The Effect of Attribution Retraining on the Academic Achievement of High School Students in Mathematics

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Abstract

This research explored the effect of attribution retraining on high school students’ academic performance in mathematics. The purpose of the study was to modify students’ attributions regarding their achievement in mathematics and to teach them adaptive styles of attributions. Sixty-seven students from grades 10 and 11 conducted the Attribution Questionnaire as a pre-test. Twenty-two students were chosen for the experimental group based on their low score on the questionnaire. The control group which had been selected from the other 45 students was formed by matching their results in mathematics with that of the experimental group. Both the experimental and control groups were equal in number (n=22). The study used a pretest-posttest control group design with matching. Although, random assignment of subjects to experimental and control groups was not performed, the research design is a form of quasi-experimental one. The results demonstrated the positive effect of attribution retraining on students’ academic achievement in mathematics and their attribution styles. In adopting adaptive attributions, students in the experimental group were able to view their success as a result of effort and ability rather than luck and task difficulty. It is recommended that the training applied in this research be implemented in developmental guidance programs.

Keywords: Math achievement, motivation, attribution theory, attribution retraining, goal orientation, intelligence, study habits.

1. Introduction

1.1 Attribution and academic achievement

Students, when given a learning task, refer to several resources to determine how they study the task, how they estimate their success, how much effort and time will they invest on the task. The result of this evaluation process
relies on students’ cognitions and motivational beliefs (Seegers, Van Putten & Vermeer, 2004). Attribution theory explains how students interpret their achievements. According to Weiner (1974, 1986), a child may attribute test results to several factors, including ability or effort, assistance from the teacher, and the difficulty level of the test. Furthermore, prior research indicates that different attribution patterns have been identified for successful and unsuccessful students (Kivilu & Rogers, 1998; McMillan & Forsyth, 1981). These attributions differ from one another in three primary ways: locus, stability, and controllability (Weiner, 2000). A major study conducted by Eccles, Meece, Adler, and Kazcza (1982) used a range of eight likely reasons for success and failure in mathematics. The sample which comprised of adolescents from 11 to 16 years ranked the relative importance of reasons. Short and long term effort, ability, and teacher’s help were the most important reasons for success. Lack of effort and ability, and task difficulty were the most important reasons for failure. In principal, these reasons highlighted the basis of students’ attributional style for academic success and failure. Hence, attributional style is a cognitive and personality variable that reflects the manner in which individuals explain the causes for the successes and failures in their lives (Peterson & Seligman, 1984). Several researchers who have studied academic achievement have reported that one of the most successful predictors of academic achievement has been attributional style (Kloosterman, 1984). Although these studies focused on the dimensions of optimism and pessimism in relation to attributional style, they provide a framework for understanding the relationship between attributions and academic performance. Studies by Wilson and Linville (1982, 1985) were based on the reasoning that, in the first year of college, students might experience a series of academic setbacks common to the transition from one level of schooling to another, such as more challenging courses and a new social environment. The way in which students explain these academic setbacks is considered crucial. Students who blame their academic difficulties on internal, stable factors are likely to experience anxiety, put forth little effort, and thus have difficulty in learning new material. Dweck (1975) indicated that encouraging students to attribute their poor performance to unstable causes resulted in both improved effort and performance. She reasoned that students who view their intelligence as a stable trait react to failure very differently from students who view their intelligence as unstable. Therefore, students’ understanding of their attributional styles may help them improve their academic performance (Metallidou & Vlachou, 2007). This process can be done through attribution retraining programs. These programs attempt to enhance motivation by altering students’ attributions for successes and failures (Schunk, 2003).

### 1.2 Attribution Retraining

Attribution retraining is an intervention technique based largely on two related ideas (Weiner, 1986; 1988). First, maladaptive attributions for performance made by students make them disposed to helplessness and failure. Second, these maladaptive patterns can be modified. The intervention involves a theoretically based educational program designed to replace negative maladaptive causal explanations for success and failure with more adaptive ones: effort and ability attributions are emphasized in the case of success, while effort is stressed in the case of failure. Robertson (2000), in reviewing and assessing the effectiveness of twenty attribution training programs, concluded the following:

- Attribution retraining must ensure that students have the ability to succeed at a given task before using attributions for effort.
- Combining attribution retraining with strategy instruction seems useful when students do not understand the causal connections between the study strategy and success and failure.
- The more direct approaches have advantages over the indirect ones in attribution training.
- Large group attribution retraining may be inappropriate.
- Attribution training is productive only for those with maladaptive attributional styles.

