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ABSTRACT

Achievement attributions of adolescent females in the masculine domain of mathematics were investigated in relation to self-schemas for gender, expectancy of success, and mathematics achievement. The most important findings revealed by multiple regression analysis were that mathematics achievement and the self-schema for masculinity predicted expectancy of success. Expectancy of success, the self-schema for masculinity, and mathematics achievement predicted the attribution of success to ability. Expectancy of success predicted the attribution of failure to lack of ability, and expectancy of success and the self-schema for androgyny predicted the attribution of failure to task difficulty. Results are discussed in terms of both Deaux's model of attribution behavior and the importance of the schematic structure of the individual in relation to expectancy of success and attribution. (Author)

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Achievement attributions of adolescent females in the masculine domain of mathematics were investigated in relation to self-schemas for gender, expectancy of success, and mathematics achievement. The most important findings revealed by multiple regression analysis were that mathematics achievement and the self-schema for masculinity predicted expectancy of success. Expectancy of success, the self-schema for masculinity, and mathematics achievement predicted the attribution of success to ability. Expectancy of success predicted the attribution of failure to lack of ability, and expectancy of success and the self-schema for androgyny predicted the attribution of failure to task difficulty. Results were discussed in terms of both Deaux's model of attribution behavior and the importance of the schematic structure of the individual in relation to expectancy of success and attribution.

The sex-typing of a task or domain has been suggested as an important variable to study in relation to causal attributions (Deaux, 1976). Causal attributions for achievement in mathematics, a domain which has been shown to be sex-typed as masculine (Eccles, 1983; Ernst, 1976; Fennema, 1974; Fennema & Sherman, 1977; Fox, 1976; Sherman & Fennema, 1977), have been found to influence high school students' decisions about whether to continue the study of mathematics beyond minimal requirements. This was found to be especially true for female students (Pedro, Wolleat, Fennema, & Becker, 1981). In addition, lack of training in this domain has been identified as a major factor in preventing females from entering scientific and technological careers (Ernst, 1976; Fennema & Sherman, 1977).

There has been some recent question about the importance of gender differences in the study of causal attributions (Deaux, 1984). For example, the consistency and consequentiality of findings of sex differences in achievement attributions has been questioned (Sohn, 1982). One suggestion that has been made is that both gender role variables and motivational variables may contribute to some findings of sex differences in attributional patterns (Deaux, 1984; McHugh, Frieze, & Hanusa, 1982).

The literature has shown that expectancy of success is related to causal attributions for achievement (Feather,

1969; Feather & Simon, 1971a, 1971b, 1973; McMahan, 1973; Simon & Feather, 1973). Two other variables that have received some attention in relation to achievement attributions are level of achievement and degree of self-perceived masculinity and femininity. Expectancy of success and degree of self-perceived masculinity and femininity are both variables that play a role in how one organizes one's psychological world. The concept of schema has been used to describe this cognitive organization (Neisser, 1976). A schema has been defined as a cognitive representation of a particular stimulus domain which contains knowledge and which functions in the guiding, selecting, and processing of the vast array of information in the environment (Taylor & Crocker, 1981). Self-schemas for the domain of gender have been studied (Bem, 1981; Markus, Crane, Bernstein, & Siladi, 1982). Individual differences in the content and organization of these schemas have been found, and these differences have been shown to affect information processing.

Markus (1977) has shown that established schemata relating to the self have a predictive function in relation to future behavior and decisions, and a selective function, determining what information is attended to, and how it is organized, evaluated, and categorized. Markus et al. (1982) have proposed that gender schemas intersect the self-schema so that components of the masculine gender schema are contained as part of the self-schema of the masculine individual

while components of the feminine gender schema are contained as part of the self-schema of the feminine individual. Components of both domains form part of the self-schema of the androgynous individual. These authors have found systematic differences in memory, endorsement of attributes, speed and confidence of judgments, and retrieval of examples based on differences in self-schemas for gender.

