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Does Level of Education Make a Difference? An Examination in Emotion-based Decision-making

Claire A. Rosenberger
Department of Psychology
Saint Norbert College

This study examined the correlation between participants' level of education and their performance on the Iowa Gambling Task (IGT). Emphasis is placed on the complexity of the task with the idea that the participant must use emotion-based learning to deal with complex decision-making. Previous research suggests that more-educated participants should perform better on the IGT than those with less education. To test this prediction, twenty-eight participants from a small Midwestern town were recruited. Participants completed the IGT via computer administration. While there was a tendency for participants with more education to choose from the advantageous decks more often, the relationship was not statistically significant.

Keywords: Level of education; Emotion-based Decision-making; Development

Author Note
Claire A. Rosenberger is now at the Department of Psychology at the Center for Healthy Minds, University of Wisconsin-Madison, WI. The reaeach was supported in part by Raquel Cowell, Ph.D., and the Developmental Decision-Making Lab. Correspondence concerning this article should be addressed to Claire A. Rosenberger, 625 W. Washington Ave., Madison WI, 53703. Contact: crosenberge2@wisc.edu

Education plays a large role in human development, both in and out of the classroom (Havighurst, 1953). Most children in the industrialized world start school around the age of five when they have developed the necessary skills that allow them to be away from their primary caregivers for extended periods of time. In school, they learn the basics of their society's cultural norms, language, and edification (Bruner, 1990). Students typically remain in school until they are 18, at which point they have the option to continue their education or enter the workforce. This decision may seem relatively simple, but what are the implications of these decisions? While entering the workforce may seem like a viable option, pursuing higher education is also a desirable option for many young people. It is true that the estimated lifetime earnings of a person with an advanced degree are far greater than those for someone with a GED or equivalent (Julian, 2012). With more young people pursuing higher education (de Brey, Musu, McFarland, Wilkinson-Flicker, Diliberti, Zhang, Branstetter, & Wang, 2019), it's increasingly important to understand the effects of higher educational attainment. More specifically, this study sought to understand how additional education affects emotion-based decision-making.

The Relationship between Education and Emotion-Based Decision-Making

Research has suggested that the level of education highlights the role of emotions in decision-making (Bowman & Turnbull, 2004). For example, prior work (Huffman, 1974) examined Midwestern farmers' ability to adjust the amount of nitrogen in their fertilizer with the intent to grow and produce more corn. They found participants with a higher level of education were able to grasp changes faster and adjusted with greater ease and accuracy than those with less education. Huffman showed that level of education was correlated to the production of corn; farmers with more education produced more corn. Therefore, level of education, combined with the availability of information, was directly related to effectiveness. This suggests that participants with higher levels of education may perform better on an emotion-based decision-making task than those with lower levels of education.

More recent research (Fry, Greenop, Turnbull, & Bowman, 2009) examined the effect level of education has on the IGT. The researchers found that university-educated participants outperformed the less educated group, whose highest level of education was grade 10 or lower, but only in the last stage of the task. They believe this may be due to a range of possible explanations including: lack of motivation, differences in tracking punishments, differences in risk taking behaviours and difficulty with reversal learning. The study concluded that the university educated group may have an advantage by obtaining a combination of emotional and cognitive sources, that the less educated group did not have.

The Iowa Gambling Task and Emotion-Based Decision Making

The current study seeks to determine whether one's level of education affects emotion-based decision-making. The Iowa Gambling Task (IGT) was used to examine this relationship because of its reputation as a reliable measure of emotion and decision-making (Bagneux, Thomassin, Gonthier, & Roulin, 2013; Bechara, Damasio, Damasio, & Anderson, 1994; Busemeyer & Stout, 2002; Evans, Bowman, & Turnbull, 2005). One review found more than 400 papers have made use of this paradigm (Dunn, Dalgleish, & Lawrence, 2006). Due to its consistent results, the task reliability demonstrates the extent to which learning based on emotion is useful in dealing with complex problem solving and decision-making (Bechara, Damasio, Damasio, & Anderson, 1994).

