Journal of Educational and Developmental Psychology; Vol. 12, No. 1; 2022
ISSN 1927-0526 E-ISSN 1927-0534
Published by Canadian Center of Science and Education

Do Preschoolers and Adults Think That Academic and Athletic Abilities are Inherited? A Pilot Study

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Received: December 22, 2021 Accepted: February 11, 2022 Online Published: March 11, 2022

doi:10.5539/jedp.v12n1p71 URL: http://doi.org/10.5539/jedp.v12n1p71

Abstract

The following study examined if preschoolers and adults think that certain academic and athletic abilities are inherited or determined by the environment. Twenty-one preschoolers and 28 adults were presented with 9 switched-at-birth vignettes (math, reading, science, language, music, art, gymnastics, soccer and swimming) where in certain cases the birth parents were good at a task and in other situations the adoptive parents were good at a task. Participants had to decide if their child would resemble the birth parents or the adoptive parents in their abilities. The results suggest that overall there are no significant differences between preschoolers and adults reason in the way they reason about the role of inheritance in the area of academics, arts, and athletics. However, the one domain where there was a significant grade difference between preschoolers and adults was in the area of academics (math, reading and science) with adults attributing inheritance as being more responsible for abilities in this area. Overall these results suggest that there is no significant difference in the way preschoolers and adults reason about the inheritance of these abilities.

1. Introduction

1.1 Introduction to the Problem

One important factor that determines how hard children try to improve on their abilities depends on their belief of whether they can actually improve with effort or if they think that inherent ability plays an important role. Several studies have examined if children think their abilities are determined by inherent ability or effort.

1.2 Importance of the Problem

The question that this paper addresses of whether children and/or adults believe that they can improve in certain areas is important as it will determine children's and adults' motivational styles as to whether they can improve their performance in the areas of academics and athletic abilities through effort or not.

1.3 Literature Review

Cain and Dweck (1995) propose that children hold either an entity view of intelligence (where intelligence is seen as a fixed asset) or an incremental view of intelligence (where intelligence can be improved through effort and learning). They tested first, third, and fifth graders about their ability, achievement and their motivational responses to challenging puzzles. They found that a sizable minority of subjects at all ages showed the maladaptive helpless pattern (e.g., nonpersistence, negative expectations). However, among the older participants, helpless and mastery orientations were associated with differences in whether intelligence was seen as fixed or malleable. Interestingly, younger participants did not subscribe to the implicit theory of intelligence. First-graders with the helpless pattern gave outcome-oriented explanations for school grades instead of inherent abilities, whereas those with a mastery orientation gave process-oriented explanations (Cain & Dweck, 1995).

Similarly, Bempechat and London (1991) asked students to complete questions about assessing achievement goals and personal beliefs about intelligence. They found that of all the students, 4.4% embraced performance goals and had low confidence in their intellectual ability which is a combination of beliefs that can place them at risk for later underachievement. As expected, they found that older children have more of an entity view of intelligence than younger children did in their assessments of physical appearance.

Stipek and Gralinski (1996) examined if third through sixth graders had an incremental or entity view of

intelligence. There were 425 students (at or above the 97th percentile) who completed questions assessing achievement goals and personal beliefs about intelligence. Students ranged widely in learning goals that focus on understanding material and performance goals that focus on doing better than others. As learning goals became stronger, so did beliefs that intelligence can increase via effort. Of all students, 4.4% embraced performance goals and had low confidence in their intellectual ability, a combination of beliefs that can place them at risk for later underachievement. Surprisingly, they found that third graders in fact demonstrated more of an entity view of intelligence than fourth through sixth graders.

Nicholls et al. (Nicholls, 1978; Nicholls & Miller, 1984) asked children different questions about ability and effort and how different levels of performance can occur when similar effort is exerted. They found that 5–6 year olds reasoned that effort and ability are related (smarter people work harder) whereas older children demonstrated an inverse relationship (more effort indicated lower ability). Younger children also thought that ability was changeable by putting in more effort whereas older children seem to think that smarter people succeed with less effort.

Stipek and Gallinski (1996) focused on domain differences in children's belief about ability in social and academic domains. Interestingly, they found that all children believed that their classmates could improve somewhat in each of the domains but sixth graders felt that they could improve less than third graders or kindergartners. This was true both for the social and academic domains.

