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Online intervention program to change implicit theories about intelligence, achievement goals and self-efficacy

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Abstract

Hidden perceptions about intelligence have been found to be associated with different aspects of one's behavior and personality and therefore has been the focal subject of many researchers over the last years (Burnette et al., 2019; Yeager, Dweck & Trzesniewski, 2013; Yeager, Hanselman, Walton, Murray, Crosnoe, Muller, & Paunesku, 2019). These perceptions range between intelligence as a fixed entity that is innate and permanent, and intelligence as a malleable quality that is variable and developed throughout life (Dweck & Leggett, 1988). The perception of intelligence as a malleable quality has been found to be more adaptive and related to the investment of higher effort and of coping better with failures (Dweck & Leggett, 1988). Hence it is indirectly associated with high achievements mediated by the effort invested (Dweck,1999; Dweck, 2006; Yeager et al., 2019).

Previous studies (Blackwell, Trzesniewski & Dweck, 2007; Paunesku, Walton, Romero, Smith, Yeager & Dweck, 2015) have shown that through a short-term intervention program, a student's perception of intelligence can be transformed from a fixed to a malleable. Most of these studies presented models of intervention programs that required a lot of time and resources such as classrooms, teacher training, and more. **This study presents a model of a shorter online intervention that enables the participant the autonomy to decide where and when to execute the intervention program. The model allows the transfer of the program to large, diverse populations at low cost and without the need for additional physical resources. Also, this study investigates the relationship between hidden intelligence perceptions and the student's self-efficacy and achievement goals.**

Self-efficacy is defined as the subjective perception of an individual pertaining to perform a given task that may affect events that have an impact on his life (Bandura, 1997). Four key factors have been found to derive self-efficacy: performance accomplishments (Bandura, 1977), vicarious experiences (Schunk, 1989; Schunk & Usher, 2019), verbal persuasion (Schunk, 2001), and physiological states (Schunk & DiBenedetto, 2020). In this study, we

examined whether conducting an online learning task on brain elasticity could match the characteristics of verbal persuasion and thus raise a student's self-efficacy, as well as whether self-efficacy is associated with hidden perceptions of intelligence and achievement of goals.

According to the achievement of goals theory, motivation is defined by the goal the individual strives to achieve when accomplishing a task in a challenging environment (e.g., studies and sports activities) (Ames, 1992; Elliot, 2005). In the learning environment, it is customary to address three major achievement goals:

Mastery goal: The individual strives to acquire knowledge or skill and improve himself.

Performance approach goal: The individual strives to gain a positive evaluation of his or her abilities by others.

Performance avoidance goal: The individual strives to perform the task no worse than others and to avoid negative evaluation (See: Elliot, 2005).

Previous studies have found an association between a person's achievement goal to his or her self-efficacy and hidden intelligence perceptions (Cho et al., 2019; Dweck, 2006; Dweck & Legget, 1988). This study examines whether the student's achievement goal can be affected by changes in his hidden intelligence perceptions and self-efficacy. In light of the findings of previous research, the following **research hypotheses** were tested:

1. An association between hidden intelligence perceptions and performance of the given task: students that accomplish the task successfully will tend to perceive intelligence as a more malleable quality compared to students who do not accomplish the task. This perception will be maintained over time.

2. An association between self-efficacy and performance of the given task: Students who do the learning task will report an increase in self-efficacy versus students who do not. This increase will be maintained over time.
3. An association between the perception of intelligence and the type of achievement goals:
    a. A positive correlation between the perception of intelligence as a malleable quality and the mastery goal achievement, and, accordingly, a negative correlation will be found between the perception of intelligence as a malleable quality and the avoidance performance goal.
    b. A positive correlation between the perception of intelligence as a fixed entity and the avoidance performance goal, and accordingly, a negative relationship will be found between the perception of intelligence as a permanent entity and a mastery goal of achievement.
4. An association between the type of achievement goals and self-efficacy:
    a. A positive correlation between mastery goal achievement and self-efficacy. The more the student will tend to mastery goal achievement his or her self-efficacy will be higher.
    b. There will be a negative correlation between the tendency to avoidance performance goal achievement and self-efficacy. The more the student will tend to avoidance performance goal achievement his or her self-efficacy will be lower.

To examine these hypotheses, the study built a length research array in which 165 high school pupils participated (48% of the 11th graders, 52% of the 12th graders) from around the country. Of all participants, 95 students were chosen randomly as the trial group and carried out the online task. The others were assigned to the control group. This study used repeated measurements at three-time points. After the first measurement, the trial group carried out the

task, and after the second measurement the control group carried out the task. All participants were measured using the same questionnaires at identical three-time points.

This study used as a base a few questionnaires that were validated in previous studies. The questionnaires included these indices: Academic Self Efficacy (PALS; Midgley et al., 2000), Hidden Intelligence Perceptions (Dweck et al., 2015), and Achievements Goals (PALS; Midgley et al., 2000). A personal information questionnaire was also provided in which students were asked to indicate gender, grades as well as several representative indices for statistical control. In addition to the questionnaires for this study, online learning software was built based on the 2007 Blackwell, Tresnews, and Dwak studies (Blackwell, Trzesniewski, & Dweck, 2007). This task was built in accordance with the population of the State of Israel through various learning videos and writing assignments, and emphasis was placed on the software visibility and learning experience.

From the **results of the study**, which were analyzed using hierarchical-linear model analysis (HLM; Raudenbush & Bryk, 2002), it can be learned that the learning software created a long-lasting change in the perception of intelligence. It was found that among the participants who carried out the learning task, there was a significant increase in the perception of intelligence as a malleable quality, whereas, in the group that did not perform this learning task, this index was maintained ($\beta = 0.69$, $p < .001$). Accordingly, there was a significant interaction between the groups and the change in perception of intelligence as a fixed entity ($\beta = -0.61$, $p < 0.001$). Among the participants who carried out the task, there was a significant decline in their perception of intelligence as a permanent entity, while for the participants who did not do the task, no significant change was found. There was also found to be an increase in self-efficacy following the task, but this change was not preserved over time.

In examining the general model analyzed using the Pearson correlation coefficient, a statistically significant positive correlation was found between Self-efficacy and intelligence perception as a malleable quality in the first measurement, but no prediction was found over time. No statistically significant relationship was found between the type of Achievement goals and the perception of intelligence. A statistically significant positive correlation was found between goal achievement and Self-efficacy in all measurements. From these results, one can conclude that there is partial support for the notion that self-efficacy predicted achievement goals even though the general model did not fit the data. This may be due to the relatively high stability of self-ability and achievement goals.

In conclusion, it can be learned from the results of the study that the intervention program did indeed help with perceptions of intelligence, but not through the mediation of self-efficacy and achievement goals. The limitations of the study and its unique characteristics should be considered, for example, the study period, the maturity period, a period characterized by dealing with educational and personal challenges, as well as its focus on concepts related to academic study and the use of quantitative tools only. It is recommended to continue researching the topic by monitoring relevant background variables, examining self-efficacy in other areas, understanding the relationship between perceptions and actual achievement as well as integrated research tools.

Despite the limitations of the study, it can be concluded that the intervention program to change the perceptions of intelligence can be converted to an online program, thus enabling its use for a broad population that will benefit from its adaptive benefits. In addition, from this study, we can learn about the complex model of the variables that influence students in building self-efficacy and personal perceptions of learning.