The IGT was originally developed to assess decision-making in patients with damage to the ventromedial prefrontal cortex (Bagneux, Thomassin, Gonthier, & Roulin, 2013). However, over the year's importance has been placed on the complexity of the task with the idea that the participant must use emotion-based learning to deal with the complex decision-making process. The IGT is able to tap into emotion-based learning by mirroring real life decision-making situations that deal with uncertainty, rewards, and punishments. In the early stages of the task, participants are not aware of the complexities of the game, however, they report developing a 'feeling' about which decks will give them positive or negative gains before figuring out the task (Bechara, Damasio, & Damasio, 2000). In other words, emotion is guiding the participants' learning, and it is helping the participant recognize and recall important knowledge about which deck to choose. This 'feeling' begins as nonconscious processing but will eventually come into the participant's conscious awareness after several trials (number varying on the individual). Once it has reached conscious awareness, the player will develop a set of rules that can be seen in their deck choice as well as their oral or written statement of their experience (Bechara et. al. 2000). The development and feeling of these insights are critical for success in the game.

To begin the task, the player will randomly select cards from one deck or another, noting the gains and losses. However, before they are consciously aware that the decks are predisposed, participants will begin to show an emotional response before choosing a card. This is generally shown after their first encounter with a great loss; their reactions change, rapidly shifting from excitement to disappointment (Bechara et al., 2000). From this point on, participants do not draw from this deck in the same way as before (Bechara, Damasio, Tranel, & Damasio, 1997). After playing a while longer, participants are able to accumulate enough information about the decks, and are able to describe the rules about which decks to choose and which to avoid (Immordino-Yang & Faeth, 2010). That is to say, the participant has learned how to play the game. These findings suggest that the IGT measures an aspect of cognition that belongs in the domain of decision-making and complex problem solving.

Brain Areas Involved in Emotion-Based Decision-Making

There is evidence suggesting the prefrontal cortex handles the temporal organization of behavior and cognition, and plans for future behavior and cognition (Ingvar, 1985). To further investigate the role of the prefrontal cortex in decision-making, Bechara et al. (2000), compared normal participants' decision-making performance on the IGT to those with prefrontal lobe

damage. They found that participants with normal brain function began to choose advantageous decks before they realized which strategy worked best, whereas patients with prefrontal lobe lesions continued to choose disadvantageous decks, even after they knew the correct strategy. This led Bechara and colleagues to conclude normal participants may consider emotional cues to develop an affinity toward advantageous decisions that will subsequently guide decision-making (Bagneux et al., 2013). Simply put, normal participants strongly relied on their emotions and intuition to make advantageous decisions.

More specific research has been done on participants with damage to their ventromedial frontal lobes. Because persons with lesions to their ventromedial frontal lobes do not have the ability to express emotion or to experience feelings in situations that would normally evoke emotions (Damasio, 1996), this makes them the ideal candidate to see how emotion and intuition play a role in the IGT. When this paradigm was studied, the results showed that participants with damaged ventromedial frontal lobes fail to realize negative outcome choices and consistently lose money on the IGT (Bechara, Damasio, Damasio, & Lee, 1999). It also appeared they had no ability to develop an anticipation of the emotional consequences that would follow from choosing bad decks.

Additionally, there is literature showing alterations of emotional experience in people with schizophrenia (Aghevli, Blanchard, & Horan, 2003; Kring, Kerr, & Earnst, 1999; Kring, Kring, & Neale, 1996; Schneider, Heimann, Himer, Huss, Mattes, & Adam, 1990). Patients diagnosed with schizophrenia also show widespread impairments in several cognitive domains, including emotion-based decision-making (Sevy, Burdick, Visweswaraiah, Abdelmessih, Lukin, Yechiam, & Bechara, 2007). However, when emotion is evaluated by means of self-report, people with schizophrenia do not appear to differ from controls (Berenbaum & Oltmanss, 1992; Kring & Bachorowski, 1999). A key finding of the study done by Evans, Bowman, and Turnbull (2005) relates to the subjects' experience ratings on the IGT. All participants, including those with schizophrenia, demonstrated and reported significant awareness of which decks were 'good' and 'bad'. One of their participants with schizophrenia reported, "I don't know what's going on, but I get this feeling in my tummy that those [decks] are no good" (Evans et al., 2005). These findings further show how the IGT can measure emotion-based decision-making.

Emotions and Decision Making

It is important to know how emotions are classified in order to understand how they affect decision-making. Decision-making has traditionally been thought of as a rational process that does not leave much room for emotions. However, in recent years, researchers have begun to examine whether or not emotions play a role in decision-making, and if they do, the size of their role. Psychologists Pfister and Böhm (2008) have developed a classification of how emotions function in decision-making. They broke down the role emotions play in decision-making into a four-function framework of emotional mechanisms: providing information, improving speed, assessing relevance, and enhancing commitment.

