Lesson Plan 2

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Lesson Title: Waste mitigation strategies
Grade Level and Course: 11 (IB DP DT)
Time Segment of Lesson: 55 minutes

In this lesson my goal is to demonstrate the InTASC Standards 1-3: Learner Development, Learning Differences, Learning Environments

Standard(s) Addressed in Lesson:

IB Nature of Design: The abundance of resources and raw materials in the industrial age led to the development of a throwaway society, and as resources run out, the many facets of sustainability become a more important focus for designers. The result of the throwaway society is large amounts of materials found in landfill, which can be considered as a new source to mine resources from. (2.7:Often, by solving one problem and designing new technologies, there are unforeseen consequences, which bring new problems)

International mindedness: The export of highly toxic waste from one country to another is an issue for all stakeholders.

TOK: The circular economy can be seen as an example of a paradigm shift in design. Does knowledge develop through paradigm shifts in all areas of knowledge?

Aims (Aim 2): The exploration of possible solutions to eliminate waste in our society has given rise to ideas developed as part of the circular economy. By redesigning products and processes, the waste from one product can become the raw material of another.

CCSS.ELA-LITERACY.RI.11-12.1
Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

CCSS.ELA-LITERACY.RI.11-12.7
Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

Overarching Unit Goal(s):

Unit: Resource management and sustainable production (22 hours)
Students will

- **Consider the challenges of development of renewable and sustainable resources as one of the major challenges of the 21st century for designers;**
- **Identify waste mitigation strategies and provide relevant examples;**
- **Learn that energy conservation and efficient energy use are pivotal in our impact on the environment;**
- **Explore clean technology found in a broad range of industries, including water, energy, manufacturing, advanced materials and transportation;**
- **Find out about the iterative development of green products can be incremental or radical depending on how effectively new technologies can address the environmental objectives;**
- **Consider that designers should have a firm understanding of their responsibility to reduce the ecological impact on the planet. Eco-design concepts currently have a great influence on many aspects of design;**
- **Differentiate between green design and eco design.**

Objective(s) of the Lesson:

By the end of this lesson students will:

1. Critically think about various examples of waste mitigation strategies in our lives.
2. Explore possible solutions to eliminate waste in our society.
3. Differentiate between linear and circular economy and identify the challenges of moving towards circular economy.
4. Identify how dematerialization can improve product efficiency by saving, reusing or recycling materials and components -
   with the accuracy of above 75% as measured in a **formative assessment: Study guide** and **summative assessment: Unit quiz**. (Note: unit quiz is submitted by students at the end of the unit)

Student Diversity and Differentiation of Instruction

Standards 1-3 are addressed when evaluating students' abilities, approaches, learning styles and designing activities, grouping them considering every students' needs:

Identify students who will need differentiated instruction for this lesson.

Student Diversity	Differentiation of Instruction

All students are ELL	Allowing to use translation tools on their laptops; allowing more time upon their request (when they work in groups/pairs/independently) on formative tasks; allowing to ask questions - if something isn't clear. Visual support: images and videos are provided when introducing new concepts. Students are expected to come after classes, if they need additional explanation
1 student is on medications. She prefers to work independently and doesn't feel comfortable in social situations	In the beginning of each week my mentor gives this student tasks to work on. She is familiar with unit goals and submission requirements. Visual support: images and videos are provided when introducing new concepts. She can always approach and ask additional questions. She is coming twice a week to continue working on her tasks or to ask questions from my mentor.
Low performing students	Never grouped together; often grouped heterogeneously with medium/high performing students. Visual support: images and videos are provided when introducing new concepts. Students are expected to come after classes, if they need additional explanation or help.
Challenging behavior students	Never grouped together. Usually grouped with the students, who can role-model expected behavior in a positive environment. Students are expected to come after classes, if they need additional explanation.

Formative and Summative Assessments- include open ended questions that will lead students to think deeply about the content and will also build on prior knowledge.

