Classrooms of the Future: The Potential of Artificial Intelligence in Kindergarten to Grade 12 Education

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Introduction

Advancements in the world of technology in recent years have provided a promising glance into the future of education and the influence it will have on student learning as a whole (Baker, 2000). With virtual and augmented reality already finding a place in classrooms around the nation, it has come to no surprise that the next widespread development in education could be that of Artificial Intelligence (A.I.) (Du Boulay, 2016). With A.I. in the classroom, educational goals can now shift from mainly focusing on preparing students for the workforce to guiding them into becoming 'adaptive experts' (Roll & Wylie, 2016). A.I. then has the potential to strengthen and enhance the concept of online and face-to-face learning with students, engaging them in the learning process, much like a human teacher would (Adams Becker, Freeman, Giesinger Hall, Cummins, & Yuhnke, 2016).

Methodology

Previous reviews have examined the concept of A.I. in education as a whole, focusing on the benefits and the techniques that are emerging, but there has not yet been reviews that solely focus on the potential benefits and challenges of A.I. in the Kindergarten to Grade 12 learning environments. As a result, this review was based on a compiled list of pertinent research articles related to A.I. in education, fueling the creation of an annotated bibliography, and this information was then used to construct a review of the literature, summarizing the main key points.
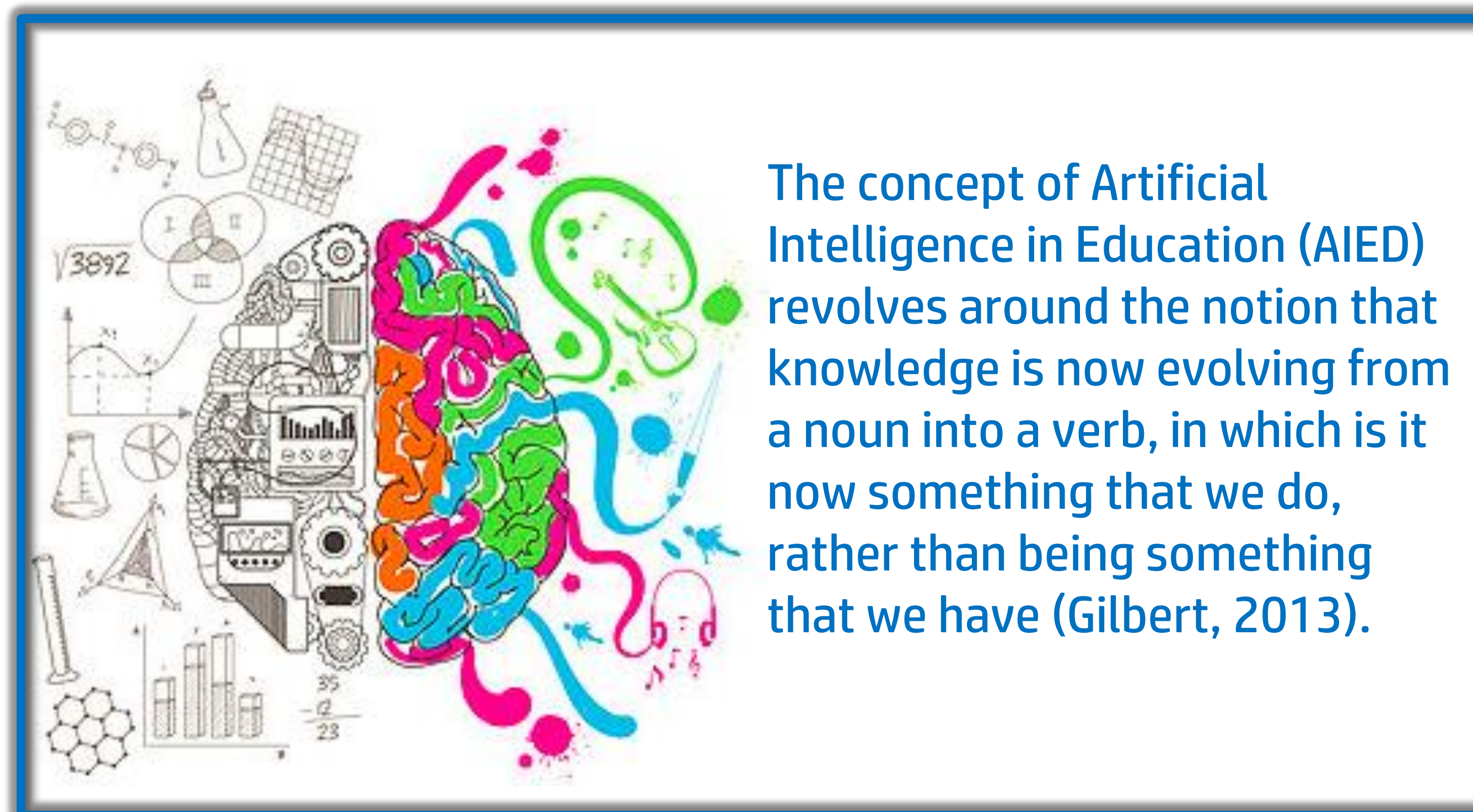
Purpose