First, they argue any decision requires some kind of information, more specifically, information that is personally relevant. They suggest a particular class of emotions serve this purpose, pleasure and displeasure. Second, they address time and pressure. They acknowledge that the decision maker has to decide within a certain window of opportunity. If the window is short, say seconds or a few minutes, the decision maker will often decide quickly, relying more heavily on emotions than logic. Third, the decision maker must consider the relevance of the situation. This is typically done by the individual's personal history and the state of mind they are in. The last requirement is commitment. Studies have shown when the situation involves social and moral decisions, the decision maker shows more commitment to the decision, but first struggles with the idea of which is a better option; the good of the self or the good of the whole.

This framework of emotions can aid in understanding why people have a tendency towards a particular type of action. In particular, why someone would be more likely to choose advantageously on the IGT than others. This idea helps support the current studies hypothesis that level of education plays a role in emotion-based decision-making.

Overview of the Present Research

After examining the literature, it is clear that emotions play a role in how participants learn and make decisions on the IGT, but there is little research on how level of education affects emotion-based decision-making on the task. Because people with higher levels of education have collected more information from advanced educational experiences, they should have more experience making decisions based on emotions. Thus, they should be able to rely more so on their emotions when making decisions, than those with less education. Therefore, the hypothesis is that participants with higher levels of education will choose advantageous decks more often than those with lower levels of education, because they will tap into emotion-based decision-making earlier in the task. To test this possibility, I will utilize a sample of 28 older adults and examined if their education level is related to their performance on the IGT (i.e., emotion-based decision making).

Method

Participants

Twenty-eight participants from a small Midwestern town were recruited. Participants were pre-screened and had to be 55 years of age or older. This helped ensure they had achieved their highest level of education. Participants varied in level of education, ranging from a high school degree to a doctoral degree. They were split into three groups (High School Degree= 6, Some College/Bachelor Degree = 12, Post Bachelor Degree = 10). They were similar in gender (n = 13 female, n = 15 male) and age (M = 70.82, SD = 9.33). At the beginning of each session,

participants signed an informed consent form and then completed a demographic questionnaire before starting the IGT in a quiet room in the Psychology Department at a small, private university. After completion of the study, participants received a $5 gift card as compensation.

Measures

The experiment ran with E-Prime 2.0 software installed on a DELL computer equipped with a 17" monitor. Once participants were briefed on how to use the computer to perform the task, via oral and written instructions, four decks of playing cards, labeled 1, 2, 3, and 4, were presented on the screen. Each deck corresponded to four distinct buttons on the computer keyboard. The back of each deck looked the same, but they differed in reward level. Without participants knowledge, decks 1 and 3 were advantageous, meaning if chosen would yield high reward or punishment, and decks 2 and 4 were disadvantageous and would yield low reward or punishment. Over the course of 200 trials, participants were tasked with trying to get the highest possible score, which was determined by point values associated with each card. Point values differed in valence and magnitude; small gain, small loss, large gain, large loss. Each participant started with a score of zero, which could be added to or subtracted from over the course of the game. Participants saw on the screen the amount of money that they won or lost; this amount was updated after each choice.

The number of times an advantageous or disadvantageous deck was chosen during the IGT was recorded for each participant using E-Prime software. Participants' deck choice on every trial (N = 200) was coded with a 1 (advantageous deck choice) or 0 (disadvantageous deck choice). The coded scores were then summed for each participant and used to indicate the total number of times they chose advantageously. The participants' level of education was coded as 1 (high school degree), 2 (some college/ bachelor's degree) or 3 (post bachelor's degree).

Results

To examine the relationship between IGT performance and level of education, both variables were treated as continuous and a Pearson's r was run to assess the relationship between education level and IGT deck choice along a continuous scale (r = 0.256, p = 0.835). These findings were not significant. Participants' scores ranged from 32-172 and were grouped and coded as 1 (scores 30–65), 2 (scores 66-101), 3 (scores 102-137) and 4 (scores 138–173). Second, a chi-square analysis was conducted with both level of education and IGT scores treated as categorical variables. The results were not significant ($\chi^2(n\text{-}1, N) = 4.401$, p =.671, r = 0.396). Lastly, an ANOVA was conducted. This too yielded insignificant results $F(2, 26) = 0.015$, p = .985, $\eta_p^2 = 0.006$).