Formative Assessment	Summative Assessment

1. After class (submitted online): Study guides on **moodle (online platform)** for Topic 2 - The study guides are formative assessments that help to review the material (by answering questions, by researching, analyzing, and following tasks) and to prepare for formal summative assessments (unit quizzes and exams). The successful completion without/minimum number of mistakes would indicate the student is completely following/understanding the class material and no/minimal adjustments are required; poor performance would indicate the opposite (approach, slides, formative assessments have to be reviewed, especially if a large amount of students has failed the study guide tasks) My goal is to gather such data, analyze, and make according decisions. Given as a homework assignment. Expected completion: after the end of the unit. Can be started earlier. A draft version of study guide can be found here: https://docs.google.com/document/d/1nZ4RVesRSgjVRILdxjGRWCcOBcVgUI9N/edit	Unit quiz (SL and HL students): quiz of 20 questions uploaded on Moodle to test their understanding of the entire unit. The goal is to ensure the students have mastered the standards, fulfilled the objectives. Time limit: 35 minutes After the end of unit (not during this lesson)
2. Class discussions, asking questions.	
3. Collaborative activity 2-3 groups explore the topics of dematerialization, energy/material recovery. After discussing with their group members - identify key aspects and share with the other	

group(s). The other group is asking questions.	
4. Formative quiz (independent) on topic 2.1 in class on Moodle	

● If there is no summative assessment in this lesson, what/when will the summative assessment be/take place

Questions for formative assessment during and/or after the lesson:

1. What do you see in this picture? (Landfill) What are possible solutions to reduce waste?
2. How would you describe a throw-away society?
3. What are the examples of reusing? Recycling? Refurbishing? Reengineering?What do you usually repair before throwing away?
4. Discussions after watching a video “precious plastic” - values, identities, actions
5. What is a circular economy? What are examples of circular economy?
6. After watching the video “WEEE design for the dump”: - What is “design for the dump?”
    - What is the connection between Moore’s law, a technology progress, and a global toxic emergency?
    - How would “product take back” improve the situation?

Big Ideas to be Addressed in the Lesson:

Waste mitigation strategies can reduce or eliminate the volume of material disposed to landfill.

The abundance of resources and raw materials in the industrial age led to the development of a throwaway society, and as resources run out, the many facets of sustainability become a more important focus for designers. The result of the throwaway society is large amounts of materials found in landfill, which can be considered as a new source to mine resources from.

The exploration of possible solutions to eliminate waste in our society has given rise to ideas developed as part of the circular economy. By redesigning products and processes, the waste from one product can become the raw material of another.

As DP Design Technology student you should explore:

- Use and recovery of standard parts at the end of product life
- Recovery of raw materials

- Reduction of total material and energy throughput of a product or service, and the limitation of its environmental impact through: reduction of raw materials at the production stage; energy and material inputs at the user stage; waste at the disposal stage

- How dematerialization can improve product efficiency by saving, reusing or recycling materials and components
- The impacts of dematerialization on each stage of the product life cycle including: material extraction; eco-design; cleaner production; environmentally conscious consumption patterns; recycling of waste
- Potential results of successful dematerialization

Discussion Questions

Write out questions that you would like students to discuss in class, before class or after class because they are interesting, support higher order thinking, and make for a lively and engaging discussion. If discussions must happen outside class, what tool will you use to facilitate the discussion (e.g. Twitter)?

1. Continue exploring the waste mitigation strategies around you and think about the examples for each strategy
2. What are the examples of circular economy in our city?
3. Watching more videos after class on IB websites such as design and inquiry: https://sites.google.com/view/designandinquiry/dp-sl-design/topic-2-resource-management-and-sustainable-production/2-2-waste-mitigation-strategies
4. Guardian article: Only 14% of plastics are recycled – can tech innovation tackle the rest?

