Conversation: Loose Parts - A Pathway from Play to Technology

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***Abstract*--Computational thinking was defined as a way humans solve problems. It is not trying to get humans to think like computers. There has been a lack of interest for computational thinking in higher education. This presentation is calling for an innovative approach that starts with the identification of a discipline specific problem space within a higher education student's program of study.**

Keywords- loose parts; imaginative behavior; instructional design; computational thinking.

I. INTRODUCTION

This presentation is designed to engage participants in an active discussion of critical thinking, computational thinking [18], creativity, imagination and loose parts. Imagination is a life-long cognitive endeavor and acts as the catalyst for all creative functions. If we believe that experiences expand imagination and that imaginative acts expand our reality, we consider how we can create meaningful and creative experiences for students of all ages. As educators, we create meaningful experiences for our students. Some of these experiences take the form of STEM-based technology actions [7]. However, at the higher education level, we sometimes forget the fundamental nature of meaningful play experiences. The concept of loose parts provides the vehicle for higher education faculty and students to practice problem-solving strategies in discipline-specific situations. The practice is often considered 'risky' because solutions are not always known. However, the success/failure cycle that often occurs in 'risky' problems acts as a catalyst to create and enhance problem-solving schemas. The process starts with parts that can be moved, carried, combined, redesigned, lined up, and taken apart and put back together. These actions can be repeated in coding, in STEM activities and in any discipline-specific content that encounters problems and dilemmas. After all, computational thinking is about the schema we form to create workable heuristics and algorithms. The nature of playing with loose parts shows the user that designing and redesigning is a welcome practice. Loose parts form the basis for future problem-solving schemas. This discussion will provide loose parts with which the participants can play.

II. LITERATURE REVIEW

Imagination is a life-long cognitive and affective act. It serves as the catalyst for all creative actions [10] [17]. This essential dynamic serves both our cultural and scientific lives. Vygotsky [17] stated, and was later re-interpreted by Moore [11], that imagination is the link between emotion and thought and between reality and imagination. Piaget [14] makes a connection between the initial stage of imaginative autistic thought, which later develops into a stage of realistic thinking. This notion of imagination and play is later found in Hewes [6] discussion of play as essential for optimal development. Our notion of introducing play at an early age supports the development of students' cognition to perform coding and to build robots later in life.

Imaginative behavior is based on the brain's ability to draw upon and combine elements from our previous experiences. These experiences are cumulative and are based on both informal and informal learning processes that shape our future behavior. As teachers, we can structure these experiences so that we are infusing imaginative thinking into the curriculum. Our curriculum becomes experiences that promote imagination and we welcome imaginative behavior. Vygotsky [17] states that the brain not only stores and retrieves our experiences but also combines those experiences into new meaning and permits our behavior to change. Thus, when we learn to code or to build robots, we often combine parts together in unique ways to form new mindful structures.

Loose Parts is a term that was created by Nicholson [12] in the 1970's. This term is defined as providing children with "loose" materials that can be carried, moved, revised, taken apart and put back together. Loose parts not only develops all areas of the domains of child development but also encourages creativity and develops problem solving skills [1][11][13]. Loose parts can be the use of natural materials such as stones, bark, sand, but also can include construction materials such as wood, wire, plastic and so on. When children manipulate such materials, they are

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expanding their ideas and are often collaborative with others in order to make meaning from their creations [5].

As we use these loose parts in our imaginative behavior, we often find ourselves repeating processes that serve our purpose at the time. Our purpose could be solving problems that have known solutions as in learning environments or as problems that do not have known solutions as in authentic living. Jonassen [8] discussed the process of solving well-structure and ill-structured problems. He wrote that novice problem-solvers often rely on listed heuristics while experienced problem-solvers use analogical stories that are similar to a current problem situation. He posited how a problem-solver moves from listing the discrete parts of a solution to telling a story about the problem so as to solicit a solution. We find that our experiences change our behavior over time and if we are permitted to experience loose parts at the beginning of our learning, then we can use our imagination to alter our behavior. Thus, we can use our imaginative behavior during the building of code and the construction of robots or any other task that requires computational thinking. As teachers, we need to acknowledge the importance of imagination in the process of creating products [2].

Instructional design principles are used to create the Loose Parts curriculum. An awareness of the barriers [3] to learning new techniques begins the process. Some of these barriers are internal doubts about our ability to solve a problem or the external barriers of insufficient time or materials to solve a problem. The internal and external barriers are considered by the instructors who start the process to learn about the students. The design begins with the instructors talking with the students to identify their internal fears about performing in a Loose Parts environment. The design phase continues in the construction of the learning environment so that time and resources and support are readily available to the students [16]. An empathetic atmosphere is presented to alleviate fears and to create a warm and welcoming environment.

Social connectedness is designed into the process as influenced by Slagter van Tryon and Bishop [15]. People often work well together to solve problems. The sharing of ideas helps to build heuristics and algorithms. Students are encouraged to discuss the process of Loose Parts with each other and to build on the sharing of ideas. Additionally, the concept of Loose Parts could be considered as an ill-structured problem. However, the awareness of this phenomenon could provide a catalyst to design the learning environment to embrace the problem-solving strategy where the complete solution is unknown [4]. Drag and drop programming is a visual programming language that requires low reading levels and almost is absent of syntactical structure [9]. The low reading level is important so that we can show children in grade 1 or even in Kindergarten how to program in code. The process starts with an avatar on a screen and our desire to make it move. Movements such as left, right, up and down are easily understood by most students between the ages of five and eight. It is a powerful tool for students to effectuate action such as sequential movements and loops [9]. We may be familiar with the Logo turtle robot created by Seymour Papert in the 1960's. This same programming environment was converted to drag and drop programming in apps such as Hopscotch, Scratch and Alice.

III. OBJECTIVES

1. Participants will be introduced to the concept of loose parts.
2. Participants will discuss how imagination, computational thinking is integral in engaging the use of technology.
3. Participants will create structures using loose parts
4. Participants will transfer created structures into technology pieces.

IV. CONCLUSION AND FUTURE WORK

It is important to learn problem solving skills and higher order thinking and creativity early. Student can progress into computational thinking as part of their second nature and not as a new skill to acquire in upper grades or at the university. Students will spend a lifetime of learning in the realm of solving problems. They will learn the power of imagination to develop habits of mind to think of new ways to solve problems. This practice permits them to constantly build on their learning.

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