Hence, a central objective of attribution retraining should be to provide students with realistic knowledge of their own abilities, thereby altering, in a positive fashion, their self-related cognitive concepts and performance behaviors (Ziegler & Heller, 2010). In summary, the main purpose of the present study was to examine how attributions affect students’ academic achievement in mathematics in 10th and 11th grades in a private school in Lebanon. It was
hypothesized that attribution retraining would improve the attributional style of students, and as a consequence, it would lead to an increase in students’ achievement in mathematics.

2. Methodology

2.1 Design and Participants

The participants in the study consisted of 67 students in 10th and 11th grades chosen from a private school in Mount Lebanon. The sample included 25 males aged between 15 and 16 years (M = 15.9, SD = .29), and 19 females aged between 15 and 16 years (M = 15.8, SD = .34). Students of the target school came from middle to relatively high socioeconomic status. The participants were varied in mathematical achievement (M = 72.86, SD = 14.12). The study used a pretest-posttest control group design with matching. Participants were not randomly assigned to experimental and control conditions. Instead, participants in the experimental group (N = 22) were chosen based on their maladaptive attributional style, which was determined by an attribution scale administered to all 67 students at the beginning of the third term (i.e., students with the lowest 33% of the scores). The control group was formed by selecting an equal number of students (N = 22) matched on math achievement using scores on the second monthly exam of the first term. Informed consent was obtained from parents and participation in the intervention was voluntary. None of students in the experimental group withdrew from the intervention.

2.2 Measures

Attributional style was assessed using a questionnaire constructed by the researcher. The researcher relied on an interactive multimedia program called “Just Think It!” in writing the Attribution Questionnaire. The program was designed by Amy Tompkins-Bjorkman and John J. Horan to enhance academic achievement motivation via attribution retraining. “Just Think It!” was administered with classroom-delivered study-skills training (Horan, Hackett, Kovalski, Tompkins-Bjorkman, & Clark, 2000). The purpose of the program was to enhance motivation through attribution retraining. The ultimate goal was to replace “maladaptive causal attributions” with “functional attributions” (Horan, Hackett, Kovalski, Tompkins-Bjorkman & Clark, 2000). The questionnaire was administered to the whole sample (N = 67) as a screening test and to the experimental group as a pre-test and post-test. Each option in each question was assigned a numerical value depending on the nature of the question so that higher scores indicated more favored style attributing success to ability and effort and attributing failure to effort and learning strategies. Students with low scores on the pre-test were chosen to take part in the intervention. The questions were classified into effort/ability, internal/external, and motivation orientation types based on how students explained their successes and/or failures. The questionnaire was piloted on twenty-five students who did not belong to the control or experimental groups. No changes on the questions were made after piloting. The observed test retest reliability coefficient was .75 and Cronbach’s alpha for the whole sample was also .75, indicating a relatively acceptable reliability for research purposes. Five measures of math achievement were used in this study. First, the scores of the second monthly exam of the first term (score 2) were used as matching scores to select participants in the control group. Second, participants in the experimental condition were given one math test before (math pretest) and another math test after (math posttest) the intervention. Third, the scores of the first term (score 1), obtained before implementing the attribution training program, were used as a pretest to be compared with the scores of the third term (score 3) obtained one month after the closure of the training program in order to evaluate the long term effects of the intervention.

2.3 Procedure

Most of the attribution retraining programs described in literature divided the intervention into three phases (Heller, 2010). First, a target behavior such as low interest, low motivation, poor achievement, or helplessness in which failure was likely to be attributed to internal and stable causes is identified. In the second phase, students are trained to make more favorable attributions, e.g. to attribute failure to a lack of effort over which the student had control. Third, the efficiency of the training is evaluated by a post-test. In the current study, the three phases were closely identified. In phase one of this study, the attribution scale was administered to 10th and 11th grades students in order to identify students’ attribution style (attribution pretest). Based on the test scores, 22 students with
Maladaptive attributions were assigned to the experimental group to take part in the intervention. The researcher met with three cooperating mathematics teachers twice. In the first session, the teachers were briefly introduced to the research problem and objectives of the study. Then, a presentation about attribution styles and motivation orientation was conducted. The teachers were trained to use direct attributional feedback from a list of statements based on Weiner’s classification. Besides, the teachers received an explanation of how gender specific attributional styles in mathematics occur and how motivation can be affected by attributional styles. In the second session, the teachers were introduced to the mathematics log which helped students monitor their understanding and allowed teachers to provide written attributions related to performance. The teachers were urged to apply both verbal and written attributions to be drawn from a list of positive attributional comments provided by the researcher and intended to direct students’ attributions towards a more positive and adaptive direction in terms of motivation. In phase two, the intervention was carried out over four weeks. Only students enrolled in the program were given the mathematics log which they had to fill out at home after each mathematics period. The mathematics teachers were asked to provide the students with a constructive feedback every lesson during the period of the intervention. In phase three, the researcher administered the attribution scale one more time as a posttest to be compared with the attribution pretest scores of the experimental group. In addition, students in the experimental condition took another mathematics test which covered the last chapter they studied (math posttest). Finally, scores of the final exam of the third term (score 3) were collected in addition to the scores of the final exam of the first term (score 1).

