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ABSTRACT

Although women are entering male-dominated occupations at a greater rate, they still tend co avoid those occupations, as well as college majors that require math. Lack of an adequate ma.h background, and thus lower math achievement, seems to effectivel} bar women from high level, technological, and male-dominated occupations. This study examined the relationship of identity development to the development of math self-efficacy beliefs in an effort to clarify career decision-making behaviors of men and women. The purpose of this study was to test a causal model of math/science career aspirations that incorporated key elements of math self-efficacy and identity development theories. The extent to which socioeconomic status, sex role identity, gender, math ability, number of math/science high school courses, identity status, math anxiety, math self-efficacy, and interests influence occupational aspirations of high school students (N=136) and college students (N=153) were evaluated. Structural modeling using LISREL was supportive of math self-efficacy and research, though unsupportive of the inclusion of identity status variable in the model. Separate models were fit for the entire sample and the male and female subsamples. (ABL)

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A Causal Model of Career Aspirations

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Presented at the 1991 meeting of the
American Psychological Association

Running Head: A Causal Model of Math/Science Career Aspirations

Abstract

This study examined the relationship of identity development to the development of math self-efficacy beliefs in an effort to clarify career decision-making behaviors of men and women. The purpose of this study was to test a causal model of math/science career aspirations that incorporated key elements of math self-efficacy and identity development theories. The extent to which socioeconomic status, sex-role identity, gender, math ability, number of math/science high school courses, identity status, math anxiety, math self-efficacy, and interests influence occupational aspirations was evaluated. The sample included 289 high school and college student participants. Structural modeling using LISREL was supportive of math self-efficacy theory and research, though unsupportive of the inclusion of identity status variable in the model. Separate models were fit for the entire sample and the male and female subsamples.

A Causal Model of Math/Science Career Aspirations

Women's participation in the labor force has dramatically increased during the 20th century. Although women are entering male-dominated occupations at a greater rate, they still tend to avoid those occupations, as well as college majors which require math (Bureau of Education Statistics, 1988; Bureau of Labor Statistics, 1990). Lack of an adequate math background--and thus lower math achievement--seems to effectively bar women from high level, technological, and male-dominated occupations. Thus, inadequate preparation can act as a "critical filter" which limits women's choice of undergraduate majors and, correspondingly, their consideration of math-relevant non-traditional careers (Sells, 1980; Fennema, 1990). Understanding why women prematurely circumscribe their occupational aspirations is a necessary goal if counselors and educators are to facilitate women's exploration and consideration of non-traditional careers.

The empirical literature devoted to women's vocational decision-making has dramatically increased in recent years (Betz & Fitzgerald, 1987). Career self-efficacy theory (Hackett & Betz, 1981) and in particular studies of math self-efficacy (Hackett, 1985; Post-Kammer & Smith, 1986, Betz & Hackett, 1983) have been most useful in understanding why individuals choose to consider math/science career aspirations.

Self-efficacy beliefs are a person's perceived ability to successfully perform particular tasks. Low math self-efficacy expectations have been found to restrict consideration of math-related careers (Betz & Hackett, 1983). Furthermore, women were found to have lower math self-efficacy beliefs than men (Betz & Hackett, 1983). Hackett (1985) tested a causal model of math-related major choice for college-age men and women which incorporated math self-efficacy as a major mediating variable. This model was found to be generally supportive of math self-efficacy theory. Though math self-efficacy theory has received preliminary support, a broader, more integrated research model would advance our understanding of those factors contributing to math self-efficacy beliefs. Also, such a model would illuminate those factors which inhibit women's consideration of math/science occupations.

A number of potentially important background variables should be studied as part of such a model (e.g., age, socioeconomic status [SES], gender, sex-role identity, math ability, and the number of prior high school math/science courses) as well as other variables such as math anxiety and interests (Hackett, 1985; Lapan, Boggs, & Morrill, 1989). These factors are expected to directly and indirectly influence the degree to which one aspires to math/science occupations. In addition, both men and women should be included in the development of such a model. Knowledge of the factors which influence men to enter math/science careers, contrasted with the factors which influence women, will increase our understanding of career choices.

Efforts to explore conceptual linkages between self-efficacy and other established theories of self development are also warranted. For example, self-efficacy theory has yet to be studied in relationship to identity development theory. An individual's level of identity development is an indication of how committed he or she is to an inner sense of stability or consistency (Marcia, 1966). It is also an indication of how capable an individual is at thinking self-referentially. Asking an individual to rate self-efficacy beliefs presumes that the individual is confident in and capable of self-referential thinking.

Self-efficacy beliefs regarding a particular performance domain should be reliable indices of competence only insofar as an individual is already committed to a particular self view. For an individual whose self view is uncertain or diffuse, self-efficacy beliefs should be less reliable predictors of competence, motivation, and choice behavior. It is thus expected that an individual's level of identity development will influence the stability and predictive utility of math self-efficacy beliefs. Research linking identity development to career development (Blustein, Devenis, & Kidney, 1989) and vocational decision-making (Blustein & Phillips, 1990) has found preliminary support for several theory-derived predictions.

It is further expected that the joint effect of one's gender role and one's identity status will influence the development of math self-efficacy beliefs and math/science aspirations. The gender intensification hypothesis postulates that expectations regarding girls' behavior change during puberty, with expectations for girls becoming more gender specific (Hill & Lynch, 1983) at puberty. Bush and Simmons (1987) have suggested that the gender intensification hypothesis is a key element in understanding how girls narrow their expectations and aspirations. For example, those girls receiving social pressure to be "feminine" may pay less attention to or place less importance on information they are receiving regarding their math ability. Instead, these girls may concentrate on information which is less threatening to or more consistent with their gender identity. Girls who consolidate their self-views (identities) under these circumstances may be especially unlikely to develop strong math self-efficacy beliefs or math/science occupational aspirations.

The purpose of this study is to propose and test a causal model of math/science career aspirations for men and women that incorporates key elements from math self-efficacy and identity development theories. Clarification of those factors which contribute most importantly to the choice of a math/science career will assist counselors, teachers, and other professionals in their efforts to promote students' optimal career development. Identification of the most influential factors for a particular group (i.e. women) will be of use in the development of appropriate career intervention techniques.

