How Growth Mindsets Relate to Cultural Differences in Insight Problem-Solving

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Abstract

East Asian students often outperform Western students in academic scores (Guglielmi & Brekke, 2017). Past research suggested that this cultural difference is because collectivist norms in East Asian countries increase students' willingness to view problems as opportunities to grow (Guglielmi & Brekke, 2017), and this mindset may improve insight problem-solving accuracy. We hypothesised that higher collectivism scores would be related to greater insight problem-solving accuracy, higher insight experience, and higher growth mindset scores. Through an online survey, 108 Canadian and Chinese university students participants completed the Cultural Orientation Scale (Triandis & Gelfland, 1998), Dweck (1999)'s Growth Mindset Scale, a compound remote associates (CRAs) test for insight problem-solving ability, and ratings on their insight experience. The data was analysed through linear regression models and mediation models in R. The data did not support the hypothesis but still suggested that growth mindsets can predict higher accuracy in insight problem-solving. The results of this study can be used to justify growth mindset interventions at universities in both individualistic and collectivistic countries.

How Growth Mindsets Relate to Cultural Differences in Insight Problem-Solving

Insight problems are ill-defined, like riddles, and non-insight problems are well-defined, like basic arithmetic. Insight problems require insight to facilitate problem restructuring, which allows the solution to become apparent (Vervaeke, 1997). People with fixed mindsets believe their problem-solving ability is set while people with growth mindsets believe it is malleable (Dweck & Leggett, 1988). Therefore, growth mindsets may increase insight problem-solving accuracy because the mindset may further problem restructuring.

Collectivist and individualist cultures differ in regards to self-concept, cognition, and values (Markus & Kitayama, 1991). Guglielmi and Brekke (2017) found that East Asian students consistently outscore Western students in academic performance. East Asian cultural norms may increase students' willingness to self-correct and view the problems as challenges (Guglielmi & Brekke, 2017). Thus, collectivist cultures may encourage growth mindsets. However, collectivist countries are becoming increasingly more individualistic due to modernization (Hamamura, 2012). This shift in cultural orientation may demonstrate the need to understand the influence of cultural identity on growth mindset and cognition. Therefore, this study focused on understanding how the influence of cultural identity relates to growth mindset and insight problem-solving.

Background

Insight Problem-Solving

Insight problem-solving is a key concept in the field of cognitive science. Insight is characterised by suddenly gaining understanding, often in regards to solving a problem (Cushen & Wiley, 2012). In cognitive science, insight has been used to explain how problem-solving is a core ability of human cognition (Vervaeke, 1997). As a cognitive science term, insight is the

ability of humans to restructure their perspective about a problem in order to solve it (Vervaeke, 1997). While many cognitive scientists argue that insight cannot be easily observed (Holyoak, 1990), many researchers have attempted to design studies to observe this phenomenon.

There are two types of insight problems in cognitive science literature, which are classic and non-classic insight problems (Webb et al., 2016). Classic insight problems present as riddles and brain teasers (Webb et al., 2016). Participants would also be given a non-insight problem to contrast with the classic insight problem (Webb et al., 2016). More recent research has used non-classic insight problems, however, and has relied on participants' self-report to understand their insight experience (Webb et al., 2016). Non-classic insight problems present as puzzles, such as compound remote associates (CRAs), rebus puzzles, and anagrams (Webb et al., 2016). According to Webb et al. (2016), classic insight problems are better correlated to insight experiences compared to non-classic insight problems. However, recent studies may continue to use non-classic insight problems because they can be easily translated into different languages (Wu & Chen, 2017).

Growth Mindsets

A growth mindset is the belief that one's personal abilities, such as problem-solving, can improve and develop (Dweck & Leggett, 1988). In contrast, people with fixed mindsets believe their problem-solving ability cannot change and is set from birth (Dweck & Leggett, 1988). Mindset theory is not necessarily a theory of academic achievement but rather observes how people respond to challenges (Yeager & Dweck, 2020). Therefore, growth mindsets may relate to how people approach ill-defined problems, such as insight problem-solving.

Research has suggested that cultivating growth mindsets can improve educational outcomes. Yeager et al. (2019) found that after an intervention designed to cultivate growth

mindsets, lower-achieving students improved their academic scores. However, Yeager and Dweck (2020) argued that whether growth mindsets can improve educational outcomes is controversial, due to differing results in the current body of literature. Therefore, more research on growth mindsets can possibly elucidate the connection between growth mindsets and educational outcomes.