Due to the low sample size, a bootstrap resampling was completed where N = 3,000 (High School Degree = 1,000, Some College/Bachelor Degree = 1,000, Post Bachelor Degree = 1,000). A Pearson's r was run to reassess the relationship between education level and IGT deck choice along a continuous scale (r = 0.398, p = 0.740). These findings were also not significant. Using the adjusted sample size, an ANOVA was also conducted. This too yielded insignificant results $F(2, 2998) = 0.188$, p = .740). Thus, it was concluded that level of education did not appear to play a role in participants deck choice on the IGT (Figure 1).

Discussion

The current study sought to examine if there was a relationship between emotion-based decision-making and level of education, specifically whether having higher education attainment resulted in increased emotion-based decision-making as measured by the IGT. While this study was unable to produce significant results, other studies have demonstrated a link between emotion-based decision-making and level of education. There may be a few possible explanations for these mixed findings.

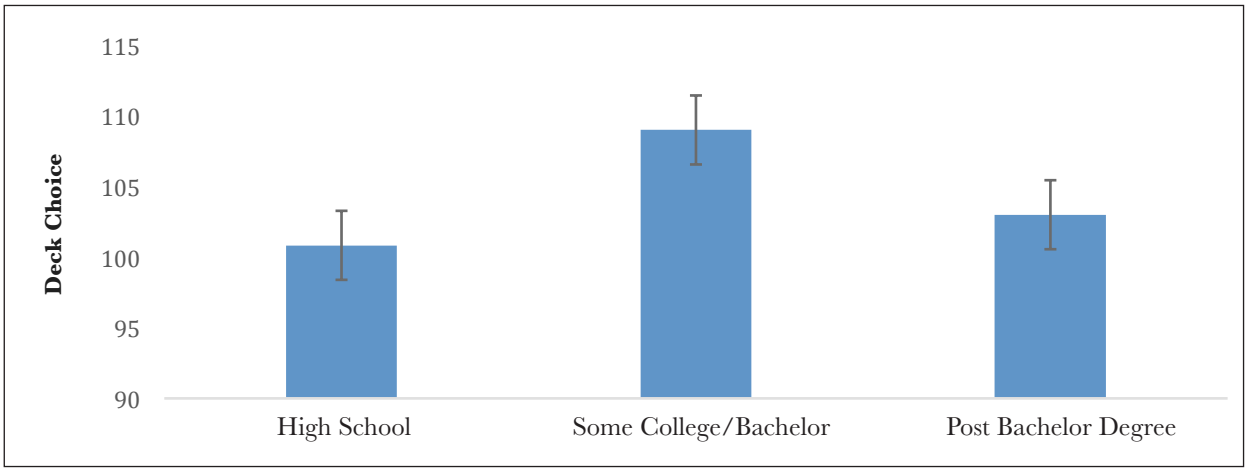

Figure 1. Bar charts representing the mean number of times participants chose an advantageous deck, based on their level of education.

Limitations of This Study

Sample Size. Although the groups were similar in terms of education level, gender, and age, the size of this sample was not large enough to detect the hypothesized effect. Previous studies had 30 or more participants (Bowman, & Turnbull, 2004; Evans, Kemish, & Turnbull, 2004; Van den Bos, Homberg, & de Visser, 2013; Vries, Holland, & Witteman, 2008). Thus, it is possible that with a larger sample, the effect of education level on emotion-based decision making may emerge. However, when a bootstrap analysis was conducted on these data, there were still insignificant results.

Mood. Another possible limitation may have been the mood of the participants during the study. A study conducted by Vries, Holland, and Witteman (2008), investigated the role of mood on the IGT and found that it affects performance. Specifically, when looking at the early stages of the IGT after participants experience their first losses in the bad decks, data showed participants in a happy mood state outperformed those in a sad mood state. They concluded that participants in a happy mood state relied more on emotional reactions toward different decision-making options, whereas participants in a sad mood state adopted a more careful, rational decision-making strategy (Vries et al., 2008). In the present study, participants were not asked to rank their mood on the questionnaire they were given. This would be a good addition for future research.

Motivation. In addition to mood, motivation should also be considered when examining the results of this study. Rather than being unable to make the correct decision, participants may simply not care enough about the negative outcomes to try and avoid them. If, however, the decision maker is in a good mood, this may make their decision about a certain task easier as the current mood is dominating their feelings over a future occurrence (Lowenstein & Lerner, 2003).