Freedman-Doan et al. (2000) assessed first, second and fourth grade children's beliefs regarding the kind of activities they though they were good or bad at and if they could improve in these domains. They examined the areas of academics, sports, music and art. Children in all the grades were optimistic that increased effort would result in better performance. The one exception was the area of sports where children believed it would be difficult to get really good in the sports domain. However, by fourth grade the children doubted if they could improve enough to be best at the activity they were performing the worst in indicating that they recognize that they can only get better to a certain extent.

All of the above studies have examined if children think they can improve in certain abilities and how that changes with age. However, none of the studies have examined where children think abilities come from and whether they are inherited or determined by the environment. The following study, examines this very question with preschoolers and adults by asking if they think certain academic and athletic abilities are inherited or determined by the environment. This task was accomplished by using the standard switched-at-birth task (Hirschfeld, 1995) which have typically been used to determine if biological traits are inherited or environmentally determined (Giménez & Harris, 2002; Hirschfeld, 1995; Johnson & Solomon, 1997; Solomon, Johnson, Zaitchik, & Carey, 1996; Sousa, Atran, & Medin, 2002; Springer, 1996; Waxman, Medin, & Ross, 2007). Springer and Keil (1992) used the fixed at birth task to determine if preschoolers think certain physical characteristics such as internal organs are inherited from the biological parents or if they are determined by the environment. Children were presented with parent animals with abnormal features. Children were then asked if the offspring would have the abnormal or normal feature. The features were either internal or external, inborn or acquired after birth. Among preschoolers, features with functional consequences were considered inherited much more frequently than any other type, but only when the functional consequences were biological rather than social or psychological. Older children demonstrated more awareness of the inheritance of inborn traits but overall the results suggest that preschoolers have biological notions of inheritance. Raman and Gelman (2006) used the fixed-at-birth task to assess if preschoolers could distinguish the difference between genetic and contagious illnesses. They found that preschoolers recognized that genetic illnesses are inherited and cannot be contagiously transmitted. Taylor (2009) used the switched-at-birth task in children to compare the development of concepts of animal species and human gender to examine children's notions about gender. Five and 6 year old children treated animal species and human gender as equivalent. However, 10 year olds and adults treated gender and species concepts as distinct from one another. They reasoned that gender-linked behavioral properties were open to environmental influence and endorsed environmental based mechanisms to explain gender development. At all ages, children demonstrated differentiated reasoning about physical and behavioral properties, although this differentiation became more stable with age.

1.4 Hypotheses

There have been no studies that have used the switched-at-birth task to determine if preschoolers think that academic, artistic and athletic abilities are inherited or environmentally determined. All of the studies that have examined children's beliefs about academic abilities have examined if older children think they can get better if they try harder or if they think abilities are inherent. This study is the first of its kind to examine if preschoolers

think that academic, artistic and athletic abilities are inherited or environmentally determined. The hypotheses for this study are: (a) based on the fact that children are told that they can improve their abilities if they try harder, we would expect preschoolers to reason that they can improve in the areas of academics, artistic and athletic abilities. This would suggest discounting the genetic contribution; (b) however we would expect adults to have a more nuanced idea of the contribution of genetics and the environment.

2. Method

2.1 Participants

Twenty one preschoolers (15 females and 6 males, M age = 4.6 months, range = 4.0-5.1 years) and 28 adults (17 females and 11 males. M age = 19.5 years, range 18.1 years -20.2 years) were tested. Due to Covid (which interrupted in person testing), half of the preschoolers were tested in person and the other half were tested online. The adult testing was all done in person.

2.2. Sampling Procedures

Participants were presented with a total of 9 vignettes. There were three areas – academics, arts, and athletics. Each of the areas had 3 vignettes. Academics consisted of abilities in math, reading and science. Arts consisted of language, music and art. Athletics consisted of gymnastics, swimming and soccer. An example of a vignette for math is the following:

'Mr. and Mrs. Smith had a baby boy. Right after being born, the baby went to live with Mr. and Mrs. Johnson. They named the baby Max. Max grew up with Mr. and Mrs. Johnson and they loved Max a lot. Who was baby Max born to? Mr. and Mrs. Smith or Mr. and Mrs. Johnson? Where does he live now? (a) Mr. and Mrs. Smith or (b) Mr. and Mrs. Johnson. Mr. and Mrs. Johnson are very good at math but Mr. and Mrs. Smith are not good at math. Do you think Max will be: (a) Good at math like Mr. and Mrs. Johnson or (b) Not good at math like Mr. and Mrs. Smith?

