

TABLE 1**Classification of science teaching and learning metaphors.**

Science teaching beliefs	Themes	Metaphor examples	Roles of teachers and students in teaching and learning
teacher-centered	teacher as a nurturer (knowledge provider) (20)	oak tree, cook, farmer, sun, sunshine, rain, water, gardener, Golgi body, oxygen	The teacher is the knowledge provider and students are immature organisms who need knowledge provided by the teacher to learn (grow).
	teacher as a source (source of knowledge) (18)	battery, water, website, sun, textbook, book, encyclopedia, lightbulb, dirty plate (germs representing knowledge), a pair of glasses, Bill Nye	The teacher is the only source of knowledge, and students are the passive recipients of that knowledge.
	teacher as an authoritative leader (13)	shepherd, Dumbledore (headmaster), chef, scientist, beekeeper, lighthouse, rock, glue, trainer, conductor	The teacher is the leader who controls and regulates classroom actions, while students are passive followers of their teachers.
	teacher as a performer (5)	magician, artist, juggler	The teacher is the main performer of the teaching process, while students are passive audiences who are watching their teachers' performances.
mixed	teacher as a nurturer (16)	gardener, water, tree, parent, sun, farmer, soil, leaf, spine, coral reef, branch of a tree	The teacher is the support provider (knowledge and instructions), and students are active participants in their learning processes, but they are still immature organisms who need the teacher's support.
	teacher as a team leader (14)	captain of a ship, ringleader, captain, superhero, symphony conductor, scientist, tour guide	The teacher leads classroom actions, and students are active followers participating in classroom activities.
	teacher as a source of knowledge (10)	Earth's core, encyclopedia, sun, Siri, candle, internet	The teacher is the source of knowledge, and students need a teacher in order to continue the learning process.
student-centered	teacher as a guide (18)	Uber driver, street sign, bus driver, firefly, map, tour guide, scientists' boss, mentor, handlebars of a bike, scout leader, map, guide, chef, orchestra conductor	The teacher provides indirect guidance for students' learning and to help them reach their goals as they are learning, while students lead their own learning process.
	teacher as a facilitator (12)	coach, midwife, springboard, bridge, catalyst, flight attendant, travel agent, mirror	The teacher facilitates students' learning, and students are the performers/main characters responsible for their own learning.
	teacher as a scaffolder (11)	gardener, sun, farmer, tree, grass, anchor, water, flower, Senzu Bean	The teacher is the supporter who provides scaffolding or indirect support to teach students how to become independent learners and creates learning environments in which students take part in their learning process.
	teacher as a source of curiosity (5)	match, stand-up comedian, light switch	The teacher is the trigger of the learning process, and students actively engage in learning processes.
	teacher as a source of learning materials (3)	Home Depot, grocery, tool box	The teacher is the source of resources and learning materials necessary for students' learning process, while students are explorers who discover scientific knowledge.

Note. The numbers in parentheses represent the total number of metaphors that were identified for each specific theme.