Age Related Effects. As our sample looked at older adults, it is possible that a decline in cranial tissue due to aging affected our results. Since the present study examined how education affects emotion-based decision-making, it was important that the sample had reached their highest level of education. Most of the sample was retired and it was safe to say they would not be pursuing further education. However, a drawback to this approach is the aging process may be compromising their decision-making ability. Age-related loss of brain tissue has been confirmed by cross-sectional neuroimaging studies, as well as by direct measurements of gray and white matter tissue loss from longitudinal studies via magnetic resonance imaging (MRI) scans in adults 55-85 (Resnick, Pham, Kraut, Zonderman, & Davatzikos, 2003). More specifically, other research has focused on older adults and their performance on the IGT. Older adults (64 years of age and above) perform worse on this task relative to younger adults (26–56 years of age) (Denburg, Tranel, & Bechara, 2005). Further research could pull a sample from the same demographic, with the age range of 35-55, and compare the results of each group to see how age affects deck choice.

Level of Education. The kind of education participants received may be the greatest factor affecting participants' scores on the IGT. A possible source of variation in emotional decision-making may be from the type of education each participant received (Turnbull, Evans, Bunce, Carzolio, & O'Connor, 2004). An education system that emphasizes the importance of validated sources of reference and tries to prevent emotions in decision-making, would hinder participants' scores on the IGT (Bechara et al., 2000). Therefore, higher levels of education may affect performance on measures of emotion-based learning (Evans et al., 2004).

Future Directions

Neuroscience studies suggest that it may be more effective for teachers to thoughtfully build opportunities for the development of skilled intuition into their syllabi (Immordino-Yang & Faeth, 2010). More importantly, to help encourage emotional connections to the material being learned, this should start at a young age. An approach that allows for students to design lessons so they still learn about the topic and the required information, seems to be the best way to incorporate emotion-based decision-making into the classroom (Immordino-Yang & Faeth, 2010). For example, if the topic is the history of Mexico from 1889-1910, the students can choose to write a report, perform a play or cook their way through the time period, all while touching on major events and contributions that shaped the country during that time period. This application gives students a sense of ownership that contributes to making later learning meaningful, and the emotions they experience relevant. Much like how participants in the IGT need both positive and negative experiences to help them learn, students must be offered plenty of opportunities for the development and feeling of experience-based intuitions on how and when to use the academic material (Immordino-Yang & Faeth, 2010). Future research should look at how students in these types of environments perform on the IGT and compare the data to older adults who have been educated in a more traditional way.

Furthermore, a study conducted by Bakos, Denburg, Fonseca, and de Mattos Pimenta Parente (2010), compared the performance of selected groups of Brazilian and American individuals on the IGT. Their results show that culture influenced performance on the IGT. Specifically, when participants were tasked with choosing financial options, more than half of the Americans made advantageous choices, and 80% of the Brazilian participants made disadvantageous choices. Nevertheless, the learning process for the task did not differ between the two groups. This suggests that both groups had similar choice-based learning skills but different decision-making strategies. Bakos et al. (2010) referenced educational experience being a factor explaining these results. They discussed how exploring teaching quality would be important to further understand their findings, due to the different educational systems in Brazil and America.

Finally, previous research has shown that time constraint does play a role on participants' performance on the IGT. A study conducted by Cella, Dymond, and Turnbull (2007) placed

participants into three groups, a time-constraint of either two seconds, four seconds or no time constraints (control group). Their results showed that the two second time restraint group differed significantly from the control group. Their findings demonstrate the effects of time constraints on emotion-based decision-making. Additionally, Lowenstein and Lerner (2003) looked at how a delay in time can affect decision-making. They found that the sooner the impending possible outcome, the greater the emotion associated with that event. Further investigation on how time-constraint effects advantageous deck choice should be conducted.

Conclusion

Traditionally, decision-making has been seen as a rational cognitive process but recent studies suggest that is not the case (Evans et al., 2005; Pfister, & Böhm, 2008). Emotions are often involved. Based on the present results, in line with prior research, there is reason to believe that several factors contribute to emotion-based decision-making. Specifically, examining type of education, culture, and the length of time allowed to make an advantageous decision will give researchers greater insight to emotion-based decision-making. This will hopefully lead to a better understanding of how level of education affects emotion-based decision-making. In sum, emotional influences on decision-making have shaped an innovative path of interdisciplinary research, one that should continue to be studied.

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