2.3 Experimental Manipulation

Participants were read the vignettes out aloud and their responses were noted. Stick figures were used to hold the preschoolers' attention. Only participants who passed both control questions were included in the final analyses. When we transitioned to online testing, four preschool participants had to be dropped as they did not pass the control questions.

3. Results

3.1 Data Analysis

The data was coded in the following manner. Birth parent matches were assigned a '1' and all other responses were assigned a '0. A 2 grade (preschool; college) x 3 topic (academics; arts; athletics) repeated measures ANOVA was conducted. The results indicated no significant main effects for topic, $F(2,77) = 1.21$, $p > 0.3$, topic x grade, $F(2.77) = 0.8$, $p > .04$, or grade, $F(1, 47) = 3.47$, $p > 0.07$. However, although overall the topic x grade did not indicate any significant differences, there was a significant grade difference in the area of academics between preschoolers and adults, $p < .038$ indicating that adults have a more genetic bias than the others do. Comparison to chance responding (1.5) for each domain demonstrated that adults' responded above chance to academic abilities.

3.2 Participant Flow

All the recruited participants completed the study.

4. Discussion

This study is the first of its kind to investigate preschoolers' beliefs about the role of inheritance in the areas of academics, arts, and athletics. Previous studies have examined children's assessment of academic, sports, music and arts with older children but not with preschoolers. The results of this study demonstrate that there is no significant difference between the way preschoolers and adults reason about the impact of genetics or the environment on academic, artistic or athletic abilities. Overall both age groups primarily make an environmental attribution for these abilities. The results also indicate that except for the academic domain among adults, the reasoning among other domains indicate that participants believe that those abilities are not inherited and that environmental influences from their adoptive parents are greater than genetic influences. This result argues more for the incremental view of intelligence rather than the entity view of intelligence.

These results confirm the hypotheses that preschoolers will make more of an environmental attribution in these domains. This result argues more for the incremental view of intelligence rather than the entity view of intelligence.

It is important to stress that we did not ask about the possibility of improvement in these abilities but just asked if they would perform like their biological parents or adoptive parents on these tasks. It is also important to clarify that we are equating adoptive parent ability matches to environmental versus genetic influences. Freedman-Doan et al. (2000) examined how first, second and fourth graders ability to think that they would improve and found that by fourth grade, children were doubting that they could actually become best at their worst activity. However, we do not know how preschoolers would reason when asked about the possibility of improvement. Freedman-Doan et al. (2000) found that half of the children in their sample responded that they could be best at their worst current activity. These results extend Stipek and Gralinski's (1996) findings that children's beliefs about the stability of intelligence were not activity specific across the academic subjects of math and social studies. However, Freedman-Doan et al. (2000) also found that older children were less optimistic than younger children about the possibility of improving in athletic activities like sports.

The findings of this study have several implications. First, if children think their abilities can change determines their motivation to either try harder or not this will have a direct impact on their education. With help from their teachers children who hold this view should improve in their academic abilities. Second, parents can devise appropriate strategies for children to improve their abilities and skills through effort and strategies.

There are a few limitations to this study. First, the testing technique was switched from in person testing to online testing due to the Coronavirus pandemic. This could have had an impact on the results although strict testing protocols were established for the online testing to make sure that the children were minimally impacted by the online testing. Second, the participant numbers could have been bigger for each of the samples.

Future research should focus on conducting this study cross-culturally to determine if there is a difference in reasoning between cultures that emphasize improvement through effort versus intrinsic ability. Lindberg, Hyde, Petersen and Lynn (2010) used meta analyses to analyze gender differences for math performance in adolescents. Overall they found no gender differences suggesting that males and females perform similarly in mathematics. However, it will also be interesting to assess gender differences to determine if girls are more likely than boys to entertain that certain abilities like math and science in this younger population (where they typically lose interest as they get closer to middle school) are determined by genetics as they get older.

Overall this study has demonstrated that preschoolers reason in a similar manner to adults when assessing the role of genetics and the environment on performance. Given that other studies have demonstrated that fourth graders show a decline in their belief of how the environment influences performance, we might be seeing a U-shaped curve with an increase of environmental influence in the preschool years and adult years but a decline in the elementary school years.

Acknowledgments

Many thanks to the children and parents of the Lowry Early Childhood Center for letting us test at their facility. Great appreciation to the children and parents who signed up for the online study.

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