Confusion affects gameplay

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ARTICLE INFO

Keywords:
Epistemic curiosity
Interactive learning environments
Learning strategies

ABSTRACT

This study tested key predictions of confusion, which accompanies a state of cognitive conflict triggered by erroneous Chinese characters, for students to detect and correct in an online Chinese reading-correcting game competition. In addition, this study examined how participants’ concepts of human intelligence could predict whether they maintained their levels of gameplay anxiety and reflected their intention to join the competition as mediated by epistemic curiosity. There were 189 sixth-grade students who returned the questionnaires, and the results revealed that the incremental theory of language intelligence could predict 2 types of epistemic curiosity (EC): D-type EC was positively correlated to gameplay anxiety, while I-type EC was not significantly associated with gameplay anxiety. Moreover, gameplay anxiety was positively correlated with intention to join the contest. The implication of these findings is that teachers may use scaffolding with a positive effect on incremental theory of language intelligence to encourage students to have more EC.

1. Introduction

Researchers have found that confusion, which is important to learning, prevails both during human-computer interactions and human-human tutoring sessions (D’Mello & Graesser, 2014a; D’Mello & Graesser, 2014b; Lehman, D’Mello, & Graesser, 2012). Lehman et al. (2012) found that confusion recurrently occurs and can induce fundamental emotions in a learning-centered setting. If a statement that potentially triggers confusion can impede deep learning (VanLehn, Siler, Murray, Yamauchi, & Baggett, 2003), this benefit of confusion would solicit this question: How can a game utilize confusion to explore a student's learning attitude and behavior? Thus, this study addressed individual beliefs of language intelligence, epistemic curiosity, gameplay anxiety, and behavioral intention in a Chinese reading-correcting context.

A major social-cognitive approach to the study of implicit theories of human intelligence has been developed by Dweck (1999), who highlighted that people have the possibility of either of two implicit theories of intelligence, and who argued that intelligence is a fixed, stable quality. Previous research has shown that incremental theories of intelligence (ITI) are associated with more academically fixable behaviors. For example, ITI notions are positively associated with increased effort and perseverance in response to the statements of theoretical, academic challenge response (Robins & Pals, 2002; Shih, 2011). Blackwell, Trzesniewski, and Dweck (2007) found that junior high school students who supported ITI were more likely to respond with positive self-regulation strategies, such as increased efforts in studying, instead of responding to failure with helpless attributions. The reason is that they probably have set up victory goals for their learning of new knowledge or skills in order to increase their competence, in addition to seeking challenging tasks based on their belief in effort (Dweck, 1999).

Many studies have established relationships between students’ ITI and their performance in various learning contexts (e.g., Blackwell et al., 2007; Braasch, Bråten, Stremso, & Anmarkrud, 2014; Dupeyrat & Mariné, 2005; Greene, Costa, Robertson, Pan, & Deekens, 2010). However, few studies in the past have examined the ITI effect on game playing. Therefore, this study undertook to explore the correlates of ITI in a Chinese word correcting game.

A notion that cognitive process extends cognitive confusion into emotions has also been acknowledged and investigated for decades (Graesser, Lu, Olde, Cooper-Pye, & Whitten, 2005; Lazarus, 1991; Stein & Levine, 1991). In fuzzy situations, high epistemic curiosity encourages deep thinking and effortful processing of information. In this regard, those students with high epistemic curiosity will have more deliberation and thoughtful processing of information than those with low epistemic curiosity (De Dreu & Steinle, 2006). Robins and Pals (2002) showed that incremental theorists displayed greater evidence of mastery-oriented strategies including effort escalation. Given prior research on implicit theories of intelligence, it is reasonable to assume that this individual belief relevant to language intelligence may also play a role in the challenging reading-correcting task context in a time constraining competition. What is less clear, however, is the trajectory

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http://dx.doi.org/10.1016/j.lindif.2017.09.004
Received 21 May 2015; Received in revised form 25 May 2017; Accepted 2 September 2017
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of cognitive-affective processes that are spawned by cognitive confusion, and how these processes impact educational game performance in terms of problem solving. Thus, incremental theories may lead to participants’ epistemic curiosity in relation to gameplay anxiety in Chinese word correcting.

In an attempt to understand how the Chinese reading-correcting game based on the Theory of Reasoned Action (TRA) can become popular in elementary schools, this study focused on factors that may influence participants’ willingness to take part. According to Ajzen and Fishbein (1980), the formation of attitude involves a combination of elements of belief and affectively loaded evaluations concerning a particular activity. To explore the correlates, we related behavioral intention to take part in the competition to measures of incremental theory of language intelligence (ITLI). Few studies have found support for the value of intelligence beliefs associated with both epistemic curiosity and gameplay anxiety reflecting behavioral intention. Therefore, this study first attempted to establish a conceptual framework for identifying the role of ITLI bonding to two types of epistemic curiosity, and reflected gameplay anxiety as well as behavioral intention; second, this study attempted to determine the validity of the pathway by testing the correlates between ITLI and intention to join the Chinese reading-correcting competition as mediated by students’ epistemic curiosity and gameplay anxiety.

