

A Study of Causal Attributions for Success and Failure in Mathematics among Brazilian Students

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Abstract

As causal attributions for school success and failure are central constructs for achievement motivation, an investigation of causal attributions for success and failure in a mathematics exam was carried out among 110 public school Brazilian students. Participants were from both sexes and low SES, and ranged in age from eight to 16 years old. Subjects were interviewed individually and their causal attributions were assessed through 14 yes or no paired items related to a math exam situation. Data revealed that effort and lack of effort were the most important attributions for success and failure. Significant differences emerged between causal attributions and predictor variables. Findings are discussed in terms of their contribution for understanding the role school context plays in enhancing students' motivation.

Keywords: Causal attributions for success and failure; mathematics exam; school achievement.

Um Estudo sobre as Atribuições de Causalidade Relativas ao Sucesso e ao Fracasso Escolar em Matemática entre Estudantes Brasileiros

Resumo

Como as atribuições de causalidade para sucesso e fracasso escolar são constructos centrais para a motivação acadêmica, foi realizado um estudo sobre atribuições de causalidade para sucesso e fracasso escolar entre 110 alunos brasileiros. Os participantes eram de ambos os sexos, nível sócio-econômico desfavorecido e de idade variando entre oito e 16 anos. Os sujeitos foram entrevistados individualmente. As atribuições de causalidade foram medidas por meio de 14 itens de escolha forçada relacionados a um exame de matemática. O esforço e a falta de esforço foram as atribuições mais importantes. Diferenças significativas entre as atribuições de causalidade e as variáveis demográficas foram encontradas. Os dados são discutidos em termos do importante papel da escola na promoção da motivação para a aprendizagem adequada, no aluno.

Palavras-chave: Atribuições de Causalidade para Sucesso e Fracasso; Exame de Matemática; Rendimento Escolar.

Attributing causes to events that usually happen in the environment has been considered as an human tendency. People not only use to think about facts that occur in their lives, but also try to explain them searching for their causes. Heider (1944) was the first to conduct studies aimed at understanding the way individuals look for links between causes and effects of events in their lives. His pioneer work had demonstrated that comprehending how people attribute causes is very useful information for predicting and modifying future behavior.

Weiner (1979, 1985) in subsequent studies emphasized the relationship between individuals' causal attributions for success and failure and their achievement behavior in academic domain. As suggested by Weiner (1985), the attribution theory links the process of

thinking, feeling and action. Individuals generally point out ability, effort, task difficulty and luck as possible causes for their success and failure experiences in academic settings. Other causes such as mood, feeling tired, teacher's influence and other people's influence were also found, but to a much lesser extent.

Causality within the attribution theory is conceptualized as having three dimensions: locus, stability and controllability. In respect to its locus, a cause can be considered as external or internal (factors that are inside or outside the individual). Regarding its controllability, an event can be caused by a factor which is or is not under the individuals' control. In terms of its stability, a cause can be permanent or subject to change. Intelligence is frequently seen as internal, stable, and uncontrollable. Effort is considered as internal, unstable and controllable. Task difficulty and luck are taken as external, unstable and uncontrollable (Weiner, 1985). In fact, according to Weiner, a cause itself is less important to determine an achievement behavior than its dimensions. The stability is

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the most important dimension influencing future expectations. If individuals perceive the cause of an outcome to be stable, it will increase the likelihood that the same event will be expected in the future.

The cognitive theories of achievement motivation in academic domain differ from the more mechanistic approaches in the importance given to internal beliefs such as thoughts, causal attributions, and feelings in the learning process. Such cognitive theories assume that behavior is determined by students' beliefs. Indeed, beliefs are mediators of behavior. According to Tapia and Garcia-Celay (in Coll, Palacios, & Marchesi, 1996), causal attributions for success and failure are central constructs in a general theory of motivation. In fact, attributions exert an impact on students' motivation to learn, emotions and future expectations for success and failure (Weiner, 1985). In addition, Weiner (1993) advocates that causal attributions and issues regarding individuals' control and perceived responsibility of events that occur in their or others' lives are central constructs influencing individuals' social relationships generating different sorts of social reactions, as well.