Hypothesized Model

The model of math/science career aspirations to be tested is represented pictorially in Figure 1. This model will examine variables believed to influence such aspirations. These factors include age, sex-role identity, gender, socioeconomic status, math ability, prior math and science courses, identity status, math anxiety, math self-efficacy beliefs, and math/science interests.

Insert Figure 1 about here

Background variables

The background or exogenous variables in this study are SES, age, sex-role identity, gender, math ability, and number of high school math/science courses. There is expected to be some intercorrelation among these variables. For example, high correlations are expected between gender and sex-role identity, between age and number of high school math/science courses taken, and between math ability and number of high school math courses taken.

SES. Hackett (1985) suggested that background variables such as SES be included in studies of math self-efficacy beliefs in order to explain the mathematics preparation an individual engages in during high school. Furthermore, SES is expected to affect the type of occupations an individual considers. For example, those who come from low SES backgrounds are more likely to consider low prestige occupations (Gottfredson, 1981; Hannah & Kahn, 1989, Henderson, Hesketh, & Tuffin, 1988). Math/science careers often require further education and/or training and thus may be less likely to be pursued by those from low SES backgrounds. Though Rotberg, Brown, and Ware (1987) found that SES did not predict a range of career choice or self-efficacy expectations, the relationship of SES to range of occupations and math/science courses taken in high school will be further examined in the present study.

Sex role. Sex-role identity is expected to directly influence math self-efficacy and math anxiety. Those who have a more masculine sex role are expected to have lower levels of math anxiety (Hackett, 1985) and higher levels of math self-efficacy (Hackett, 1985; Betz & Hackett, 1983; Rotberg, et al., 1987).

Sex-role identity is also expected to indirectly influence self-efficacy beliefs through identity status. Children begin to form sex-role identity at an early age (Gottfredson, 1981; Henderson, et al., 1988) and these perceptions of self are considered to be an integral part of the identity formation process (Marcia, 1966; 1980). Sex-role identity impacts on what classes one might take and/or enjoy. Furthermore, the gender intensification hypothesis suggests that during adolescence girls, in particular, become more sensitive to what others think of them (Bush & Simmons, 1987; Hill & Lynch, 1983). The influence of sex-role identity and gender intensification may be one reason why some girls do not explore careers inconsistent with their gender identity.

Math ability. Math ability is expected to directly influence math anxiety, math self-efficacy beliefs, and occupational aspirations. High math ability is expected to be associated with low math anxiety. High math ability should also directly contribute to high math self-efficacy beliefs and math/science career aspirations (Fassinger, 1990).

Previous math/science courses. The number of previous high school math and science courses is expected to be directly related to math anxiety and math self-efficacy. Those students who have taken more math and science courses in high school are expected to have decreased levels of math anxiety (Cooper & Robinson, 1989) and increased levels of math self-efficacy (Betz & Hackett, 1983).

Identity status

Identity status is expected to be directly related to math self-efficacy beliefs. Those students who are at a more stable stage of identity development (i.e., identity achievement or foreclosure) are expected to be strongly associated with strong, stable patterns of self-efficacy beliefs. Those students at less stable stages of identity (i.e., moratorium or identity diffusion) are expected to be associated with weaker relationships between self-efficacy beliefs. Age and sex role are expected to be directly related to identity status, and to indirectly influence math self-efficacy beliefs. For example, an individual who is in college, has a feminine sex-role, and is at the identity achieved stage of identity development is expected to have low math self-efficacy beliefs and occupational aspirations which are unrelated to math and science.

Math anxiety

Math anxiety is expected to be directly related to math self-efficacy beliefs. It is expected that high math anxiety is associated with low math self-efficacy beliefs. Bandura (1977, 1986) discusses four sources of self-efficacy: past performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal. Math anxiety measures often focus on reported physiological reactions, or the degree of emotional arousal subjects experience in math performance situations. Thus, math anxiety is expected to be directly related to the formation of self-efficacy beliefs.

Math anxiety is expected to be influenced by math ability and the number of math/science courses taken. Low math anxiety is expected to be associated with high math ability and a high number of math/science courses taken in high school.

Math self-efficacy.

Math self-efficacy is expected to be directly related to interest level in math/science careers (Lapan, et al., 1989; Lent, Lopez, & Bieschke, 1991).

Those with a high level of math self-efficacy beliefs are expected to express more interest in math/science-related careers.

Interests

Interest in math/science-related careers is expected to directly influence the preference of occupational roles and the level of exploration (consideration) given to those roles (Lent, Brown, & Larkin, 1986; Rotberg et al., 1987; Lent, et al., 1991). Specifically, those interested in math/science careers are expected to have higher math/science occupational aspirations.

Occupational preference

Occupational preference serves as the outcome variable for this model. It is expected to be directly affected by SES (e.g. Gottfredson, 1981; Hannah & Kahn, 1989), interests (e.g. Lent, et al., 1986; Rotberg et al., 1987) and math ability (Betz & Hackett, 1983; Hackett, 1985).

Methodology

Subjects

The sample used in this study included 289 high school and college students (118 males, 170 females, 1 unidentified). The mean age of participants was 20.51.

Participation in the research was voluntary. Each participant received extra credit in one of their courses for completing the study questionnaires.

College students enrolled at a major western university were asked to participate in the study for extra credit in a course. 153 college students (94 females, 58 males, 1 unidentified; mean age = 25.1) agreed to complete the questionnaires. The high school sample included 136 students (76 females, 60 males; mean age = 15.9) enrolled in math classes who also agreed to complete the study for extra credit.

Procedures

College and high school students were provided with a general statement of the purpose of the project and asked to participate in the research during one of their classes for extra credit. Participation included the completion of a battery of questionnaires and permission to access the student's academic record in order to obtain math test scores. Parents of high school students were asked to sign a parental consent form which explained the purpose of the project prior to their students' being asked to participate.

Questionnaires were administered to each subject in counterbalanced order, with the exception of the Bem

Sex Role Inventory (BSRI), which was always administered last.

Instruments

Background questionnaire. Subjects were asked to provide the following background information: birthdate, gender, a list of math and science courses taken in high school, year in school, marital status, probabl career choice, degree of commitment to career preferences, parents' occupations, and parents' levels of education. College students were also asked to identify their academic major.

