future more often than with energy or kinetic energy. Many of the responses revolved around the connection between the gravitational potential energy and vertical locations, for example, “heights”, “staircase”, and “roller coaster”. Potential energy was also thought of microscopically, such as its relation to molecular stability and bonding as seen in the use of “bond energies”, “enzyme”, “atoms”, and “molecules”. Again this focus on the stability of molecules and relative bond strengths is an important concept in chemistry and biochemistry and is discussed throughout these courses in various contexts. This manner of thinking and the use of these words in such a context would be expected in chemistry and life science students due to their previous coursework.

TABLE 2. Categorization of responses from the word association task for kinetic and potential energy.

Category	Provided Words
Kinetic Energy	Moving, motion, movement, collisions, never still, rolling, falling, running, swinging, speed, velocity, released, conversion
Potential Energy	Capability, future outcome, pre-movement, impending, stored, stationary, at rest, heights, distance, top high up, staircase, roller coaster, interaction, stability attraction, repulsion, bond energies, enzyme, atoms, molecules, endothermic

IV. CONCLUSION

Volunteers were asked to define the terms energy, kinetic energy, and potential energy as well as perform word association tasks as part of a longer semi-structured interview on the effect of surface features on conceptualizing energy. The responses were coded based on the most common definitions and ontologies of energy. All subjects found defining energy in general to be a difficult task, most likely due to its complex and abstract nature. A majority of novices gave the textbook definition of energy (“the ability to do work”) as their main definition of the term. Experts, on the other hand, tended to define energy in terms of its characteristics and usefulness, such as emphasizing the conservation of energy. A substance ontology—that energy is a thing that objects can have or possess—was the most common when defining energy, kinetic energy, and potential energy.

The results from the word association tasks show the broad ways in which people think about energy. The most common words associated with kinetic energy were, not surprisingly, related to motion. Those provided for potential energy related to interactions for microscopic objects, locations for macroscopic objects, and future outcomes. Common to all three terms were the units and physical quantities related to energy, which would be used when solving physics and chemistry problems. Other words provided were abstract in nature, which reference important properties necessary when using energy to solve problems in chemistry and physics classes, such as conservation or transformation.

These results are part of a larger study looking at how people understand energy in the domains of both chemistry and physics. Ideally, knowledge of energy from physics instruction should transfer to chemistry contexts and *vice versa*. Future studies will examine the connection between surface features associated with chemistry or physics contexts and the ontologies of energy invoked in the interview responses. Also, explicitly asking interviewees to draw what they think of upon hearing the terms “energy”, “kinetic energy”, and “potential energy” may increase the number of people invoking the vertical location ontology compared to when people are asked to define these terms in words. For example, a current chemistry student may draw an energy level diagram but still define energy in words as “the ability to do work”. This task would provide insight into the effect of representations and would complement those brought forward from the specific figures shown during the interviews. By better understanding how people think about energy in these two domains, curricular interventions can be created to better facilitate the transfer of knowledge between courses in chemistry and physics.

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