Trees Lesson Plan

PLANNING THE LESSON/SUBTASK: Part 1

Date: July 25, 2024 | Grade: ICS 4U | Time Frame (time available): 75 mins

Curriculum Area: Computer Science | Title of Unit (if appropriate): Advanced Data Structures

Context: *Where does this lesson fit into your overall unit planning — introductory, middle, culminating? (Prior Knowledge?)*

Taught towards the end of the unit. Covered other structures like stacks, queues, maps.

Prior Knowledge (assessed by exit ticket in previous class):

- Basic data structures and types (int, string, lists)
- OOP: classes, objects and methods
- Implement basic algorithms
- Recursion (note: tree implementations do not require recursion, but it does make it simpler. So for this assignment I'm assuming I am teaching trees after recursion. But the lesson could be altered so that recursion is not required knowledge if needed).

Curriculum Expectations:

Overall:	**Specific:**
• A3. design and write algorithms and subprograms to solve a variety of problems • C1. demonstrate the ability to apply modular design concepts in computer programs	• A3.6 design a simple and efficient recursive algorithm (e.g., calculate a factorial, translate numbers into words, perform a merge sort, generate fractals, perform XML parsing) • C1.1 decompose a problem into modules, classes, or abstract data types (e.g., stack, queue, dictionary) using an object-oriented design methodology (e.g., CRC [Class Responsibility Collaborator] or UML [Unified Modeling Language])

Big Ideas:

- Data structures and algorithms
  - Understanding the tree data structure
  - Designing and implementing algorithms to add, remove, and traverse a tree
- Object-oriented programming
  - Tree data structures are implemented using OOP design

Connections to Equity, Diversity, And Social Justice:

- Lesson incorporates a variety of teaching methods to suit students' learning styles (whole group and small group instruction, visual, auditory and kinesthetic components)
- Opportunities to share perspective and communicate with other students (whole class discussions and small group collaboration)
- Foster a welcoming learning environment for all students, regardless of abilities or backgrounds

Assessment:

Diagnostic	Formative	Summative
Observation Learning Log/Journal Presentation/Performance Anecdotal Notes Self-assessment Audio/Video/Technological Presentation Exit Ticket (previous class)	Work Samples Peer-assessment Project Interview/Conference Personal Reflection Rubric Checklist Oral Reports	Other Presentation/Performance Published Work Graphic Organizers Quiz

'Creating the Dynamic Classroom, A Handbook for Teachers, Revised Edition', Schwartz/Pollishuke, Pearson Publishing, 2011

Accommodations and/or Modifications / Differentiated Instruction:

Instructional	Environmental	Assessment
Peer tutor/Partner Oral explanation Include visuals, models, organizers Include translations Typed notes	Wheelchair access Assistive devices for computer	Record student Scribe for student Increase allowed time Allow translator app Allow writing in L1 Include translations

Modifications for:

Student(s) with physical disability: wheelchair access, assistive devices for computer

Student(s) with learning disability: oral explanation, include visuals, models, organizers, record student, scribe for student, increase allowed time, typed notes

MLL Student(s): oral explanation, include visuals, models, organizers, include translations, record student, increase allowed time, allow translator app, allow writing in L1, typed notes

Materials/Resources:

Teacher Resources	Student Materials	Equipment
• Whiteboard examples • Live coding plan • Small group questions	• 1 page information sheet (1 copy per student) • Small group questions (1 copy per group of 3)	• Whiteboard markers • Human Tree Activity - index cards • Chart paper • Markers

BLM 5.12 Lesson Plan Template #1 (Cont'd)

DELIVERING THE LESSON/SUBTASK: Part 2 **Grouping: W = Whole class; S = Small group; I = Independent*					

Timing
 	
5
	Grouping
	W
		S	I	**Mental Set** *(hook)*:
				
				• Show a representation of a tree data structure on the whiteboard.
				  ○ What do you notice?
				  ○ What do you wonder?
				  ○ How do you think this could be used as a data structure?
				  ○ How does it compare to other abstract data types we've seen before?
					Materials/ Resources
					
					• Whiteboard markers
					• Whiteboard examples

7	X			**Sharing the Purpose/Objectives** *(in student language)* • Hand out the 1-page information sheet for Trees • Review the learning goals and success criteria with the students • Discuss the motivating example and terminology	**Materials/ Resources** • 1-page information sheet

				Body: Input, Modeling, Check for Understanding, Guided Practice, Independent Practice	**Materials/ Resources**

6	X			• Whiteboard examples
				  ○ Use the prepared whiteboard examples to draw on the board
				  ○ Simulate adding and removing nodes
				• Human Tree Activity
				  ○ Students will arrange themselves like a tree with the root at the front of the room and child nodes branching off towards the sides/back of the room
				  ○ Hand out an index card with a number to each student
				  ○ By writing pseudocode on the whiteboard, add and remove nodes from the tree (ex. add(6, parent=2), remove(8))
				  ○ The student holding that card joins/leaves the tree at the front of the room
				  ○ Gradual release of responsibility: start by guiding the students where to go, then you can just write the code on the board and have the students arrange the tree
				  ○ Question students:
				  ■ If I want student X to join the tree as a child node of student Y, what is the code?
				  ■ What happens if I remove student Z?
				  ■ How could I move student A to be a sibling node of student B?
				  ■ etc.
				• Live coding
				  ○ Follow prepared live coding plan for creating classes Node and Tree, and related methods to add, remove, and traverse
				  ○ Question students:
				  ■ Should the [add, remove, traverse] method go in the Node or Tree class? Why?
				  ■ What does this line of code do?
				  ■ What is the base case of this method?
				  ■ What would happen if I reversed these lines of code (pre, in order, post order traversal)?
				• Small group work - vertical surfaces
				  ○ Divide class into 8 small groups (3 students per)
				  ○ Give each group 1 problem to work through on a section of white board or chart paper (2 groups per problem)
				  ○ Support, extend, and assess learning while circulating the room (take anecdotal notes)
					• Whiteboard markers
					• Whiteboard examples
					• Human Tree Activity index cards
					• Live coding plan
					• Computer & projector
					• Small group questions
					• Chart paper
					• Markers
					
					Bloom's Taxonomy:
					__Remembering
					X Understanding
					X Applying
					X Analyzing
					X Evaluating
					__Creating
					
					Learning Styles:
					X Visual
					X Auditory
					X Kinesthetic
					
					Multiple Intelligences:
					X Verbal/Linguistic
					X Logical/ Mathematical
					__Musical/ Rhythmic
					X Body/ Kinesthetic
					X Visual/Spatial
					X Interpersonal
					__Intrapersonal
					__Naturalist
					__Existential

12	X				
25	X				
10		X			

10	X			**Closure:** *(sharing the learning in some way):*
				• Share and review the work from small groups (like a math talk)
				  ○ 1 person from each group explains the problem and their group's solution
				  ○ Discuss anything they found challenging about the problem
					Materials/ Resources
					
					• Small group questions

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				○ 2 groups are given the same problem, so have them compare/contrast their solutions ○ Students in other groups can ask questions or offer their perspective ○ If misconceptions are identified, clarify them with the class	
				Homework/ Reminders: ● Independent practice for the next ~2 class periods to complete coding assignment ● Trees Quiz upcoming (after assignment is submitted and feedback given)	**Materials/ Resources**

Reflections: **Include Successes, Challenges, Changes, Next steps**