Socioeconomic Status. Parent occupations were rated using Duncan's Socioeconomic Index (1961; SES).

Math/Science Courses. College and high school students were asked to list the high school math and science courses they had taken. The total number of courses taken by each student was computed (MCOURS).

Ability

Two different ability measures were utilized in this study for high school and college students. Scores for each measure were converted to t-scores in order to make the scores comparable to one another. Scores from the ACT Mathematics Usage test were obtained for college students from university records. Scores from the math portion of the Stanford Achievement Test (SAT) were obtained from high school academic records for high school students (TABILITY).

Extended Objective Measure of Ego Identity Status (EOM-EIS; Bennion & Adams, 1986). This 64-item questionnaire uses a 6-point Likert response format to assess the relative dominance of each of the four ego identity statuses (i.e., diffusion (DIFEIS), moratorium (MOREIS), foreclosure (FOREIS), and identity achievement (IAEIS)). Higher scores in each status indicated stronger endorsement of items consistent with that identity status.

Fennema-Sherman Mathematics Anxiety Scale (MAS; Fennema & Sherman, 1976). Mathematics anxiety was assessed by the 10-item scale which uses a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). This study used the 10-item revised version of the MAS developed by Betz (1978) for use with college students.

Math Self-efficacy Scale (MSE; Betz & Hackett, 1983). Two subscales of the Math Self-Efficacy Scale were used in this study: Math Problems and Math Tasks. Each of these scales contains 18 items. The Math Problems scale was designed to assess confidence in one's ability to solve math problems (i.e., similar to those found on standardized tests of mathematical aptitude and achievement). The Math Tasks subscale was constructed to measure confidence in one's ability to solve everyday math problems (i.e., balancing a checkbook). Subjects were asked to indicate their degree of confidence using a 10-point scale ranging from "No confidence at all" (0) to "Complete confidence" (9) (Betz & Hackett, 1983). The total mathematics self-efficacy score was defined as the sum of responses to the Math Tasks and Math Problems subscales.

Bem Sex Role Inventory (BSRI; Bem, 1981). The BSRI measures the extent to which subjects identify themselves along gender-typed attributes. The BSRI consists of 60 adjectives for which subjects are asked to rate themselves according to a 7-point scale, ranging from 1 (never or almost never true) to 7 (always or almost always true). The 60 items are personality characteristics scaled as being desirable for men, women, or desirable for both (neutral). The masculinity (MASC) and femininity (FEM) subscales of the BSRI were used in this study.

Math/Science Interests. Items from the investigative activities section of the Self-Directed Search (SDS;

Holland, 1977, 1985) and six additional items were used to create a scale to assess math/science interests. Subjects were asked to indicate whether they liked, disliked, or were indifferent to each of the activities. Item scores were totaled, with higher scale scores indicating less interest in math/science activities (INT).

Occupational Preference. This questionnaire used a 9-point Likert scale to assess how seriously the student has considered each of 23 math/science related occupations. Each of the 23 occupations were rated along a 5-point science continuum (scores ranging from 1 to 5) developed by Goldman and Hewitt (1976). Lower scores characterized fields with a relative absence of math/science content (e.g. art), while higher scores reflected progressively greater scientific emphasis (e.g. engineering). This questionnaire only included those occupations rated either a 4 or a 5 using the Goldman-Hewitt continuum. Items for this scale were summed and the mean was obtained. Lower scores indicated a greater level of interest in math/science occupations (OCCUP).

Research hypotheses

The model in Figure 1 represents the research hypotheses for this study. The overall fit of this hypothesized model will be assessed. Since the proposed model is exploratory and the relationships hypothesized between variables are tentative, the model will be revised if necessary.

Data analysis

1. For each of the measures of the latent and background variables, the following descriptive statistics will be computed: mean, standard deviation, variance, kurtosis, and skew.
2. A correlation matrix will be computed which will examine the relationships between each of the variables.
3. The first stage of data analysis will be a path model using multiple regression. Results of this analysis will be used to develop a structural model using the computer program LISREL VII (Joreskog & Sorbom, 1989).

Results

Descriptive Statistics

Table 1 contains the full name, abbreviated name, mean, standard deviation, range and skewness of each of the variables specified in the proposed model. The age variable is considerably positively skewed (sk = 1.95).

This is to be expected, given the sizeable high school population sampled for the study.

Insert Table 1 about here

The zero-order correlation matrix for all the variables used in the proposed model can be found in Table 2. Math/science interests, math self-efficacy beliefs, math anxiety, masculinity, foreclosure, and math ability are all significantly correlated with math/science relatedness of occupation ($p > .001$). Interest in math/science activities was most highly correlated with math/science relatedness of occupation ($r = .42$; $p > .001$). Somewhat surprisingly, number of math courses was not significantly related to math/science relatedness of occupation ($r = .04$), though it was related to math self-efficacy beliefs ($r = .33$; $p > .001$).

Insert Table 2 about here

<u>Whole Sample</u>

<u>Path Analysis</u>. In order to test the hypothesized model (see Figure 1), path coefficients were estimated

via a series of multiple regressions. Each endogenous variable was regressed on the exogenous and endogenous variables hypothesized to affect it. Beta (standardized regression) coefficients were examined (Pedhazur, 1982). All path estimates equal to or greater than .15 were included in the reduced model (see Figure 2). These analyses are presented in Table 3, along with the decomposition of indirect, direct, and total effects for each variable and the calculation of R_2 for the reduced model. Figure 2 presents the reduced path model with all significant path coefficients (p values > .15) representing the direct influence of one variable upon another. Squaring a path coefficient represents the percentage of explained variance for each path. Path coefficients for the residual variables are also included, and are represented by the R's in Figure 2.