These discussions/thoughts if not fully explored in class can be submitted with the study guides on moodle.

21st Century Knowledge and Skills

21st Century Knowledge and Skills	Teaching Strategies
Critical thinking	asking questions and letting them work on formative assessments using various technology tools (moodle, course websites,

	external websites)
Collaboration	letting them work in groups, brainstorm, discuss)
Communication	letting them work in groups, brainstorm, discuss
Information literacy	letting them research, read primary/secondary, online/paper resources using various technology tools (moodle, course websites, external websites)

Literacy Skills

Oral language skills (when answering questions, presenting their findings, summarizing reading, when working in groups, brainstorming, discussing, presenting in groups)
Self-regulation and self-monitoring (while reading, speaking, writing, when working in groups, brainstorming, discussing, presenting in groups)
Connecting background knowledge to the information in the text/video (reading,when researching, reading/watching/listening primary/secondary, online resources, searching for examples online)
Reading comprehension (reading with purpose, when researching, reading primary/secondary, online/paper resources)
Writing (working on formative/summative assessments)

Teaching Strategies and Related Student Activities (Include Web 2.0 activities and innovative strategies,as appropriate):

Teaching Strategies and Activities: What are the teaching strategies and activities that you plan to use to help students meet the lesson's objectives? What are the steps that you will take to deliver this lesson (e.g., introduce the author, read the poem, ask students to…)? Make this section as detailed as possible. It should allow you to hand it off to a substitute teacher.

Sections of the lesson	explain	Mods **Standard 2**

Standard 3 **Before the lesson starts:** Greet students, let them prepare for the lesson, tell them that they would need their laptops, but need to put away their cell phones; talk about how they are doing, if they want to share anything; or propose a topic to discuss		
Intro (I do, they do)		
Standard 3 Talk about expectations, ask questions	What does "active listening" mean?"	Visual: sentences, images on the slides (for ESL students)
Standards 2,3 Daily check-in	Ask questions	Visual: sentences, images on the slides (for ESL students)
Standard 1 Formative quiz on moodle	1. Explain what the test is about (Topic 2.1 renewable non-renewable resources) 2. Explain that the test is formative "for learning" 3. Time allowed 10 minutes 4. Show on screen where exactly to find it	Even though permitted time is 10 minutes for everybody; they are allowed to ask questions if they struggle; low voice discussions are also allowed
Standards 2,3 Introduction of the new topic: Ask a question to grab attention: What do you see?	Provide a picture of a landfill. Explain why this is a problem: The abundance of resources and raw materials in the	Visual: sentences, images on the slides (for ESL students)

	industrial age led to the development of a throwaway society, and as resources run out, the many facets of sustainability become a more important focus for designers. The result of the throwaway society is large amounts of materials found in landfill, which can be considered as a new source to mine resources from What are potential solutions to reduce waste?	
Provide the agenda for the lesson.		Visual: sentences, images on the slides (for ESL students)
Main part (I do, we do, they do)		
Standards 1,2, 3 Step by step introduce the waste mitigation strategies: **Powerpoint with more details is available here**	- provide definitions, examples; talk about features, goals and key benefits of reusing, repairing, refurbishing, recycling - Tell them that Different materials have different degrees of recyclability. Aluminum for instance, doesn't degrade to the same degree as most plastics, and can be recycled quite easily	keep asking if everything is clear. if yes - ask them to provide examples for each strategy if no - provide more examples; if necessary - talk after class (provide more resources to study at home or after class - office hours)

	and frequently and still maintain its desirable physical and aesthetic properties. Most plastics, on the other hand, degrade during the recycling process, and their physical properties change.	
Standard 2 Video “Precious plastic” and discussion time	Watch video and think: A THINKING ROUTINE FROM PROJECT ZERO, HARVARD GRADUATE SCHOOL OF EDUCATION: values, identities, actions	
Talk about circular economy	Provide definitions; compare with linear economy; ask if they know about the examples of circular economy.	Visual: sentences, images on the slides (for ESL students); keep asking if everything is clear. if yes - ask them to provide examples for each strategy if no - provide more examples; if necessary - talk after class (provide more resources to study at home or after class - office hours)
Standards 1,2,3	Electronic devices contain a	Visual: sentences, images on