This review will contribute to the field by providing a sound definition of A.I. technology in education, offer an overview of existing research surrounding A.I. in Kindergarten to Grade 12 education, explain the current roles of A.I. in education, the potential future applications of A.I. in education, and identify the benefit to the learner based on the 21st century competencies.
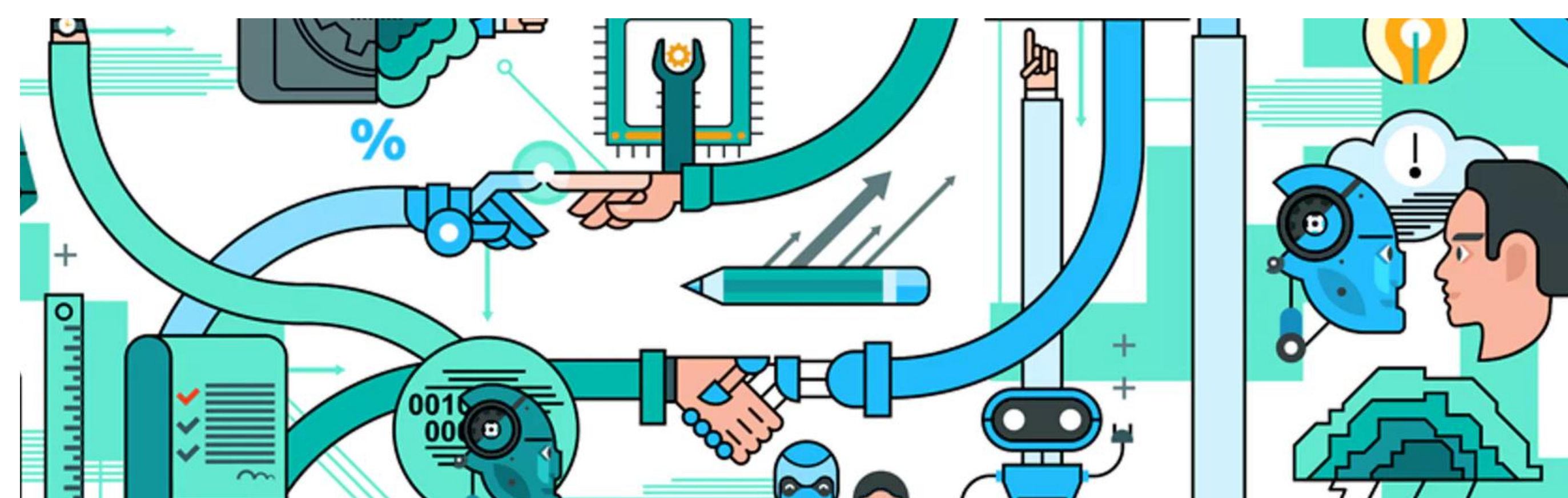
Definition of A.I.

The technology and the mastery behind artificial intelligence attempts to harness human-like qualities, along with many others, in an effort to create 'intelligent entities' that have the potential to think, reason, predict, and manipulate their surroundings (Russell & Norvig, 1995). With this review in mind, these unique qualities about the concept of A.I. can be translated into the classroom and used to captivate the student while simultaneously assisting the teacher with everyday responsibilities (Adams Becker, Freeman, Giesinger Hall, Cummins, & Yuhnke, 2016).

The concept of Artificial Intelligence in Education (AIED) revolves around the notion that knowledge is now evolving from a noun into a verb, in which is it now something that we do, rather than being something that we have (Gilbert, 2013).

Current Roles of A.I. in Education

The most common use of AIED is that of the **intelligent tutor systems (ITSs)**, which are "computerized learning environments that can track the psychological states of the learners in fine detail (student modelling) to provide more opportunities for personalized learning" (DuBoulay, 2016) (Graesser, Conley, & Olney. 2012).

❖ 'Coach Mike' is an interactive computer program that encourages the students to embark on touring various informal learning environments with the use of their problem-solving skills, therefore promoting the idea of inquiry based learning and curiosity that can be applied in a cross-curricular manner (Du Boulay, 2016).
❖ The A.I. Braille Tutor was created and designed to assist and educate students of all ages with visual impairments, taking advantage of the adaptive computer instruction (McCarthy, Rosenblum, Johnson, Dittel, & Kearns, 2016).
❖ Another ITSs has the potential to teach the English language and its grammar in an easy and smooth manner, starting with a diagnostic and then adapting to the learning style of the student (Alhabbash, Mahdi, & Abu Naser, 2016).
❖ Carnegie Learning's software ("Mika") is a computer platform that provides personalized tutoring and real-time feedback to post-secondary students (Faggella, 2017).
❖ Captivating Virtual Instruction for Training (CVIT) is a learning strategy that focuses on uniting live classroom methods with suitable virtual technologies in remote learning environments. (Faggella, 2017)

Potential Future Roles of A.I. in Education

The focus of the future seems to beginning to lean towards the possibility of combining the advances in artificial intelligence with the field of robotics. This union would then take advantage of a multitude of sensors to promote the creation of intelligent entities that are able to think, reason, predict, and maneuver through the world. Certain research studies have labelled these futuristic intelligent entities as 'educational cobots', that will work alongside the classroom teacher as a 'robot co-worker', being present to collaborate and support individuals within the learning space (Timms, 2016). The robots would be able to adapt to those they encounter, communicate with the use of language, and evaluate the environment as well as the people within it (Timms, 2016).