Insert Figure 2 about here

<u>Structural equation modeling</u>. Table 4 presents a summary of the overall and detailed fit information for the Initial, Revised and Final Models for the whole sample. The testing of the Initial Model produced a

significant X^2 (X^2=37.41, df=17, p=.003). A significant X^2 indicates the rejection of the null hypothesis, suggesting that the model being tested is not a plausible one in the population. Since the X^2 statistic is easily influenced by sample size, other measures of fit were also examined including the goodness of fit index and the root mean square residual. The goodness of fit index is interpreted similarly to a correlation coefficient in terms of desirable values (Fassinger, 1987) and is relatively free from the influence of sample size (Marsh, Balla, & McDonald, 1988). The value of .962 is indicative of a good fit of the Initial Model to the sample data. The root mean square residual for the Initial Model is also supportive of the model. Values close to zero are desirable; the value of .049 in this model is desirable (Fassinger, 1987).

Insert Table 3 about here

Detailed fit information presented in Table 4 suggest where some of the fit problems in the Initial Model are. The coefficient of determination for the structural equations (which indicates the overall strength of the relations among the latent variables; Fassinger, 1987) is moderate (.50), suggesting structural weaknesses. The equations predicting identity achievement status and consideration of math/science careers have low squared multiple correlations (.110 and .182, respectively), again indicating structural weakness. Squared multiple correlations for equations are an indication of how accurate a measure is and an indication of the strength of the relationships among the latent variables (Fassinger, 1987). In addition, there are two standardized residuals which are significantly greater than 2.0, indicating that the relationships between these pairs of variables (math ability and math/science interests, math/science occupations and math/science interest) are not being fit well.

Insert Table 4 about here

Possible problems in the prediction of math anxiety is supported by a non-significant t-value for the path between number of math courses and math anxiety ($t = -.103$). Possible problems in the prediction of math self-efficacy beliefs is supported by a non-significant t-value for the path between math ability and math self-efficacy beliefs ($t = 1.68$). Values of t less than 2.0 determine which paths might be removed from the model without large increases in X^2 (Fassinger, 1987). There is also a high modification index for one indicator (math self-efficacy beliefs in relation to theta epsilon) indicating the possibility of measurement error in the math self-efficacy beliefs variable (Joreskog & Sorbom, 1989).

Based on the above fit information, only one modification was made in the Revised Model. The math self-efficacy beliefs variable was allowed to vary in the theta epsilon matrix in order to account for possible measurement error in this variable. As a result, the overall fit of the model improved. The value for X^2 was barely significant ($X^2 = 26.92$; $p = .042$). The goodness of fit index increased to .97 and the root mean square residual decreased to .037; both are indications of improved model fit. Though the coefficient of determination improved to .582, the low squared multiple equations for identity achievement status and occupations stayed approximately the same, indicating structural weakness in the model. Normalized residuals for variables were all less than

2.0, indicating that relationships between variables are being fit well in the Revised Model. Finally, the t-value of -.103 indicates that the path between number of math courses and math self-efficacy beliefs can be eliminated. A high modification index of 10.35 indicated that the path between age and math self-efficacy beliefs be added to the model.

The following modifications in the model were made prior to testing the Final Model. Based on the non-significant t-value, the path between number of math courses and math anxiety was eliminated. Theoretically, it seemed plausible that the other variables predicting math anxiety (masculinity and math ability level) might subsume the effects of the number of math courses variable. In addition, a path between math self-efficacy beliefs and age was added. It seemed possible that older students, further along in their high school or college education, would have higher math self-efficacy beliefs. The overall fit information for the Final Model was very supportive. The X^2 value of 15.98 was non-significant ($p = .454$), the goodness of fit index improved to .98, and the root mean square residual improved to .033. All these are supportive of the Final Model being plausible in the sample. Though the coefficient of determination increased to .625, it still fell somewhat short of an acceptable value of .70. The squared multiple correlations for identity achievement status and math/science occupations also remained the same. Thus, though the overall fit information is supportive of the model there is still some indication of structural weakness in the model. Finally, the t-value for the path between identity achievement status and math self-efficacy beliefs ($t = 1.377$) indicates that this path should be eliminated.

Despite the suspicion of structural weakness between endogenous variables, other changes in the model do not seem statistically or theoretically justified, and thus the Final Model is presented in Figure 3 with parameter values.

Insert Figure 3 about here

Gender Differences

In order to decide whether separate models should be fitted for males and females, Box's M test was conducted. Box's M test examines whether variance-covariance matrices are homogenous (Tabachnik & Fidell, 1989). Results of this test can be found in Table 5 and indicate that the variance-covariance matrices are different for males and females. Given these results, separate models for males and females were explored and fit.

Insert Table 5 about here

In addition, univariate analyses of variance of each variable by sex were also conducted. Results are presented in Table 6.

Insert Table 6 about here

Path analysis for Males. Decomposition of the direct, indirect and total effects for the path analysis for males can be found in Table 7. R^2 for the reduced model is also presented in Table 7. All paths with a p value of less than .15 were excluded from the reduced model. Figure 4 presents the path model with the significant paths and the path coefficients for the residuals.

Insert Table 7 about here

Insert Figure 4 about here

Structural equation modeling for males. The PRELIS procedure was used to create a matrix system file to be used as a data source for LISREL. Table 8 is a summary of the overall and detailed fit information for the Initial, Revised, and Final Models for male sample

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Insert Table 8 about here

The test of the Initial Model produced a non-significant X^2 ($X^2 = 33.29$, $p = .225$), indicating that the Initial Model is a plausible one for the data. The goodness of fit index of .933 is also supportive of the data. The root mean square residual of .085 is somewhat higher than the desirable value of .05.

There are some indications of structural weaknesses in the model. The coefficient of determination of .132 is much lower than is acceptable, achievement status variable was eliminated and the occupations variable was allowed to vary in theta epsilon. Once again, the overall fit information for the Final Model improved. The X^2 value decreased to 8.31 and was non-significant ($p = .503$), the goodness of fit index increased to .972 and the root mean square residual decreased to .067. The detailed fit information revealed continued structural weakness in the model, as the coefficient of determination decreased to .185. However, the only equation with a squared multiple correlation less than 2.0 was the one for interest in math/science activities. In addition, all of the standardized residuals were less than 2.0 indicating good fit between variables. None of the t-values for paths were greater than 2.0, and the modification indices were small.

Insert Figure 5 about here

No other changes were made in the model, despite the suspicion of structural weakness between variables. The Final Model for males is presented in Figure 5.