2.4 Data analysis

Data entry and analysis were performed using the Statistical Package for Social Sciences (IBM SPSS, version 20). Cronbach’s alpha and test retest reliability coefficients were calculated to assess the reliability of the attribution scale. Nonparametric tests were used to compare independent and related samples. The Mann-Whitney test was used to compare the control and experimental groups on math achievement before the implementation of the training program. The Wilcoxon test was used to compare attributional style before and after the intervention and to compare math pretest and math posttest in the experimental group. In addition, the Wilcoxon test was used to compare the scores of the first term (score 1), obtained before implementing the attribution training program, with the scores of the third term (score 3) obtained one month after the termination of the training program in order to evaluate the long term effects of the intervention. In all analyses, an alpha level of .05 was used for statistical significance.

3. Results

3.1 Effects of attribution retraining on attributional style

In support of our first hypothesis, The Wilcoxon signed ranks test indicated significant differences between pretest and posttest attribution scores in the experimental group ($Z = 3.71, p \leq .05, r = Z/\sqrt{n} = .79$). Scores on the post attribution test ($Mdn_{post} = 61, range = 14$) were much higher than scores on the pre attribution test ($Mdn_{pre} = 55, range = 18$). Furthermore, changes in various dimensions of the attributional style were explored. Results showed significant improvement in six attributional dimensions ($Z < .05$) and lack of any change in three other dimensions. It seems that attribution training made students more likely to attribute their failure to effort ($Mdn_{pre} = 2, Mdn_{post} = 3, range = 2$) and to internal causes ($Mdn_{pre} = 8, Mdn_{post} = 10, range = 6 and 8$ respectively) and less likely to attribute failure to ability ($Mdn_{pre} = 3.5, Mdn_{post} = 5, range = 3 and 4$ respectively). Meanwhile, students become more likely to attribute their success to internal causes ($Mdn_{pre} = 9, Mdn_{post} = 10, range = 5$) and less likely to attribute their success to external causes ($Mdn_{pre} = 4, Mdn_{post} = 5.5, range = 3$). Students also became more likely to adapt a learning orientation to task engagement ($Mdn_{pre} = 14, Mdn_{post} = 15.5, range = 6$ and 5 respectively) focused on making progress and learning from mistakes. However, the attribution retraining program did not seem to make any improvement in attributing success to effort or to ability and in not attributing failure to external causes.
3.2 Effects of attribution retraining on math achievement

Results of a baseline comparison of the experimental group and matched control group confirmed the equivalence of the two groups on math achievement prior to the implementation of the training program. A Mann-Whitney test indicated that the scores of the first term (Score 1), obtained before implementing the attribution training program, were not significantly different for the experimental group ($Mdn = 70$) and matched control group ($Mdn = 68$), $U = 229, p = .760$. However, a Wilcoxon signed-ranks test indicated that math posttest scores ($Mdn = 80$, range = 49) were significantly higher than math pretest scores ($Mdn = 73$, range = 80), $Z = 3.069, p = .002$ for the experimental group. Furthermore, the Wilcoxon test also showed the scores of the experimental group in the third term (Score 3, $Mdn = 77$, range = 56) were significantly higher than the scores of the first term (Score 1, $Mdn = 68$, range = 53), $Z = 2.921, p = .003, r = .488$. Furthermore, this long term benefit for the experimental group was not matched by any equivalent benefit by the control group. Indeed, the Wilcoxon test indicated that students in the control group maintained the same median and range from Score 1 to Score 3. These results provide further support to the positive long term effects of the attribution retraining program.