Mindsets may also differ depending on cultural identity, leading to differences in thinking. Heine et al. (2001) conducted an experiment on North American participants and Japanese participants. They attempted to induce growth mindsets and fixed mindsets on both participants and then gave them a CRA task. In this particular study, the researchers were not studying insight but rather creative thinking by using the CRAs. Heine et al. (2001) found that Japanese participants were more self-critical than North American participants, which inspired them to persist in the task even when they failed. However, North American participants were more likely to persist after succeeding a question on the task. The researchers suggest that North Americans can improve their problem-solving ability by becoming more self-critical, while Japanese people can improve by becoming more self-enhancing. Therefore, cultural identity may play a role in cultivating growth mindsets.

Collectivist vs Individualistic Cultures

In psychology, cultures have been described as either collectivist or individualistic based on differences in self-concept, cognition, and values (Markus & Kitayama, 1991). Individualistic cultures, including North American culture, encourage individuals to define themselves by their uniqueness and build their self-esteem (Markus & Kitayama, 1991). Past literature has suggested that the cultural practices associated with individualism directly affect individuals' psychological processes (Kitayama & Markus, 1999). In contrast, collectivist culture, including East Asian

cultures, often encourages individuals to adjust themselves based on existing hierarchy or situation and build their self-discipline (Markus & Kitayama, 1991).

Because collectivist cultures encourage individuals to view themselves as malleable, Heine et al. (2001) argued that individuals from collectivist cultures are more open to self-criticism. Guglielmi and Brekke (2017) also suggested that East Asian cultural norms may increase students' willingness to self-correct and view problems as challenges (Guglielmi & Brekke, 2017). Therefore, this paper argues that East Asian cultures may also promote growth mindsets, encouraging people to believe their problem-solving ability can change. In insight problem-solving specifically, individuals are forced to challenge themselves to view the problem differently in order to solve it. Therefore, individuals from collectivist cultures, who are encouraged to view themselves as malleable, may be better at insight problem-solving. This paper suggests that the accuracy in insight problem-solving and insight experience can be predicted by growth mindset and cultural identity differences.

Research Question

This study's research question was how do growth mindset and cultural identity differences relate to insight problem-solving in Chinese and Canadian university students? The hypothesis was that higher collectivism scores are related to higher insight problem-solving accuracy, higher insight experience, and higher growth mindset scores. Accordingly, Chinese university students were expected to perform better on the insight problem-solving task, have more insight experience, and have a higher growth mindset score.

Method

Participants

Participants were domestic Canadian students and international Chinese university students from the University of Toronto St. George campus. Participants were either Chinese or Canadian because China is considered to be collectivist, and Canada is considered to be individualistic (Guo et al., 2023). Therefore, the study can observe the cultural differences between a collectivistic and an individualistic country.

Participants were recruited via flyers, University Departmental Mailing lists, social media, and psychology courses that provide course credit for experiment participation. Participants were compensated with a $7 Amazon gift card or course credit. There were a total of 216 participants in the study, but only 108 responses were used in the data analysis. Responses were eliminated if the participant received a zero on the insight problem-solving measure or failed quality checks in the questionnaire. The sample size of 108 was reasonable given the time constraint of six weeks and the similar sample size in other studies within relevant fields. Participation was voluntary and all survey responses were anonymous.

Data Collection

Our study used a quasi-experimental design. The study was conducted online through a Qualtrics questionnaire. Interested students certified that they were either a Canadian domestic student or Chinese international student. Qualifying students signed an online consent form further detailing the study.

The first part of the questionnaire addressed demographics, such as the participants' age, gender, and ethnicity. Participants were then asked to self-report their cultural identity, rating on a scale of 1 to 100 how strongly they felt Canadian and Chinese culture had influenced them.

Participants then completed the Cultural Orientation Scale (Triandis & Gelfland, 1998) where they rated 16 statements on a scale of 1 = Definitely no to 9 = Definitely yes. Then, participants completed the Dweck (1999) Growth Mindset Scale where they chose whether they strongly agreed, agreed, mostly agreed, mostly disagreed, disagreed, or strongly disagreed with three statements.

After completing the scales, participants were shown CRAs, which previous studies on insight problem-solving have used (Webb et al., 2016). Because insight problems are essentially riddles, there may be a language barrier, so participants chose between English (Appendix A) and Mandarin CRAs (Appendix B). Participants solved 20 English CRAs created by Bowden and Jung-Beeman (2003) or the Mandarin version by Wu and Chen (2017). Participants were shown three words/characters which can be combined with a fourth word/character. They had 30 seconds to type the fourth word/character. For example, participants could have been given 'potato, tooth, heart,' and they would write the word 'sweet.' In the Mandarin version, participants could have been given '歌 (song)、友 (friend)、養 (care),' and they would type the character '老 (old; old age).'

After each CRA, participants self-reported their feelings of insight. On a scale of 1 to 10, they rated feelings of confidence in the right answer, strength of insight experience, pleasantness of insight experience, surprising nature of insight experience, and feelings of impasse before the insight experience. Each participant was individually tested, and the questions were presented in random order. No solutions were given.