Path analysis for females. Decomposition of the direct, indirect, and total effects for the path generally supportive. A non-significant X^2 value of 20.80 was obtained (p=.348), the goodness of fit index increased to .933, and the root mean square residual decreased slightly to .08. There were still indications of structural weakness in the model. Though the coefficient of determination increased to .473, it is still considered a low value. The squared multiple correlation for the occupation, identity achievement status and interest in math/science activities equations remained the same. In addition, the two standardized residuals which were greater than 2.0 in the Initial Model (interest in math/science activities and math anxiety and math self-efficacy beliefs) remained.

The t-values for the paths between identity status and math self-efficacy beliefs, and between masculinity and identity achievement status were below 2.0, indicating that these paths should be deleted. Modification indices supported adding a path between math/science interests and one or more of the following variables: math ability, math anxiety, or occupations. Measurement error in the occupations variable was also indicated.

For the Final Model (see Figure 5), the identity as are the squared multiple correlations for the equations for math/science occupations, interest in math/science activities, and identity achievement status. The standardized residuals for two pairs of variables (interest in math/science activities and math self-efficacy beliefs, and interest in math self-efficacy beliefs and math anxiety) indicate that the relationships between these variables are not being fit well.

The t-values for a number of paths were non-significant, indicating that these paths should be deleted. In particular, the paths which involved either identity achievement or diffusion identity status seemed to have low t-values. Modification indices indicated that adding a path between math/science interests and freeing the occupation variable in theta epsilon would increase the fit of the model.

It was decided to delete all the paths with t-values of less than 1.0. As a result, the diffusion and femininity variables were deleted, as were the paths between number of math courses and math anxiety, and math ability level and math self-efficacy beliefs. The overall fit information for the Revised Model was analysis for females can be found in Table 9. R^2 for the reduced model can also be found in Table 9. All paths with p-values less than .15 were not included in the reduced model. Figure 6 presents the reduced model with significant paths and path coefficients for the residuals.

Insert Table 9 about here

Insert Figure 6 about here

Structural equation modeling for females. The PRELIS procedure was used to create a matrix system file to be used as a data source for LISREL. Table 10 is a summary of the overall and detailed fit information for the Initial, Revised, and Final Models for the female sample.

Insert Table 10 about here

The X^2 for the Initial Model was significant (X^2 = 56.98, df = 21, p = .000) indicating that the current model is not one which is plausible in the female sample. The other overall fit information was also generally non-supportive. The goodness of fit index of .918 was smaller than desired, while the root mean square residual was higher than is desirable (.092).

The detailed fit information is also non-supportive of the model, and is indicative of structural weakness. The coefficient of determination is low, as are the squared multiple equations for occupation and identity achievement status. There are also numerous residuals greater than 2.00; in particular, the fit of the relationship between interest in math/science activities and math self-efficacy beliefs is particularly weak.

Low t-values between identity achievement status and math self-efficacy beliefs, masculinity and math anxiety, femininity and identity achievement status, and number of math courses and math anxiety indicate these paths should be deleted. The modification indices suggest a number of additional paths to be added to the model.

After careful consideration, the Initial Model was revised. The identity achievement status, age and femininity variables were dropped from the model. In addition, the paths between masculinity and math anxiety, and number of math courses and math anxiety were eliminated. Finally, in order to account for possible measurement error, the occupations variable was allowed to vary in the theta epsilon matrix.

Overall fit information for the Revised Model was more supportive. The X^2 value decreased to 21.34, though it was still significant ($p = .011$). The goodness of fit index increased to .951, while the root mean square residual decreased to .082.

The detailed fit information was also more supportive of the Revised Model for females. Though the coefficient of determination for the structural equations dropped slightly to .447, the squared multiple coefficient for the occupation equation increased to .195. Though, in general, there were fewer standardized residuals greater than 2.0, two pairs were still greater than 2.0: interest in math/science activities and math self-efficacy beliefs, and masculinity and interest in math/science activities.

All t-values were greater than 2.0, indicating that none of the paths should be deleted. Modification indices indicated that a path should be added between masculinity and consideration of math/science occupations.

For the Final Model for females, the path between masculinity and consideration of math/science occupations was added to the model. The inclusion of this path seemed theoretically congruent and worth exploring. The overall fit information for this model was highly supportive. A non-significant X^2 of 8.11 was obtained ($p = .423$), the goodness of fit index increased to .981, and the root mean square residual decreased to a desirable value of .036.

Detailed fit information was also mainly supportive. None of the standardized residuals were greater than 2.0 and all of the squared multiple correlations for equations were greater than .325. The coefficient of determination increased slightly to .519, which still falls short of a desirable value of .70. None of the t-values were greater than 2.0 and the modification indices were all quite small (less than 4).

Given this generally supportive data, no further changes were made in the model. The Final Model is presented in Figure 7.

Insert Figure 7 about here

Discussion

Women with high ability levels are choosing not to enter math/science occupations at the same rate as are men (Bureau of Labor Statistics, 1990). Research which clarifies the career behavior of men and women is necessary. The purpose of this study was to test the adequacy of a proposed causal model of math/science career aspirations for high school and college males and females. Research results of studies math self-efficacy were used as the organizing schema around which the model was formulated. Background factors (socioeconomic status, sex-role identity, math ability, number of high school math courses) were included in the model along with factors typically examined as part of math self-efficacy theory (math anxiety, interest in math/science activities). Finally, an effort was made to explore the linkage between math self-efficacy theory and identity development theory. Though the results of this study were generally supportive of math self-efficacy theory, they did not support the inclusion of identity status as a causal predictor of math/science career aspirations.

Adequacy of the Proposed Causal Model of Career Aspirations

When comparing the final model for the whole sample with the proposed causal model of math/science career aspirations, many of the paths were the same. As proposed, both interest in math/science activities and ability level had a direct effect on consideration of math/science career aspirations. Math self-efficacy beliefs had a direct effect on the development of interests. Higher math self-efficacy beliefs were associated with lower levels of math anxiety, high scores on the masculinity subscale, increased number of math courses, and high math ability level. Low math ability and low masculinity scores were associated with increased levels of math anxiety.