Deaux (1976, 1984) uses the concept of self-stereotype in her proposal of an expectancy based attribution model which follows Weiner's (Weiner, 1979; Weiner et al., 1971) theory of causal attributions for achievement. Deaux (1976) considers the self-stereotype as "constituting an anchor against which subsequent experience is judged" (p. 342). This is essentially the definition of self-schema for gender (Markus et al., 1982). Deaux's model proposes that sex role stereotypes create performance expectations which in turn lead to specific attributional patterns. Performance outcomes which are consistent with expectations lead to the stable attribution of ability. Performance outcomes which are inconsistent with expectations lead to unstable or temporary attributions. The masculine self-stereotype generates expectations of competence. Those individuals with a masculine self-stereotype should experience success as consistent with their expectations and make a stable attribution of ability for a success outcome and an unstable attribution of effort or luck for a failure outcome. Those individuals with a feminine self-stereotype which does not generate expectations of competence whould experience lack of

success as consistent with expectations and make a stable attribution of lack of ability to explain a failure and an unstable attribution of effort or luck to explain a success.

The present study investigated how the three factors of schematic organization for gender, expectancy of success, and mathematics achievement level were related to the attributional processes of females in the sex-typed achievement domain of mathematics. Mathematics was chosen for study for two reasons: Lack of training in this domain functions as a barrier to female entry into scientific and technological careers; and the literature suggests that the sex-typing of a domain is important in relation to expectancy of success and attributions in that domain (Deaux, 1984; Lenney, 1977; McHugh et al., 1982).

The specific hypotheses investigated in the present study were as follows:

1) Scores on a measure of expectancy of success will be predictable from scores for self-schema for gender, and scores for prior mathematics achievement.
2) Scores on a measure of mathematics achievement attributions will be predictable from scores for self-schema for gender, expectancy of success, and prior mathematics achievement.

Method

The Sample

Tenth and eleventh grade English classes in an educational

option public high school in New York City were selected to participate in this study. There were 299 tenth and eleventh grade females in the sample. They were the female students enrolled in the 17 English classes which participated in the study.

Instruments

Personal Attributes Questionnaire. The Personal Attributes Questionnaire (PAQ) (Spence, Helmreich, & Stapp, 1974) was used as a measure of self-schema for gender. The short form of the questionnaire which contains twenty-four items of a self-report nature was used. Each item describes one characteristic stereotypically believed to differentiate men and women. Raw scores, rather than transformed scores, from the M and F scales were used in this study.

The Mathematics Attribution Scale. The Mathematics Attribution Scale (MAS) (Fennema, Wolleat, & Pedro, 1979) is an instrument designed to measure students' attributions for their successes and failures in mathematics. It consists of eight clusters of items. Each cluster briefly describes a hypothetical experience in a math class which is followed by four attributional statements. Four clusters describe success experiences and four describe failure experiences. Students read each event and then indicate the degree of their agreement with each of the four attribution statements on a 5 point Likert type scale.

Expectancy of success in mathematics. A rating scale

divided into eight equal parts with the words, "I would expect to be completely unsuccessful" on one end and the words, "I would expect to be very successful" on the other measured expectancy of success in mathematics. Students were asked to indicate their level of expected success in future math classes by placing an X on the scale.

Mathematics achievement. Scores on the mathematics test of the Stanford Test of Academic Skills from the Fall 1984 citywide testing were obtained from school records. Raw scores were transformed into scaled scores according to the test manual (Gardner, Callis, Merwin, & Madden, 1973), so that scores from the 10th-grade test and the 11th-grade test were converted to a single common scale.

Procedure

The PAQ, MAS, and the expectancy of success scale were administered to 17 English classes by the classroom teachers in May of 1985. All three scales were administered during one forty minute class period. Student participation was voluntary. The use of students' school identification numbers rather names assured students' anonymity. Only the responses of the female students were analyzed for this study.

Analyses

Hypothesis 1 suggested that self-schema for gender and mathematics achievement would explain the variance in expectancy of success. To test this hypothesis scores for self-schema for masculinity, for femininity, and for androgyny (a combined

score resulting from adding masculinity and femininity scores together), and mathematics achievement scores were entered into a stepwise multiple regression equation to predict expectancy of success.