No doubts exist that Brazil faces very serious problems of school underachievement and school drop out (Patto, 1993). Many were the investigations carried out to shed light onto the causes of these problems (Collares & Moyses, 1995; Leite, 1988; Mello, 1993). Overall, such studies have assumed that learning difficulties are caused by physical, genetic, cognitive and psychological and socio-economic characteristics of the students. This bulk of research shared in common a blame the victim's interpretation of students' underachievement and school drop out. Though the traditional explanations for underachievement and school drop out had advocated that students do not learn because of certain characteristics they have, there is some evidence that pupils who fail in school are not unable to learn and do very well in real life situations (Carragher, Carragher, & Schliemann, 1989). It is clear that the attribution theory is a very useful theoretical framework to uncover how students, an essential part of the complex equation of underachievement, experience their success and failures in school (Stipek, 1988; Weiner, 1979, 1985). In addition, research has shown that dysfunctional causal attributions can be modified by retraining programs. Such interventions can be successful not only in increasing subjects' motivation to learn and persistence, but also in helping students' to develop an awareness that certain events can be altered (Perry, Hechter, Menec, & Weinberg, 1993; Schunk & Cox, 1986). The majority of the studies investigating causal attributions for success and failure in

achievement-related contexts were based on samples of children from developed countries. Indeed, in Brazil, few were the attempts to understand learning difficulties and underachievement taking into account the students' view (Boruchovitch, 1999; Boruchovitch & Martini, 1997; Mattos et al., 1992; Neves & Almeida, 1996). Furthermore, investigations with children have been predominantly based on adults' patterns of attributions. Evidence suggested that children do not attribute and interpret causes in the same way adults do (Boruchovitch, 2000; Piccinini, 1989, 1990; Weinert & Schneider, 1993). The problems of applying adults' data in studies with children coupled with the slim cross-cultural research in this area have guided the purpose of the present investigation. In line with that, causal attributions for success and failure in mathematics were investigated among 110 Brazilian students.

Method

Selection of the School

Initially a contact with the Campinas Municipal Prefecture was made in order to obtain information regarding which public schools face serious problems of students' underachievement and drop out. One school presenting the aforementioned problems was selected from a list of all public schools to be part of this study. School selection was made taking into account suggestions of the chair of the research and planning division of the Prefecture. The selected school serves students from low SES background. Contact with the principal of this school was made to both explain the objectives of the research and confirm the willingness to participate in the research. After the school agreed on participating, a list of all classrooms of third, fifth and seventh grades was obtained.

Participants

The sample was composed of 110 Brazilian students of a public school of Campinas, São Paulo, Brazil. Subjects were from both sexes, from third, fifth and seventh grades, from low socio-economic background and ranged in age from eight to 16 years old. More precisely, 25.5% of the sample was 8 to 10 years old (group 1), 45.5% between 10 and 13 (group 2), and 29.1%, 14 or more years old (group 3). Of the total sample, 68.1% have repeated at least one school grade level.

Data Collection Procedures

Subjects were randomly selected through a draw from 19 classes of third, fifth, and seventh grade of the school. An equal division between gender was also attempted. Data

regarding subjects' history of school promotion and retention also obtained from both school files and the students themselves.

Subjects were interviewed individually by the author. Their causal attributions were assessed through 14 yes or no paired items (seven for success and seven for failure). Items were related to a math exam situation. An example of a question would be: "There are several reasons why a student gets a high or a low grade. I would like you to think about how you are doing in mathematics. How are you doing? When you get a very high grade in math do you think it happened because: a) the exam was very easy, b) you are good at math (intelligent in math), c) you are lucky, d) the teacher taught the content very well, e) you studied very hard (effort), f) you were calm and, g) the teacher likes you. The aforementioned options were based on the literature of the area for this age group (Piccinini, 1989, 1990; Weinert & Schneider, 1993). Subjects were also asked whether they believe any other reason not mentioned by the researcher could have contributed to the outcome. When this was the case, the researcher wrote down verbatim the participants' additional answers. Subjects were allowed to select as many attributions as they believed that could have contributed to the outcome. Then, participants were asked to select the attribution that best explained their success and failure. Questions and this whole procedure were pre-tested by a pilot study conducted in a sample of 12 students (four from each of the school grade level involved in this study). Questions were revised and refined based on the information provided by the pilot study. Students who took part in the pilot study were excluded from the sample.

The researcher established a good rapport with the subjects. Participants were told that they were randomly selected to take part in a research aiming at understanding more about the way they learn and their attitudes towards school. Subjects were assured of complete confidentiality and were free not to participate. It was also made clear to the participants that the information collected would be used only for research purposes.

Results

Data obtained in the present study was quantitatively analyzed by means of both descriptive and inferential non parametric statistical procedures. First, the frequencies of causal attributions responses were calculated. Then, Chi-square analyses were computed.

