms of fluorescence work. Bring various fluorescent materials with a UV light to visualize these.
	+ As homework, ask first row of students to brainstorm the environmental impacts of switching from incandescent to fluorescent light in our establishments.
		- They will write these down and briefly present it tomorrow
* Shut the lights off and allow the glow in the dark toys to produce light.
	+ Use this demonstration to explain phosphorescent light.
	+ As homework, ask the second row of students to provide some examples of this in society
		- They will write these down and briefly present it tomorrow
* Crack 2-4 glow sticks and pass them around
	+ Use this demonstration to explain chemiluminescence
	+ As homework, ask the third row of students if this is a good alternative for everyday use
		- They will write these down and briefly present it tomorrow
* Explain electric discharge
	+ Use images to explain this concept
* If cell phones are allowed, light up your cell phone to show students the backlight/ask them to think about their cell phones/music players.
	+ Use this demonstration to explain LED lights
	+ As homework, ask the fourth row of student what some possible advantages are of using LED over fluorescent and incandescent light
		- They will write these down and briefly present it tomorrow
* Briefly explain how plasma and LCD televisions work.
	+ Use a schematic representation to show this because there are many mechanical parts
* Present a summary of the new concepts learned and their definitions in a graphic organizer.
* *(Contingency plan)* Assess, based on observation, whether students understand the concepts. If not, spend more time in the lecture component.
* Collect the handout. Check for completion and make notes if any concepts were misunderstood so we can revisit them tomorrow
	+ Check that the vocabulary is being used correctly. A couple grammatical errors can also be identified.
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| Critical Thinking Activity: 20 minutes |
| * Put students into pairs
	+ Form ability groups between the ESL students and the non-ESL students
* Provide students with two fact sheets, one on LCD and another on plasma
	+ Ensure that the fact sheets are using point form and scientific language.
* Each pair is to get one piece of chart paper and a few markers/pencil crayons
* Ask students to decide which type of television is better and have them make a poster to convince their peers.
	+ Poster can be done in any format; there are no specific instructions for how the information is presented.
	+ There is no need for a lot of words, however, scientific vocabulary relevant to the subject must be included
	+ The poster must contain at least 3 convincing points
	+ The poster itself must be convincing, there is no oral presentation
* Once activity has begun, circulate through the class to ensure that the student who have English as a second language have understood the instructions and the concepts behind LCD/plasma television.
	+ If not, refer back to the graphic organizer that explains the concepts
* Allow for extra time to finish the assignment after school if the reading component was time consuming.
* Posters will be assessed for use of critical thinking skills and use of scientific terminology
* *(Contingency plan)* If lecture went long, give everyone extra time to finish this tomorrow.
* *(Contingency plan)* If students finish early, ask them to compare their poster with a group who chose opposite to them.
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| *Close**5 minutes* |
| * Remind students that their respective rows will be sharing their ideas with the class tomorrow. Each person must say one idea, as usual.
* Remind students to hand in the poster before they leave and the handout if they haven’t already.
* Approach the ESL students and remind them that they can come to see me to discuss the concepts they wrote in their journal. Remind them of my availability.
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| *Follow Up* |
| * *(Contingency plan)* If students did not get time to finish the poster, they will be given some time before the lesson.
* Address terms on the handout that were not understood or misunderstood
	+ Have a conversation with any ESL students who did not understand a concept after class if it is still unclear.
* Students briefly tell the rest of the class about the topic assigned to their row.
* Students will engage in a discovery learning by exploring their reflection in different types of mirrors (plane, convex and concave)
* I will hand back the handout and poster (if completed) from yesterday.
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*Student Assessment*

* Handout: students will get a completion mark
	+ Any blanks are to be filled out using the textbook when returned.
	+ Make note of the terms that are not understood and address them in the next class.
* Poster: assessed for critical thinking skills and use of scientific terminology
* Observation: while circulating through the class during group work, make note of any students who seem to be struggling

*Self Assessment*

Following the delivery of this lesson, I will reflect on its effectiveness by examining the comprehension level that the students were able to attain (based on my observations, the handout, the journals and conversations with students), and the timing of each component (based on whether or not I had to implement my contingency arrangements).

*Frayer Model*

**Name:**

Fill out the following table during the lecture. Hand this in before you begin the activity.

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| --- | --- | --- | --- |
| **Source of Light** | **Definition** | **Advantages and Disadvantages** | **I need clarification on:** |
| Bioluminescence |  |  |  |
| Incandescence |  |  |  |
| Fluorescence |  |  |  |
| Phosphorescence |  |  |  |
| Chemiluminescence |  |  |  |
| Electric Discharge |  |  |  |
| Electroluminescence |  |  |  |

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