Student Benefits

Based on the criteria set out by the 21st century competencies, there are many skills that all students should strive to become proficient in, as they all play a part in our way of life. Skills, such as the ones outlined below, are all characteristics that students of all ages will be able to achieve if the learning environment and delivery of information allows (Woolf, Lane, Chaudhri, & Kolodner, 2013). With the integration of A.I. in the classroom, the possible future may include students becoming more well connected with each other throughout their learning, digital materials can be provided to accommodate the learning preference of the student, and the engagement of the learner would be within arms reach (Woolf, Lane, Chaudhri, & Kolodner, 2013).
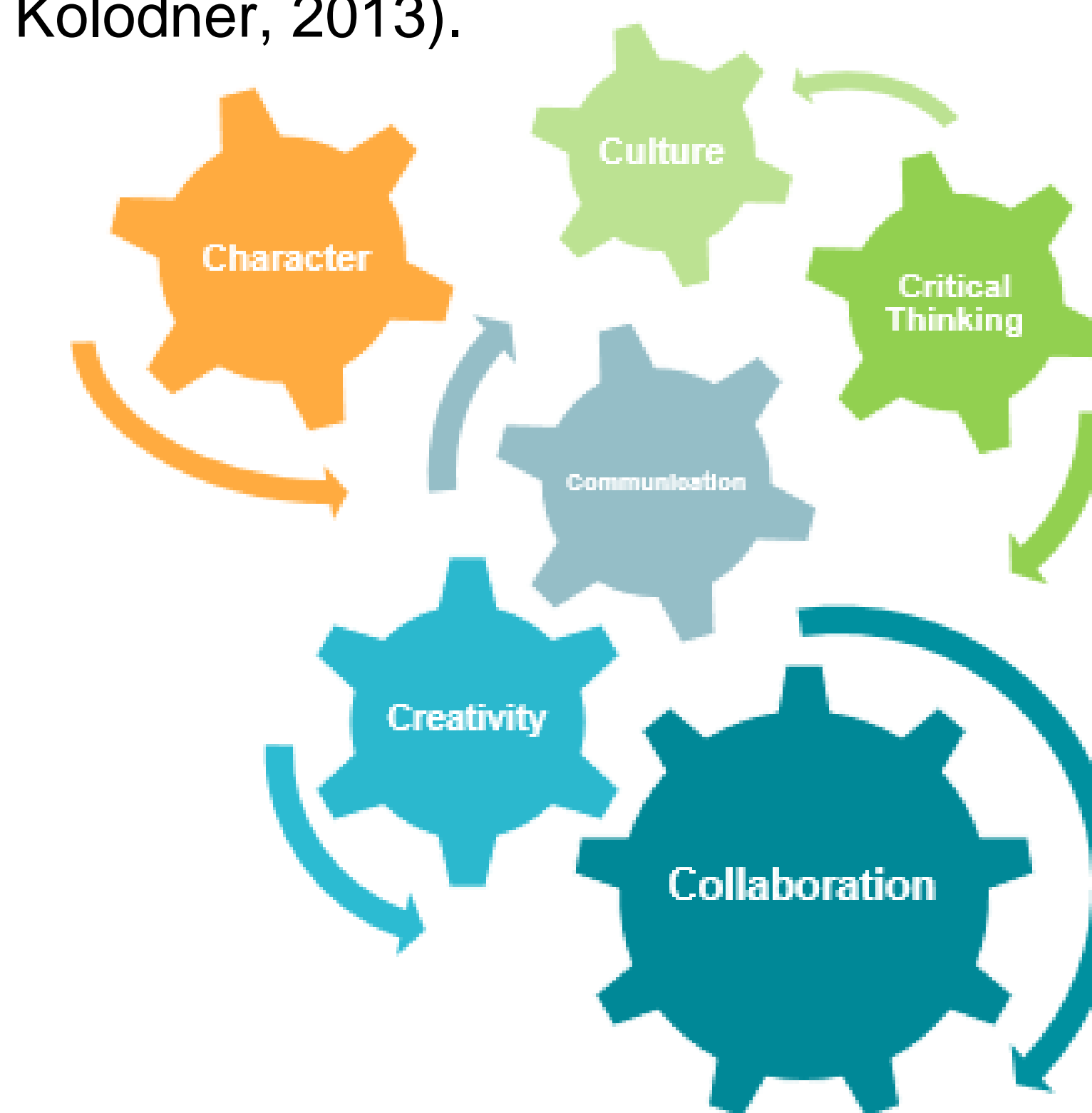
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