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Scientific reasoning correlated to altruistic traits in an inquiry learning platform: Autistic vs. realistic reasoning in science problem-solving practice

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ABSTRACT

Helping others might enrich oneself at his/her own expense. This is the catch-22 for a participant who altruistically helps others. To realize this predicament, the present study incorporated a hypothetical deductive problem-solving model into the Wright Brothers Aviation Game to examine the correlation between altruistic traits and scientific reasoning. In the study, 60 participants were divided into 20 groups based on their altruist levels, as determined using the collaborative altruism scale, and played the e-Learning platform game for 1 h. The results of this study indicated the following: (1) participants with a high level of altruism logged out to help others more times than did participants with low and moderate levels of altruism and (2) there was no correlation between the number of times a participant logged out to help others and the number of times the participant failed at problem solving. In addition, the participants with higher levels of altruism more frequently applied high levels of scientific reasoning to justify their answers. Additional studies with different competitive designs are needed to discover the gender effect of altruism on collaborative action.

1. Introduction

Social psychologists during the 20th century made many remarkable discoveries. One of these is that an individual's behavior could be shaped, changed, and even criminalized by the systematic manipulation of social interactions (Frith & Frith, 2008). Compared to all other species, human beings display much higher levels of altruistic behavior toward genetically unrelated individuals (Haviland, Prins, Walrath, & McBride, 2004). Thus, identifying the stability of altruistic behavior in humans and other animals has been one of the major scientific challenges in recent decades (Nowak, 2006). In essence, altruistic behavior has also been shown to be evoked by prosocial media exposure and to elicit helping behavior (Greitemeyer & Osswald, 2009). The paradox of altruistic behavior is that although altruistic helping adds to the common good of a group of individuals, the one contributing to the common good generally endures a higher cost than the individual returns (de Weerd & Verbrugge, 2011; West, Griffin, & Gardner, 2007). However Hamilton (1963) predicted that altruistic behavior would still be selected if the cost to the altruistic individual is less than the benefit to the recipient or that the recipient

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possesses the common good. Accordingly, the present study aimed to explore if altruistic behavior hinders the scientific reasoning performance in an online learning environment.

Scientific reasoning primarily involves the inquiry skills that are used in hypothesis generation, experimentation or observation, and evidence evaluation (Zimmerman, 2007). Inquiry learning is seen as a student-centered form of learning where the students are actively involved in the construction of knowledge through hypotheses building, evidence gathering and results interpretation (Mäkitalo-Siegl, Kohnle, & Fischer, 2011). In scientific inquiry learning, if the perceived goal of problem solving is a causal explanation, the students are more likely to try to reason and apply scientific principles or concepts to support their claims (Sandoval, 2003). Based on this assertion, the present study designed problem-solving tasks relevant to causal explanation in an online learning environment for science knowledge application during inquiry process.

Technology-based learning environments in particular increase learners' openness, selection, and control of the learning task; while at the same time, such environments offer more adaptive, collaborative and situational learning styles (Järvenoja & Järvelä, 2005). Cress, Held, and Kimmerle (2013) posited that the Web can aggregate resources contributed by individuals, process these resources and then link them, thus creating a collaborative learning platform. In addition, Web-learning offers uniform procedures, simplicity, and wide applications that enable systematic comparisons of altruistic behavior across different individuals and learning contexts (Benenson, Pascoe, & Radmore, 2007). As such, collaborative problem-solving activities can involve a team of participants who seek alternative reasons to explain scientific concepts and who consider the applicability of scientific theories and domains (Lazonder, Hegeman, & de Jong, 2010). In this sense, this study focused on understanding the relationship between altruistic traits and scientific reasoning in a collaborative science learning setting.

2. Literature review

Problem solving provides opportunities to actively process information, to trigger prior knowledge, to obtain meaningful pleasure, and to research and organize information (Şendağ & Odabaşı, 2009). In all studies related to scientific problem solving, the learners with high levels of prior domain knowledge displayed sophisticated scientific reasoning in inquiry tasks and the less-knowledgeable learners performed less effectively. Even those with high levels of prior knowledge cannot seize the opportunities to bring their scientific reasoning to a higher level (Lazonder et al., 2010). Students with mediocre scientific reasoning skills but low prior knowledge also have less domain knowledge during their inquiries than those with high prior knowledge (Lazonder et al., 2010). Goode and Beckmann (2010) argued that the knowledge that their participants used for problem-solving tasks had some limitations and that such limitations still existed even when reasoning ability was removed from its context because complex problems cannot be controlled with prior structured knowledge. In this regard, the present study explored the relationship between individual altruistic trait and reasoning ability.

2.1. Realistic and autistic thinking

In 1952, Piaget discovered the differences between autistic and logical scientific thinking. Autistic thinking obeys the pleasure principle and is "personal, incommunicable. . .confused, indifferent to truth, rich in visual and symbolic schemas, it is dominated by imagery rather than concepts" (Piaget, 1972, pp. 204–205). Bleuler (1951) developed the constructs of autistic and realistic thinking, and discovered that realistic thinking represents reality. The images produced by autistic thinking correspond to the effects governed by pleasant, illogical rules that are based on affective needs. On the contrary, realistic thinking involves the search for an appropriate learning environment to discover the truth with logical rules. The problem-solving process, therefore, consists of the systematic construction of logical thought and is found in all intellectual activities (Kesselring & Muller, 2011). According to Piaget and Bleuler's highlights, the present study used realistic vs. autistic thinking (i.e., non-scientific thinking) to study the difference between students' altruistic behavior and their scientific reasoning in an online learning environment.

2.2. Altruistic traits and reasoning

Altruistic traits refer to individual differences that broadly affect altruistic behaviors (Rushton, Chrisjohn, & Fekken, 1981). In general, altruistic traits are most likely to be activated when the perceived need for helping is clear (Clark & Word, 1972; Lee & Lee, 2010) and the person has the freedom to choose whether or not to help (Fritzsche, Finkelstein, & Penner, 2000), whereas altruistic behavior refers to actions intended to provide benefit to another person (Dovidio, Piliavin, Schroedler, & Penner, 2006). Ben-Ner and Kramer (2011) emphasized that altruistic behavior is a sacrifice of one's resources for the benefit of others, representing a tradeoff between one's self-interest and one's regard for others. Resources can include time, money, or flesh (donating blood or organs).

People are readily perceived as altruistic, as is demonstrated by several studies showing positive relationships between behavioral altruism and peers' and teachers' ratings of how altruistic a person seems (Philippe, Chrisjohn, & Cynthia Fekken, 1981). While helping is a motivational tool that assists in achieving a team's goals (Lehmann & Feldman, 2008), help is an action that is intended to provide some benefit to others (Batson, 1998; Dovidio et al., 2006), regardless of whether the action is motivated by selfishness or altruism. Accordingly, help can be found everywhere, including workplaces, and it is not only sexually attractive but also vital for a well-functioning society. Alexander (1987) hypothesized that altruistic assistance,