WEEE	mixture of materials and components that can be hazardous and cause environmental damage when disposed of improperly. This wastes are also referred to as e-waste. Video questions: What is “design for the dump?” What is the connection between Moore’s law, a technology progress, and a global toxic emergency? How would “product take back” improve the situation?	the slides video with subs (for ESL students); keep asking if everything is clear. if yes - ask them to provide examples for each strategy if no - provide more examples; if necessary - talk after class (provide more resources to study at home or after class - office hours)
Standards 1,2,3 Dematerialization, energy recovery, raw material recovery - groups teach each other	Each group researches about group 1: dematerialization group 2: raw material recovery group 3: energy recovery Time 15 min Each group tells 5 important aspects of the subject they have researched Other groups listen and come up with 1 question for a group who presents A very good question - receives a round of applause A very good response - receives a round of applause	Based on the total number of students - separate into 2 to 3 groups - group heterogeneously based on SEL and behavior - group homogeneously based on academics level - best friends and worst enemies are separated for more effective collaboration Walk around, ask questions to support their critical thinking, answer their

	too :)	questions.
Dematerialization, energy recovery, raw material recovery	Provide more details about these concepts if they have missed anything important; provide examples	
Review (they do)		
Standard 1 Provide examples for each waste mitigation strategy they learned today		if necessary - talk after class (provide more resources to study at home or after class - office hours)

Teacher/Student Input: Write a note on what you expect the teacher and students to do as a part of this activity. Include a note on whether this is an "I do it", "We do it" or "You do it" type of activity.

I do:

- introduce new information,
- provide examples,
- help,
- ask questions

  Examples: **Intro:** asking questions, **main part:** introducing the agenda of the lesson, introducing new concepts, providing examples, moderating activities, providing constructive feedback, **review:** asking question, evaluating their responses, answering questions if any

You do:

- provide examples,
- brainstorm with a partner/group,
- research, present,

- ask questions,
- take notes at all time,
- raise hands to provide an input or to ask questions,
- follow classroom norms

We do:

- ask and answer questions,
- help each other,
- do our best to meet the objectives

More information in the table above

Review: Write down ideas on how you will review the topic, including notes on types of formative assessments that you will use during the lesson.

Exit-ticket questions as a lesson overview (last 10 minutes of a lesson), the responses will indicate students level of understanding, i.e., questions will cover the knowledge students should demonstrate as a mastery of the standard and based on the covered content:

- Provide a definition and an example of reusing/refurbishing/recycling/dematerialization/energy recovery/material recovery
- What is a circular economy? How is it different from linear?
- What are the drawbacks of a linear economy?
- What is WEEE?
- I evaluate and if I see some students struggling on particular topics - provide as a review of the previous lesson during the next lesson in the beginning.

Materials and Resources for Lesson

Materials, Technology, and Websites	Required Preparation
IB Design and Inquiry website	read, watch videos, filter out based on time allowance, students understanding

Diploma Design Technology website	read, watch videos, filter out based on time allowance, students understanding
External examples	search for ideas, samples outside of regular IB curriculum open source resources

References

IB approved resources:

Where did you get ideas and resources for this lesson plan?
IB Design and Inquiry website
https://sites.google.com/view/designandinquiry/dp-sl-design/topic-5-innovation-and-design/5-3-strategies-for-innovation?authuser=0

Diploma Design Technology website
https://docs.google.com/presentation/d/17qjF2DAe20TogHc0Mp_r73unATq57e-CO1-IqFsxrDM/pub?start=false&loop=false&delayms=3000&slide=id.p37

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