Hypothesis 2 suggested that self-schema for gender, expectancy of success, and mathematics achievement would explain the variance in attributions for mathematics success and failure. This hypothesis was tested by entering scores for self-schema for masculinity, self-schema for femininity, self-schema for androgyny, expectancy of success, and mathematics achievement into eight stepwise multiple regression equations, each predicting one of the attributions for mathematics success and failure.

Results

Results of the stepwise multiple regression equation testing hypothesis 1 showed that mathematics achievement and the self-schema for masculinity were both significant predictors of expectancy of success in a positive direction, $R = .306$, $p < .0001$, adjusted $R^2 = .087$. Those females who had higher levels of achievement in mathematics and who had a more masculine self-schema expected greater success in future mathematics courses.

Results of the eight stepwise multiple regression equations testing hypothesis 2 showed significant findings for six of the eight attributions: the attribution of success to ability, and to the environment; and the attribution of failure to lack of ability, lack of effort, the environment, and task difficulty.

The attribution of success to ability was significantly

predicted by expectancy of success, a masculine self-schema, and mathematics achievement, $\underline{R} = .456$, $\underline{p} < .001$, adjusted $\underline{R}^2 = .199$. Those females with higher expectations for success in mathematics, more masculine self-schemas, and higher mathematics achievement levels more strongly attributed success to their ability. The attribution of success to the environment was significantly related to expectancy of success, $\underline{R} = .131$, $\underline{p} < .05$, adjusted $\underline{R}^2 = .014$. Those females with higher expectations of success in future mathematics courses attributed success to the environment in greater degree, while those with lower expectations made less use of this attribution.

In the failure situation, the attribution of failure to lack of ability was significantly predicted by expectancy of success, $\underline{R} = .434$, $\underline{p} < .0001$, adjusted $\underline{R}^2 = .185$. Those with higher expectations for future mathematics success made less use of the attribution of failure to lack of ability, while those with lower expectations made more use of this attribution. The attribution of failure to task difficulty was significantly predicted by expectancy of success together with the self-schema for androgyny, $\underline{R} = .323$, $\underline{p} < .0001$, adjusted $\underline{R}^2 = .098$. Those females with higher expectations for mathematics success and with higher androgyny scores used the attribution of failure to task difficulty less than did those with lower expectations and lower androgyny scores. The self-schema for androgyny was also significantly related to the attribution of failure to lack of effort, $\underline{R} = .136$, $\underline{p} < .05$, adjusted $\underline{R}^2 = .015$. Those with higher androgyny scores

made less use of the attribution of failure to lack of effort, while those lower in androgyny used it more. Finally, mathematics achievement was significantly related to the attribution of failure to the environment, $\underline{R} = .146$, $\underline{p} < .05$, $\underline{R}^2 = .018$. Those with higher mathematics achievement scores made less use of the attribution of failure to the environment, while those with lower achievement scores used this attribution more.

Conclusions

The study provides partial support for Deaux's expectancy model of attribution behavior. Those females who expected success used the stable attribution of ability to explain their success. Those who had low expectations of success used the stable attributions of ability and of task difficulty to explain their failure. As Deaux's model suggests, expected outcomes were explained by stable attributions. Unexpected outcomes were not explained by the unstable attributions, however, as predicted by the model. In one case, the attribution of success to the environment, an unstable attribution was used to explain an expected outcome. However, the stability of the environment attribution has not been clearly established.

The finding that expectancy of success in a masculine sex-typed domain was predicted by the self-schema for masculinity suggests extending Deaux's model to include the schematic structure of the individual as does the finding that the attribution of success to ability was predicted by the combination of the masculinity schema and expectancy of success. These findings

together with the absence of findings for the self-schema for femininity suggest that it is the consistency of the masculine schema and the masculine domain which has implications for expectancy of success and attributions. While the presence of the masculine self-schema may be influential, the absence of the feminine self-schema does not seem to be so.

This study found support for a hypothesized schema-expectancy-attribution relationship and thus points toward the usefulness of the schema construct in the study of cognitions important in human motivation.

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