Data Analysis

The quasi-independent variable was cultural identity, and the cultural orientation scores were expected to confirm that Canadian students are more individualistic while Chinese students

are more collectivist. Growth mindset was also measured as another quasi-independent variable. The dependent measures were the accuracy of the CRA test and ratings on the insight experience. The ratings of insight experience were averaged during the data analysis to create one variable. In R version 4.4.1, multiple linear regression models and mediation models were used to understand the relationships between cultural identity, growth mindset, and insight problem-solving. All tests were conducted with an alpha level of .05.

Results

To test the hypothesis that collectivism scores and growth mindset scores would predict greater accuracy on the CRA measure, we ran a linear regression with collectivism scores and growth mindset scores as the predictors and CRA scores as the outcome. However, there was no significant relationship between collectivism scores, growth mindset scores, and CRA scores. The model did reveal, however, that higher individualism significantly predicted lower accuracy in the CRA test, $\beta = -0.03$, $z = -4.04$, $p = <.001$. Higher growth mindset was found to significantly predict higher accuracy in the CRA test, $\beta = 0.12$, $z = 3.43$, $p = < .001$.

To test the hypothesis that collectivism scores would predict greater insight experience and higher growth mindset, we ran two linear regressions with collectivism scores as the predictor and insight experience and growth mindset as the outcomes. Supporting the hypothesis, the models revealed that higher collectivism was also found to significantly predict more insight experience, $\beta = 0.02$, $z = 2.14$, $p = 0.03$. However, higher individualism was also found to significantly predict more insight experience, $\beta = 0.03$, $z = 3.22$, $p = 0.001$. Contrary to the hypothesis, higher collectivism was found to significantly predict lower growth mindset, $\beta = -0.03$, $z = -4.69$, $p = < .001$. Higher individualism was also found to significantly predict lower growth mindset, $\beta = -0.07$, $z = -13.00$, $p = <.001$.

To test the hypothesis that Chinese cultural identity would predict more insight experience and higher growth mindset scores, we ran two separate regression analyses with Canadian and Chinese cultural identities as the predictors and growth mindset and insight experience as the outcomes. However, Chinese cultural identity was found to have no significant relationship with insight experience. Chinese cultural identity was also found to significantly predict lower growth mindset scores, β = -0.01, z = -15.52, p = <.001. Contrary to our hypotheses, Canadian cultural identity was found to significantly predict more insight experience, β = 0.01, z = 3.37, p = 0.001. Canadian cultural identity was also found to significantly predict higher growth mindset scores, β = 0.004, z = 2.86, p = 0.004.

Discussion

Insight Problem-Solving Accuracy

In the linear regression test, higher growth mindset was found to predict higher accuracy in the CRA test. This result is also supported by past literature because Heine et al. (2001) observed that inducing a higher growth mindset could increase accuracy of CRAs. In the linear regression and mediation test, higher individualism was found to predict lower accuracy in the CRA test. This result is supported by past literature because Guglielmi and Brekke (2017) found that students from individualistic countries generally performed worse in academic subjects. They alluded to the possibility that students from individualistic countries may have less growth mindsets. Accordingly, in the mediation models, individualism was negatively correlated with growth mindset scores. However, collectivism was also found to negatively predict growth mindset scores. Therefore, this study's results cannot make a clear comparison between collectivism and individualism in regard to growth mindset. As a result, growth mindset differences may not be related to the cultural differences in insight problem-solving.

Additionally, there was no significant relationship between self-reported cultural identity and accuracy in the CRA test. This result suggests that in the particular sample used in this study, the cultural identity of Canadian and Chinese students may have deviated from the trend in previous studies. Past literature suggested that Canadian students would be more individualistic and Chinese students would be more collectivist. The sample could have led to an unexpected result because Chinese international students may have been heavily influenced by individualistic and Canadian culture, or because of individual differences.

Insight Experience

As a secondary dependent variable, the cultural differences and mindset differences in self-reported insight experience were also explored. In the linear regression tests, there were no significant results suggesting that cultural identity or growth mindset predicted insight experience. This result could be explained by Webb et al. (2016), who found that completing CRAs were weakly correlated with having an insight experience. Therefore, this study may have not been able to detect a significant effect because CRAs were used to measure insight problem-solving. In the mediation tests, both higher individualism and higher collectivism scores predicted more insight experience. This result suggests that there is little cultural difference in insight experience.

Implications

This research study has theoretical impacts on the psychology and cognitive science fields, as well as potential societal impact. While some results were unexpected, the results supported that growth mindsets can predict higher accuracy in solving insight problems. In regards to the cognitive science field, the study suggests that the mindset theory in psychology can be applied to insight problem-solving. As researchers have agreed that insight is a hard

phenomenon to study in research, this study provides more information about insight problem-solving. Accordingly, the study supports that insight problem-solving can be applied to mindset theory. The results of this study suggested that a growth mindset can predict higher accuracy in insight problem-solving. Thus, both the fields of cognitive science and psychology benefited from the results of this study.