Tables 1 and 2 display the results of the total sample's causal attributions for success and failure in a mathematics

exam, respectively. Effort (96,4%), having a good teacher (96,4%) and task easy (85,5%) were the attributions most frequently selected by subjects for success in the math exam. Lack of effort (85,5%), task difficulty (79,1%), and being nervous (60,9%) were the attributions most indicated by participants to explain failing the math exam. Pay attention and Not Pay Attention were the only categories

Table 1
Yes-No Percentages of Total Sample's Causal Attributions for Success in a Math Exam (N=110)

Attributions	Yes	No
Being Calm	80,9	19,1
Effort	96,4	3,6
Task Easy	85,5	14,5
Pay Attention	7,5	90,0
Teacher Likes	20,9	79,1
Good Teacher	96,4	3,6
Luck	61,8	38,2
Intelligence	64,5	35,5

Table 2
Yes-No Percentages of the Total Sample's Causal Attributions for Failure in a Math Exam (N=110)

Attributions	Yes	No
Being Nervous	60,9	39,1
Lack Effort	79,1	14,5
Task Difficulty	85,5	20,9
N Attention	16,4	83,6
Teacher Dislikes	5,4	95,4
Bad Teacher	25,5	74,5
Lack Luck	50,0	50,0
Lack Intellig	28,2	71,8

Table 3
Yes-No Percentages of Total Sample's Selection of the Most Important Attribution for Success in a Math Exam (N=110)

Attributions	Yes	No
Effort	50,0	50,0
Good Teacher	21,8	78,2
Task easy	11,8	88,2
Intelligence	7,3	92,7
Luck	5,5	95,5
Being calm	2,7	97,3
Teacher Likes	0,9	99,1
Pay Attention	0,9	99,1

Table 4
Yes-No Percentages of the Total Sample's Selection of the Most important Attribution for Failure in a Math Exam (N=110)

Attributions	Yes	No
Lack of Effort	59.1	40.9
Being Nervous	15.5	84.5
Task Difficulty	14.5	85.5
Lack of Luck	5.5	94.5
Lack of Intelligence	2.7	97.3
Bad Teacher	1.8	98.2
N.Attention	0.9	99.1

which emerged in participants' answers to the question "any other reason could have explained the outcome?" When asked to select the attributions which most contributed to the outcomes, students pointed out mainly effort (50,0%) and lack of effort (59,1%) to explain their experiences of both success and failure. Having a good teacher (21,8%) for success and being nervous (15,5%) for failure were the second most important attributions for subjects (Tables 3 and 4, respectively).

Causal Attributions for Success and Subjects' Characteristics

Individual Chi-Square Analyses were carried out between causal attributions for success and age, school grade level, gender and students' repetition of a school grade level. Table 5 displays the percentages of children in

each group endorsing each attribution. Effort was a very important attribution to explain success regardless of age, gender, school grade level and repetition of a school grade level. Being calm was significantly more ascribed to explain success by third and fifth graders than was by seventh graders ($\chi(2)=7,73$)

Females participants, subjects who were younger and who had not repeated any school grade level explained their success in math significantly more in terms of intelligence than did subjects who were males, older and had repeated a school grade level. *Chi-square* values are for age $\chi(2) = 6,63$, for repetition of a school grade level $\chi(1) = 6,50$, and for gender, $\chi(1) = 4,93$.

Explaining success in a math in terms of being calm, being liked by the teacher and luck decreased significantly with advancement in school. Values of $\chi(2, N=110)$ are: for being calm = 7,37, for being liked by the teacher = 10,23, and for luck = 8,90. Luck was also far more selected by subjects who repeated a school grade level than was by participants who had not repeated. However, such a finding only approximated significance.

Causal Attribution for Failure and Subjects' Characteristics

Data in Table 6 shows the subjects' causal attribution (expressed in percentages) in relation to age, grade level, SES and gender. Explaining failure in a math exam in terms of lack of effort increased significantly with participants' age ($\chi(2)=6,65$) and advancement in school ($\chi(2)=7,37$).