4. Discussion

The goal of this study was to investigate whether an attribution retraining program could help students adopt more functional attributions and achieve better results in mathematics. The results obtained from the experimental group demonstrated positive treatment effects. The retraining produced an improvement in attributional style and mathematics achievement. These results are consistent with findings of other studies showing that attributional thinking is related to achievement settings (Weiner, 1974, 1985, 1986, 1992, 2000). Weiner’s studies showed that the four most frequent reasons for success or failure are ability, effort, task difficulty, and luck. When students were confronted with actual learning tasks, they draw on a number of resources to determine how they adapt to the task. In interpreting students’ causal attributions before and after the training, Weiner et al. (1971) specified that ascriptions of failure to stable and uncontrollable causes (e.g. lack of ability or task difficulty) decrease subsequent expectancies of success, whereas attributions of failure to internal causes (lack of ability or effort) maximize negative esteem and related affects following the outcome. The treatment effects appeared after a delay as well. Students in the experimental group were able to exhibit improved scores on the last grading period. These grades were scored one month after the intervention. Therefore, the treatment group was able to display advantages in the mathematics achievement test immediately following the treatment as demonstrated in Score 2 results (pre-test after the intervention) and long term benefits in the final exam. This could possibly signal that the members of the treatment group had to develop the appropriate learning skills before they could take advantage of the belief, learned in the retraining, that effort will lead to success (Ziegler & Heller, 2010). A main strength of this study is related to the training program and its implementation. The training focused on feedback techniques in which the results of actions were commented on in a style that reflected the desired attribution. In verbal attribution retraining programs, an individual’s actions are responded to with an oral commentary that should suggest motivationally beneficial attributions (Forsterling, 1985; Dweck, 1975; Craven, Marsh, & Debus, 1991). A further commentary technique suggested in the attribution retraining by Heller and Ziegler (1997) was the written attribution retraining. Teachers were instructed to write on every exam an explanation of the students’ performances for a period of time. Before choosing the appropriate attribution, the teachers were to put themselves in the students’ position and determine (for each particular student) whether their attributions represented a success, an average effort, or a failure (Jussim, Eccles, & Madon, 1996). Other studies (Ordonez, 2008; Bandura, 1977, 1981) suggest the application of modeling technique to help students adopt more functional attributions. A model verbalizes or makes clear the desired attributions in front of the person whose attributional style should be changed. This technique could also be used to secure the necessary degree of individual attention required by the training (Orbach, Singer, & Murphey, 1997). Some methodological limitations in this study are the following: the sample was drawn from a private upper middle class and upper class high school which could limit generalization of results; the relatively short duration of retraining; and the use of the researcher as the trainer. Moreover, further research would need to explore the effect of attribution retraining on other subject matter areas (Bornholt & Moller, 2003). There is also a need to explore the transfer of the skills taught in the training to real world situations through integrating them in a guidance and counseling curriculum. It is also essential to draw attention to two matters related to the planning of such an intervention. First, the training can be more effective with relatively younger children. The prospects of success are
more favorable for developmental measures than for preventive, as the former aim to modify self-concept already established and teach ways on how to change negative attributions (Awan, Noureen, & Naz, 2011). Second, some techniques require a certain level of development. One of the prerequisites for attribution retraining seems to be that students have differentiated concepts of ability, effort, and task difficulty (Kayser & Lamm, 1982; Kelley, 1972; Nicholls & Miller, 1984). The results of the study showed that attribution retraining based on Dweck (1985) and Weiner’s (2010) theories had an effect on students’ academic achievement in mathematics. Consequently, the training could be adopted in group counseling where the student could become a self-regulated learner who could explore causes of success and failure and assess his/her performance (Schunk, 1994; Zimmerman, 1998). Training teachers to use positive attributions and promote mastery learning would help students enhance their self-efficacy. Based on research, students in that case would define their success in terms of improvement and hard work. They would accept challenge and apply appropriate strategies in learning (Heller, Finsterwald, & Ziegler, 2010; Jungert & Gustafson, 2009; Jussim, Eccles, & Madon, 1996). This attribution retraining program is recommended to be taught during advisory or group counseling sessions to students who have negative attributions, low self-concept and self-efficacy. However, students with negative attributions and with low academic performance can benefit best from such a program (Eccles et al., 1989; Forsterling, 1985; James, 1997; Miserandino, 1998). Research on attribution retraining may be fruitful area for study. If retraining could change attributions to more adaptive patterns, teachers might see improved performance in emotional, social, and cognitive development as well as performance in any subject matter.

References