Contrary to the proposed model, socioeconomic status was not a significant predictor of math/science occupational aspirations for the whole sample (or any subsample) as hypothesized, supporting the results of Rotberg, et al., 1987. It may be, however, that the failure of socioeconomic status to predict occupational aspirations was due to the large amount of missing data in that variable.

Furthermore, the identity achievement status variable initially contributed significantly to the prediction of math/science career aspirations. Once the path between age and math-self efficacy beliefs was included as part of the model, identity achievement status no longer significantly predicted math self-efficacy beliefs. The direct positive effect of age on math self-efficacy beliefs was surprising, especially given that the older students in this sample seem to have low levels of math ability. Perhaps as one grows older and becomes involved in further education, beliefs about ability to learn new tasks increases, regardless of ability level.

While the final model for the whole sample was generally supported by the overall and detailed fit information available, there were suggestions of structural weaknesses in the model. In particular, the squared multiple correlation for the math/science career aspirations equation was low. Inclusion of new paths or new variables seem necessary to adequately explain math/science career aspirations. Including such variables as work and personal values, career decision making strategies, outcome expectations, and the influence of family and peers may increase understanding of the factors involved in aspiring to math/science careers.

Gender differences.

In general, for both males and females, high math self-efficacy beliefs appear to lead to the development of interest in math/science activities, which in turn lead to math/science career aspirations. However, in contrast to previous studies (Hackett, 1985; Rotberg, et al., 1987), for females (but not for males) high scores on the Masculinity subscale of the Bem Sex Role Inventory led both directly and indirectly to math/science career aspirations. One of the possible explanations for the unexpected finding may be that the sample used in this study was different from samples used previously. The data was collected from a conservative culture which encourages and supports the development of traditional sex roles. Thus, for females from more "traditional" backgrounds, perceiving oneself as masculine may be necessary in order to consider math/science careers. A second possibility for this unexpected finding may be the type of data analysis used. LISREL was not the type of analysis used in the previous studies, and it offers the added advantage of exploring simultaneous relationships among variables.

A number of researchers (Fassinger, 1990; Spence & Helmreich, 1981) believe that high scores on the Masculinity subscale are indicative of instrumentality or characteristics such as ambition and ability to deal proactively with one's environment. Perhaps, for females, the possession of instrumental qualities is necessary in order to consider math/science careers. The practical implication of this result for counselors and educators is that high ability level and interest levels are not sufficient for consideration of math/science career aspirations. Fostering the development of instrumental values and competencies also seems to be important in furthering women's consideration of math/science occupations.

It is also possible that gender typing may have a more influential role in "circumscribing" the career aspirations of women (Gottfredson, 1981). However, masculinity does not serve as a moderator variable for the relationship between math self-efficacy and interest in math/science activities. At any rate, the effects of masculinity are more complex for women than they are for men in this sample.

Gender differences exist in the strength of the path between math self-efficacy beliefs and interest in math/science activities. Men's math self-efficacy beliefs are more strongly related to the development of interests. Thus, even those females who have high math self-efficacy beliefs aren't developing interest in math/science activities at the same level as males.

It is also interesting to examine the role of the exogenous variables on the development of math self-efficacy beliefs and math anxiety. For females, all three exogenous variables led to the development of math self-efficacy beliefs: math ability, number of math courses and high scores on the masculinity scale. For males, math ability level did not lead to increased math self-efficacy beliefs. This implies that males make decisions about their math self-efficacy beliefs without regard to their math ability level. This is surprising, as performance information is hypothesized by Bandura (1977) to be the most important source of efficacy information. However, a study by Beyer (1990) indicates that gender differences exist in the accuracy of self-evaluations. Men were found to have high expectations and overly high self-evaluations of their performance of masculine tasks. Women were found to have low expectations of their performance on masculine tasks and to hold overly negative self-evaluations of their performance. Given that math is considered by many to be a masculine task, it is possible that the men in this study overestimated their beliefs about their ability to perform math tasks. Conclusions about the role of the math ability variable in this study must be tentative given the large amount of missing data in this variable.

For math anxiety in females, the only significant predictor was low math ability level. For males, both low math ability level and low masculinity scores were associated with high math anxiety. It may be that for males low levels of "masculinity" or instrumental behavior in general creates greater anxiety.

Finally, despite supportive overall fit information, it is important to add that serious structural problems seem to exist within the model for the male sample. In particular, the equation for interest in math/science activities seems particularly weak. Reordering the variables or including new variables seems to be appropriate. It may be that more men consider math/science careers because that is what their parents, teachers, and society expects of them. Including a variable such as expectations of others (similar to the foreclosure identity status) may provide researchers with interesting results.

Limitations

Plausible models were fit for the whole, male, and female samples. However, several limitations existed in this study. First of all, large amounts of missing data in the socioeconomic status variable and in the math ability variable were problematic when conducting the path analyses and testing the models. Furthermore, not using the same ability measure for both samples limits our understanding of the role math ability plays in the consideration of math/science occupations.

The college sample used in this study may represent a particular "type" of college student. The majority of the subjects were enrolled in a career and life planning class. Students in these classes are generally uncertain of their college major and career plans. In this study, the high school and college populations did not differ in number of math courses taken in high school, math self-efficacy beliefs, math/science interests, or math/science career aspirations. In addition, math anxiety levels were higher for the college population. It is possible that many of the college students in these career and life planning courses have already ruled out math/science careers as possibilities and that the sample examined in this study is significantly different from the general college population.

Finally, as Fassinger (1990) describes, causal modeling techniques are methodologically difficult. She further describes the problem as "balancing the statistical demand for parsimony with the theoretical and empirical need to be heuristically inclusive," (p. 245). It is possible that the fit of the models for each sample improved because the models used few variables and hypothesized fewer paths between variables.

Recommendations for future research

Further research is needed to explore and evaluate further the role of identity status to the consideration of math/science careers. First of all, focusing exclusively on occupational identity may be useful. Melgosa (1987) developed the 28-item Occupational Identity Scale (OIS) which classifies individuals into one of the four identity statuses. Use of the OIS may shed light on the role of identity status and career aspirations. Secondly, the inclusion of another variable, fear of success, may also shed light on the role of identity status to occupational aspirations (Larkin, 1987). Finally, it seems useful to explore the direct effect of identity status on math/science career aspirations. For example, individuals in the foreclosure status may be more likely to consider math/science careers because of the influence of family members.