Table 5
Causal Attributions for Success in a Math Exam and Subjects' Characteristics (N=110)

		Being calm	Effort	Task easy	Pay atten.	Teache likes	Good teache	Luck	Intellig
Age	8-10	81,3	100,0	93,8	18,5	31,3	92,6	70,4	66,7**
	11-13	85,5	95,2	88,7	3,9	21,0	96,1	56,9	74,5
	14-16	71,9	96,9	75,0	12,5	15,6	100,0	62,5	46,9
Gra	3rd	89,2	97,3	89,2	18,9*	37,8**	91,9	81,1**	67,6
	5th	86,8	94,7	92,1	0,0	15,8	97,4	50,0	68,4
	7th	65,7*	97,1	74,3	11,4	8,6	100,0	54,3	57,1
Gen	male	86,5	96,2	80,8	9,6	21,2**	96,2	63,5	53,8*
	fem	75,9	96,6	89,7	10,3	20,7	96,6	60,3	74,1
Rep	no	83,7	95,3	90,7	11,6	18,6	95,3	51,2	79,1**
	yes	79,1	97,0	82,1	9,0	22,4	97,0	68,7	55,2

* $p < .05$; ** $p < .01$

Table 6
Causal Attributions for Failure in a Math Exam and Subjects' Characteristics

		Nervous	Lack Effort	Task Difficult	Not. Pay Attentio	Teacher Not Like	Bad Teache	Lack Luck	Lack Intellig
Age	8-10	77,8	70,4*	92,6	25,9	7,4	18,5	59,3	33,3
	11-13	56,9	90,2	74,5	15,7	3,9	33,3	51,0	31,4
	14-16	53,1	90,6	75,0	9,4	3,2	18,8	40,6	18,8
Gra	3rd	75,7	75,7**	86,5**	27,0	8,1	21,6	64,9**	32,4
	5th	50,0	97,4	89,5	10,5	5,3	34,2	55,3	36,8
	7th	57,1	82,9	60,0	11,4	0,0	20,0	28,6	14,3
Gen	male	63,5	88,5	73,1	17,3	100,0*	25,0	57,7	32,7
	fem	58,6	82,8	84,5	15,5	0,0	25,9	43,1	24,1
Rep	no	58,1	83,7	72,1	18,6	4,7	25,6	41,9	32,6
	yes	62,7	86,6	83,6	14,9	4,5	25,5	55,2	25,4

* $p < .05$; ** $p < .01$

Table 7
Intercorrelations between Causal Attributions for Success and Failure

	Being Nervous	Lack Effort	Task Difficult	Not. Pay Attentio	Teacher Not Like	Bad Teache	Lack Luck	Lack Intellig
Being Calm	,18							
Effort		,06						
Task Easy			,23**					
Attent. Teacher Likes				,45**				
Good Teacher					,10			
Luck						,11		
Intellig							,35**	,25**

* $p < .05$; ** $p < .01$

Failure was significantly more attributed to lack of luck by subjects who were at beginning and intermediate grade levels than was among their more advanced counterparts ($\chi(2)=10,11$). Males considered failure in a math exam significantly more in terms of not being liked by the teacher than did females ($\chi(1)=5,95$). Significant associations emerged between task difficulty and school grade level. In fact, subjects who were more advanced in school were less likely to explain failure in terms of task difficulty than were their less advanced counterparts ($\chi(2)=11,41$). The same trend was found for age but the relationship turned out as non significant. Ascribing failure to being nervous was far

more frequent among third graders than among fifth and seventh graders. However, such findings only reached significance. Though not significant, males selected more being nervous as an explanation for failing a math exam than did females.

In relation to the selection of the most important attribution to explain not succeeding in a math exam, it is worth commenting that females were more prone to choose task difficulty (22,4%) as the most important cause than were males (5,8%). Moreover, males were more likely to select being nervous as the major cause for failing a math exam(21,2%) than were their females counterparts

(10,3%). Nonetheless, the aforementioned findings were not significant.

Attributions for success and failure were intercorrelated to evaluate whether subjects tend to attribute consistently the same causes to both success and failure. As it can be seen in Table 7, out of the eight pairs of attributions, four turned out significant. Intercorrelations were moderate to low.