1.1. The Chinese word reading-correcting game

Confusion, when accompanying a state of cognitive counterbalance that is triggered by discrepancy, conflicts, and incorrect information, can be beneficial to learning if appropriately generated (D’Mello, Lehman, Pekrun, & Graesser, 2014). Confusion resolution requires the individual to stop, think, consider carefully, and revise his or her existing mental models. These activities involve difficulties, which need more durable memory representations and more successful retrieval (Bjork & Bjork, 2011). In line with this, the Chinese word reading-correcting game is not merely a memory competition, but also a type of confusion, and it can give students’ access to knowledge, which is unavailable to internal representations in a way that constrains the range of possible cognitive outcomes. In the game, confusion is embedded in two types of erroneous words, that is, one resulting from stroke similarity (e.g., 當 vs 場) and the other from pronunciation similarity (e.g., 心 vs 欣, both pronounced “xin”). We assume that the similarity will confuse players when trying to identify the two erroneous words. Thus, this contest aims to address confusion so as to increase the chance of discoverability when finding two erroneous characters in a sentence.

However, in the context, the mind is restrained because of the restricted range of information processing, the limited power of working memory and attention, as well as the limited speed of some learning and reasoning operations; these factors all reveal players with a high restricted range of information processing, the limited power of working memory and attention. Thus, confusion can give students’ access to knowledge, which is unavailable to internal representations in a way that constrains the range of possible cognitive outcomes. In the game, confusion is embedded in two types of erroneous words, that is, one resulting from stroke similarity (e.g., 當 vs 場) and the other from pronunciation similarity (e.g., 心 vs 欣, both pronounced “xin”). We assume that the similarity will confuse players when trying to identify the two erroneous words. Thus, this contest aims to address confusion so as to increase the chance of discoverability when finding two erroneous characters in a sentence.

1.2. Incremental theory of language intelligence

Anyone can increase their cognitive ability, no matter what the starting point is (Jausovec & Jausovec, 2012). Incremental theory states that intelligence is adaptable or changeable with effort. When individuals holding an ITI notion encounter difficulties, they are likely to enhance their efforts, to engage in new strategies and to boost their performance. These preoccupations are likely incompatible with the curiosity-driven engagement characteristic of intrinsic motivation (Haimovitz, Wormington, & Corpus, 2011). In addition, ITI related to “object-related” intelligences can advance language learning in relation to incremental theory of intelligence (Furnham, 2014). In line with this, the present study extends Furnham’s (2014) definition to an incremental theory of language intelligence (ITLI) to explore the correlates between cognitive and affective factors in promoting error recognition in gameplay. However, it is not clear how much ITI can explain the relevance to epistemic curiosity and gameplay intention; thus, the present study focused on the malleability of language intelligence to explore such correlates.

1.3. Epistemic curiosity

Litman (2008) defined epistemic curiosity (EC) as a unique human desire to motivate an individual to learn new ideas, to eliminate information gaps and to solve rational problems, including investigation and experimentation, as well as the underlying mental development and scholarly achievement. Furthermore, Litman and Jimerson (2004) explained with more accuracy by defining EC as two different dimensional concepts, namely interest-type (I-type) and deprivation-type (D-type) EC. I-type EC involves adding new ideas and concepts to one’s memory, as well as the anticipated pleasure of new discoveries, and it is related to acquiring new knowledge simply for its own intrinsic joy. In contrast, D-type EC is connected with reducing uncertainty and eliminating undesirable states of ignorance, and therefore it is conceptualized as a need to know, for which the correcting, accuracy and relevance of the desired information related to a specific unknown state is of utmost importance (Amit & Sagiv, 2013). This indicates the behavioral consequences of epistemic motivation, which shows that it affects the likelihood of carrying out one’s decision regarding gameplay.

1.4. Gameplay anxiety

Learners’ self-reports have revealed that learning-centered emotions often occur with confusion (Lehman et al., 2012). D’Mello and Graesser (2014a) recently suggested that confusion shares several distinctive qualities usually caused by emotional processing. Actually, confusion is more than a simple cognitive condition, a position that has a considerable support in the affective state (Pekrun & Stephens, 2011; Silvia, 2009, 2010), and it may be related to an authentic emotion like anxiety and fear or to an affective state along with the feeling of being confused (D’Mello & Graesser, 2014b). Moreover, according to Mandler’s (1990) interruption theory as well as Stein and Levine’s (1991) goal-appraisal theories of emotion, individuals are constantly assimilating new information into their existing knowledge schemas while pursuing goal-directed activities. When new or inconsistent information is detected (e.g., erroneous words displayed in a sentence that conflict with prior knowledge), attention shifts to such discrepant information, and the autonomic nervous system increases in arousal (D’Mello & Graesser, 2014b). In line with this, the Chinese word-reading correcting game might encompass anxiety and affect players’ performance. This needs to be further examined.

1.5. Behavioral intention

TRA, a leading theoretical model which explains informational and motivational influences on behavior (Ajzen, 1985; Ajzen & Fishbein, 1980), suggests that the direct determinant of volitional behavior is one’s intention to engage in that behavior. Fishbein and Ajzen (1975) considered that behavioral intention denotes an individual’s willingness to do something; in other words, TRA indicates that some essential elements are required to develop an individual’s behavioral intention. Moreover, TRA seeks to address the link between the concept of attitudes and actions, where actions are considered thoughtful, intentional behaviors that an individual is consciously in control of (Fraser, 2001, p. 246).

Individual attitudes toward ambiguity not only involve subjective beliefs about possible decision outcomes, but also reflect different
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