Results seem to indicate that other variables should be included in the prediction of math/science occupations. As mentioned previously, fear of success and identity status are two variables which may prove useful to include. Fassinger (1990) also examined math/science career choices and evaluated a causal model using LISREL. Variables she found significant in the prediction of math/science career choice included family orientation, feminist orientation, attitudes toward work roles and attitudes toward family roles. Combining these two models may assist in explaining significantly more of the variation in math/science career choice.

Finally, future models should examine the reciprocal influence of interest between math/science activities and math self-efficacy beliefs, as well as the reciprocal relationship between math anxiety and math self-efficacy beliefs (Lent, et al., 1991).

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Table 1

Descriptive Statistics for All Variables

Variable Name	Abbreviation	M	SD	SK	Range
Math/Science Occupations (Combined)	OCCUP	1.80	1.21	.93	0 - 6.01
Math/Science Occupations A	OCCUPA	1.89	1.23	.93	0 - 6.75
Math/Science Occupations B	OCCUPB	1.71	1.25	.80	0 - 5.55
Math/Science Interests (Combined)	INT	1.95	.43	.17	1.00 - 3.00
Math/Science Interests A	INTA	2.03	.47	-.03	1.00 - 3.00
Math/Science Interests B	INTB	1.88	.45	.382	1.00 - 3.00
Math Self-Efficacy Scale (Combined)	MSE	6.43	1.75	-.680	.64 - 9.00
Math Self-Efficacy Scale A	MSEI	6.51	1.75	-.667	.56 - 9.00
Math Self-Efficacy Scale B	MSE2	6.34	1.80	-.69	.72 - 9.00
Math Anxiety Scale	MAS	2.98	1.10	.03	1.00 - 5.00
Math Test Anxiety Inventory (Combined)	MTAI	2.14	.77	.597	1.00 - 3.85
Identity Achievement Status (Combined)	IAEIS	3.96	.64	-.24	1.25 - 5.56
Identity Achievement Status 1	IAEIS1	4.01	.65	-.43	1.38 - 5.50
Identity Achievement Status 2	IAEIS2	3.91	.74	.04	1.13 - 6.00
Foreclosure Status (Combined)	FOREIS	2.19	.76	.315	1.00 - 4.31
Foreclosure Status 1	FOREIS1	2.27	.79	.349	1.00 - 5.13
Foreclosure Status 2	FOREIS2	2.12	.81	.453	1.00 - 4.75
Moratorium Status (Combined)	MOREIS	3.21	.62	-.188	1.44 - 4.81
Moratorium Status 1	MOREIS1	3.24	.73	-.189	1.00 - 5.13
Moratorium Status 2	MOREIS2	3.18	.24	-.120	1.38 - 4.88
Diffusion Status (Combined)	DIFEIS	2.78	.63	.174	1.19 - 4.56
Diffusion Status 1	DIFEIS1	2.73	.69	.087	1.00 - 4.38
Diffusion Status 2	DIFEIS2	2.83	.69	.155	1.00 - 5.00
Father's Education	FED	3.70	1.53	.12	1.00 - 6.00
Socioeconomic Index	SES	63.53	16.89	-.60	9.00 -96.00
Age	AGE	20.77	6.98	1.95	15.00 -50.00
Masculinity (Combined)	MASC	5.08	.77	-.15	3.10 - 7.00
Masculinity A	MASCA	5.35	.84	-.46	2.60 - 7.00
Masculinity B	MASCB	4.80	.87	.07	2.60 - 7.00
Femininity (Combined)	FEM	5.08	.70	-.38	2.90 - 7.00
Femininity A	FEMA	4.76	.73	-.02	2.60 - 7.00
Femininity B	FEMB	5.41	-.89	-.43	2.60 - 7.00
Number of Math Courses	MCOURS	2.33	1.10	.41	0 - 5.00
T-Values/Ability Scores	TABILITY	52.17	10.07	-.23	26.7 -73.26

Table 2

Correlation Matrix of Endogenous and Exogenous Variables.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. OCCUP	1.00													
2. INT	-.42**	1.00												
3. MSE	.24**	-.55**	1.00											
4. MAS	-.19**	.41**	-.58**	1.00										
5. IAEIS	.03	-.12*	.20**	-.06	1.00									
6. FOREIS	.20**	.00	.07	-.04	.08	1.00								
7. MOREIS	.05	.03	-.10*	.11*	-.21**	-.01	1.00							
8. DIFEIS	-.01	.17*	-.13*	.06	-.27**	.03	.49**	1.00						
9. SES	-.01	.02	-.04	-.03	-.02	-.01	-.03	-.05	1.00					
10. AGE	-.09	-.01	-.01	.26**	.18**	-.33**	-.21**	-.20**	-.15*	1.00				
11. MASC	.19**	-.32**	.36**	-.29**	.26**	-.03	-.17*	-.24**	.10	-.09	1.00			
12. FEM	-.07	.14*	-.06	.06	.13*	.01	.06	-.11**	.10	.01	.18**	1.00		
13. MCOURS	.04	-.23**	.33**	-.18**	.04	.09	.04	-.17*	-.01	-.08	.02	.01	1.00	
14. TABILITY	.29**	-.39**	.40**	-.51**	-.04	.23	-.03	-.12*	.10	-.26**	.05	-.18*	.34**	1.00

Significance levels: **p ≤ .001; *p ≤ .05.

Table 3

Decomposition of the Effects from the Path Analysis (Whole sample; n = 289).