Furthermore, because many day-to-day problems are ill-defined and thus require insight, the results of this study underscore the importance of promoting growth mindsets. The results agree with Yeager and Dweck (2020) and their argument that growth mindset interventions may improve educational outcomes for students. Therefore, institutions in all countries should be encouraged to implement growth mindset interventions.

Limitations and Further Research

This research study had various limitations in the data collection. More responses were collected during the data collection period, but only 108 responses were included in the data analysis due to issues in the dataset. Responses were eliminated if the participant received a zero on the CRA test or failed certain quality checks. This issue may have been exacerbated by the fact that the study was conducted online. However, the 108 responses that were included in the analysis were still satisfactory for making conclusions regarding the variables studied.

Moreover, the study had various limitations in the design and methods. First of all, the study was conducted on the University of Toronto campus, which is located in an individualistic country. Thus, Chinese international participants may have been heavily influenced by Canadian culture. To mitigate this limitation, the questionnaire asked participants to rate how strongly they felt Canadian and Chinese culture influenced their beliefs, but this cultural influence may be unconscious and thus unable to be self-reported. Further research could compare university

students from different countries, such as incorporating a university from China rather than using international students in a Western country.

Furthermore, the study uses CRAs to measure insight problem-solving ability, but other research has suggested that CRAs are weakly correlated with insight experience (Webb et al., 2016). Webb et al. (2016) argued that classical insight problems are more correlated with insight, but this study opted against these measures because of the possible cultural/language barrier for Chinese participants. Additionally, the study was conducted online, meaning participants were in an uncontrolled environment. Participants could have searched the answers to the CRA test, thus misrepresenting their accuracy in insight problem-solving.

Also, the study can only support correlation rather than causation. Further research could use an experimental method, similar to Heine et al. (2001). Heine et al. (2001) attempted to induce growth mindsets and fixed mindsets in participants from an individualistic culture and participants from a collectivist culture while they were taking a creative thinking task. An experimental procedure more similar to Heine et al.'s study may provide more support for the relationship between cultural identity, growth mindsets, and insight.

Conclusion

The current study indicated that growth mindsets are correlated with better performance in insight problem-solving. More extreme scores of both individualism and collectivism were found to predict insight problem-solving accuracy and insight experience, but self-reported cultural identity did not follow the same relationship as cultural orientation. Therefore, the study did not fully elucidate the cultural differences in insight problem-solving and how they relate to growth mindsets. This lack of clarity could be due to the data collection, which was conducted in an individualistic country. As a result, the sample size of Chinese participants was smaller than

that of Canadian participants. Further research could involve university students from a collectivist country as participants. While this study's results did not support the hypothesis, the study still supports the benefit of growth mindset interventions at universities.

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Appendix A

English CRA test

1. dress/dial/flower (answer: sun)
2. safety/cushion/point (answer: pin)
3. main/sweeper/light (answer: street)
4. house/thumb/pepper (answer: green)
5. sense/courtesy/place (answer: common)
6. light/birthday/stick (answer: candle)
7. health, taker, less (answer: care)
8. cross/rain/tie (answer: bow)
9. keg/puff/room (answer: powder)
10. boot/summer/ground (answer: camp)
11. age, mile, sand (answer: stone)
12. horse/human/drag (answer: race)
13. opera/hand/dish (answer: soap)
14. pile, market, room (answer: stock)
15. right, cat, carbon (answer: copy)
16. tank, hill, secret (answer: top)
17. foul/ground/mate (answer: play)
18. man, glue, star (answer: super)
19. cover, arm, wear (answer: under)
20. tail, water, flood (answer: gate)

Appendix B

Mandarin CRA test

1. 苦、斷、皮 (answer: 果)
2. 息、戰、寫 (answer: 作)
3. 緣、先、內 (answer: 人)
4. 黑、具、德 (answer: 道)
5. 感、號、港 (answer: 口)
6. 期、落、善 (answer: 後)
7. 通、業、李 (answer: 行)
8. 官、案、針 (answer: 方)
9. 播、導、得 (answer: 主)
10. 問、案、應 (answer: 答)
11. 尾、養、稅 (answer: 收)
12. 留、圖、隨 (answer: 意)
13. 等、架、流 (answer: 上)
14. 酒、選、髮 (answer: 美)
15. 移、態、舉 (answer: 動)
16. 師、童、警 (answer: 軍)
17. 考、產、測 (answer: 量)
18. 全、代、移 (answer: 民)
19. 印、園、費 (answer: 花)
20. 暴、營、透 (answer: 露)