Discussion

This study provided evidence that subjects attribute their success and failure to both external and internal factors. Attributions such as effort, good teacher, task easy, being calm, lack of effort, task difficulty, being nervous and lack of luck were the most common reasons pointed out by subjects to explain their experiences of success and failure in a mathematics exam, respectively. However, when asked to define which factor has contributed more to the outcome, subjects' tendency to provide internal attributions for both success and failure became apparent. Effort/ lack of effort were the causes mostly chosen by participants to explain success and failure respectively. In fact, effort was slightly more assigned by subjects to explain success than lack of effort to explain failure. This finding is consistent with the results of Weinert and Schneider's (1993) investigation with German children, but stands in contrast with the results from Taliuli's (1982) investigation in which subjects considered ability/ lack of ability as the main causes of their school success and failures, respectively. It is worth commenting that overall, findings from research based on both Brazilian (Neves & Almeida, 1996; Nunes, 1990; Taliuli, 1982) and German (Weinert & Schneider, 1993) children did not confirmed self-serving bias trend in which individuals are more likely to accept responsibility for a positive outcome and less prone to blame themselves for a negative event (Whitley & Frieze, 1985). Such a result might reflect a cross-cultural difference since the findings of Whitley and Frieze study were based on American subjects. On the one hand, how can we expect that Brazilian students do not feel responsible for their failure if the Brazilian educational system consider them as "guilty"? On the other hand, it can not be denied that lack of effort is a healthy attribution. Differently from intelligence, effort is usually perceived as within the subjects' control. Failure due to lack of effort helps the students believe that they can succeed if they work harder next time. This sense of control is undoubtedly a key variable for students' success in school.

Some developmental differences clearly emerged in this study. Indeed, age and school grade level were the best predictors of certain types of attributions. While attributing failure to lack of effort increased significantly with age and advancement in school, the reverse trend was found for failure explained in terms of lack of luck. Overall, such findings were congruent with earlier investigations in this area. According to Knopp (1982), there is a shift in emphasis from external sources of control to internal sources of control as individuals age. Furthermore, evidence from cognitive research shows that children tended to be less fatalistic in interpreting causes of an event as they age and advance in school (Green & Bird, 1986).

Attributing success to affective states, to intelligence and to external factors (luck, being liked by the teacher) tended to decrease with age and school grade level. Participants who were younger and at beginning grade levels were significantly more prone to attribute their success and failure to their own feeling states (being calm/being nervous) than did subjects who were older and more advanced in school. The impact that students' feelings have on their academic achievement appears to have been underestimated by teachers. Helping students identify and deal with their undesired feeling states may have a positive impact on their academic achievement.

Moreover, if on the one hand, this study confirmed previous research findings (Piccinini, 1989, 1990; Weinert & Schneider, 1993) that children use causes to explain their academic achievement related- outcomes not found in investigations with adults (such as affective states), on the other hand, the four major attributions proposed by Weiner (1979) were also part of children's repertoire.

Gender and repetition of a school grade level-related differences in attributions were scarce. Nonetheless, males in this investigation were more external to explain both their success and their failure experiences than were females. This result stands in contrast to findings of Stipek and Hoffmann (1980) in which males were more prone to attribute their failure to lack of ability. However, other studies have found females to be more external than males (Weinert & Schneider, 1993). Some investigations have also concluded that males were less likely to attribute failure to lack of ability or accept responsibility for failure than were their females counterparts. In addition, research has shown that girls usually feel more disturbed when facing a failure experience than do boys (Hughes, Sullivan, & Beard, 1986; Wigfield, 1988). Furthermore, intelligence

was also a far more frequent attribution for success among participants who had not repeated a school grade level than was for those who had repeated. It seems clear that gender repetition or not of a school grade level may influence children's causal attributions, but their real impact needs undoubtedly to be verified by future research.

Some causes for success and failure were intercorrelated. Nevertheless, correlations were moderate to low supporting the notion that subjects tend to ascribe causes for success and failure independently. Overall, cross-cultural similarities in causal attributions for success and failure were more pervasive than differences. For the most part, subjects exhibited a less dysfunctional attributional pattern than it could have been expected. Concepts such as control, effort, intelligence and luck among others should be more discussed in the classroom (Boruchovitch, 1997; Boruchovitch & Martini, 1997).

Indeed, effort and lack of effort were the most important attributions to explain both success and failure in school in this study. However, the finding that older students attributed their failure significantly to lack of effort raises an important question regarding what makes Brazilian students so unmotivated in advanced grade levels. As described by Zaleski (1988) advancing in school appears detrimental to students' sense of self-confidence. In fact, students tend to feel more ashamed and embarrassed about their failure in school, less motivated, and less proud of their accomplishments with advancement in school. More emphasis should be placed on uncovering students' feelings as they appear to influence their school performance.

Promoting the belief that students can do things to overcome their own difficulties is of paramount importance for both preventing learning problems and promoting self-regulatory skills, and therefore should be fostered to a certain extent by teachers and educators. However, although effort and lack of effort are key indicators of motivation and lack of motivation respectively (Maher, cited in Stipek, 1988), teachers and educators need to be more aware that achievement motivation cannot be thought of as students' internal qualities or lack of qualities only. The role of the school context in developing the adequate conditions to enhance students' motivation should be addressed by future research, as well.

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