Effect	Causal Effects: Direct	Indirect	Total	R^2 (reduced model)
On OCCUP				
Of INT	-.42	.00	-.42	.17
Of SES	-.01	not included in reduced model		
Of TABILITY	.29	.00	.29	
On INT				
Of MSE	-.54	.00	.54	.30
On MSE				
Of MAS	-.58	.00	-.58	.42
Of IAEIS	.20	.00	.20	
Of FOREIS	.06	not included in reduced model		
Of MOREIS	-.10	not included in reduced model		
Of DIFEIS	-.13	not included in reduced model		
Of MASC	.37	.22	.59	
Of MCOURS	.33	.10	.43	
Of TABILITY	.40	.30	.70	
On MAS				
Of MASC	-.29	.00	-.29	.33
Of MCOURS	-.18	.00	-.18	
Of TABILITY	-.51	.00	-.51	
On IAEIS				
Of AGE	.19	.00	.19	.11
Of MASC	.25	.00	.25	
Of FEM	.12	not included in reduced model		
On FOREIS	This variable not included in reduced model			
Of AGE	-.32			
Of MASC	-.03			
Of FEM	.01			
On MOREIS	This variable not included in reduced model			
Of AGE	-.21			
Of MASC	-.17			
Of FEM	.06			
On DIFEIS	This variable not included in reduced model			
Of AGE	-.20			
Of MASC	-.23			
Of FEM	-.11			

Table 4

Summary of Overall Fit Information for Initial, Revised and Final Models of Whole Sample (n=289).

Model	χ^2	df	p	Goodness of Fit Index	Root Mean Square Residual	Coefficient of Determination Structural Equation	Squared Multiple Correlations[a] Equations	Modification Indices[a]	t-values[a]	Standardized Residuals[a]
Initial										
	37.41	17	.003	.962	.049	.50	IAEIS= .110 OCCUP= .182	MSE/THETA EPSILON= 9.60	MCOURS/MAS= -.103 TABILITY/MSE= 1.63	TABILITY/INT= -2.72 OCCUP/INT= -2.31
Revised										
	29.92	16	.042	.97	.037	.582	IAEIS= .110 OCCUP= .191	MSE/AGE= 10.35	MCOURS/MAS= -1.03	-- --
Final										
	15.98	16	.454	.98	.033	.625	IAEIS= .110 OCCUP= .193	-- --	IAEIS/MSE= 1.377	-- --

[a] Reported values are those which indicate a need for modification of the model.

Table 5

Homogeneity of Variance-Covariance Matrices by Sex.

Box's M	F	df	p	χ^2	df	p
163.20	1.38	105,48887	.006	145.77	105	.000

Table 6

Univariate Analysis of Variance of each Variable by Sex (df=1,141).

Variable	Hypothesized Sum of Squares	Error Sum of Squares	Hypothesized Mean Squares	Error Mean Squares	f	Significance of f
SES	114.50	35736.75	114.50	253.45	.452	.503
AGE	15.77	1917.94	15.77	13.60	1.159	.283
MASC	5.87	77.72	5.87	.55	10.655	.001**
FEM	13.73	59.49	13.73	.42	32.545	.000**
MCOURS	1.30	172.30	1.30	1.22	1.066	.304
TABILITY	1408.53	13988.29	1408.53	99.21	14.198	.000**
DIFEIS	.25	56.34	.25	.39	.61	.434
MOREIS	1.89	56.56	1.89	.40	4.72	.031*
FOREIS	1.68	91.88	1.68	.65	2.58	.110
IAEIS	.14	60.23	.14	.43	.33	.568
MAS	5.51	140.94	5.51	.99	5.51	.020*
MSE	61.48	353.98	61.48	2.51	24.49	.000**
INT	2.06	24.85	2.06	.18	11.71	.001**
OCCUP	32.48	165.19	32.48	1.17	27.72	.000**

Significance levels: *$p < .05$; **$p < .001$

Table 7

Decomposition of the Effects from the Path Analysis for Males (n = 289).

Effect	Causal Effects Direct	Indirect	Total	R^2 (reduced model)
On OCCUP				
Of INT	-.35	.00	-.35	.12
Of SES	-.00	not included in reduced model		
Of TABILITY	.27	.00	.27	
On INT				
Of MSE	-.54	.00	.54	.30
On MSE				
Of MAS	-.45	.00	-.45	.30
Of IAEIS	.22	.00	.22	
Of FOREIS	.04	not included in reduced model		
Of MOREIS	-.09	not included in reduced model		
Of DIFEIS	-.20	.00	-.20	
Of MASC	.33	.27	.60	
Of MCOURS	.32	.10	.42	
Of TABILITY	.24	.22	.46	
On MAS				
Of MASC	-.32	.00	-.32	.40
Of MCOURS	-.23	.00	-.23	
Of TABILITY	-.51	.00	-.51	
On IAEIS				
Of AGE	.23	.00	.23	.32
Of MASC	.22	.00	.22	
Of FEM	.13	not included in reduced model		
On FOREIS	This variable not included in reduced model			
Of AGE	-.25			
Of MASC	-.01			
Of FEM	.08			
On MOREIS	This variable not included in reduced model			
Of AGE	-.13			
Of MASC	-.28			
Of FEM	-.03			
On DIFEIS				.20
Of AGE	-.15	.00	-.15	
Of MASC	-.41	.00	-.41	
Of FEM	-.15	.00	-.15	

Table 8

Summary of Overall Fit Information for Initial, Revised and Final Models of Male Sample (n=118).

Model	χ^2	df	p	Goodness of Fit Index	Root Mean Square Residual	Coefficient of Determination Structural Equation	Squared Multiple Correlations[a] Equations	Modification Indices[a]	t-values[a]	Standardized Residuals[a]
Initial	33.29	28	.225	.933	.085	.132	OCCUP= .076 INT= .128 IAEIS= .110	INT/MAS= 7.319 OCCUP/THETA EPSILON=5.29	IAEIS/MSE= .127 DIFEIS/MSE= -5.62 AGE/DIFEIS= -1.635 MASC/IAEIS= 1.68 FEM/DIFEIS= -.328 MCOURS/MAS= .266 TABILITY/MSE= .160	INT/MSE= -2.8 INT/MAS= -2.61
Revised	20.80	19	.348	.949	.08	.473	OCCUP= .076	OCCUP/THETA EPSILON=5.287 INT/TABILITY= 5.287 MAS/INT= 7.374 OCCUP/INT= 5.287	IAEIS/MSE= 1.270 MASC/IAEIS= 1.681	INT/MSE= -2.729 INT/MAS= 2.624
Final	8.31	9	.503	.972	.067	.185	INT= .028			

[a] Reported values are those which indicate a need for modification of the model.

Table 9

Decomposition of the Effects from the Path Analysis for Females (n = 170).

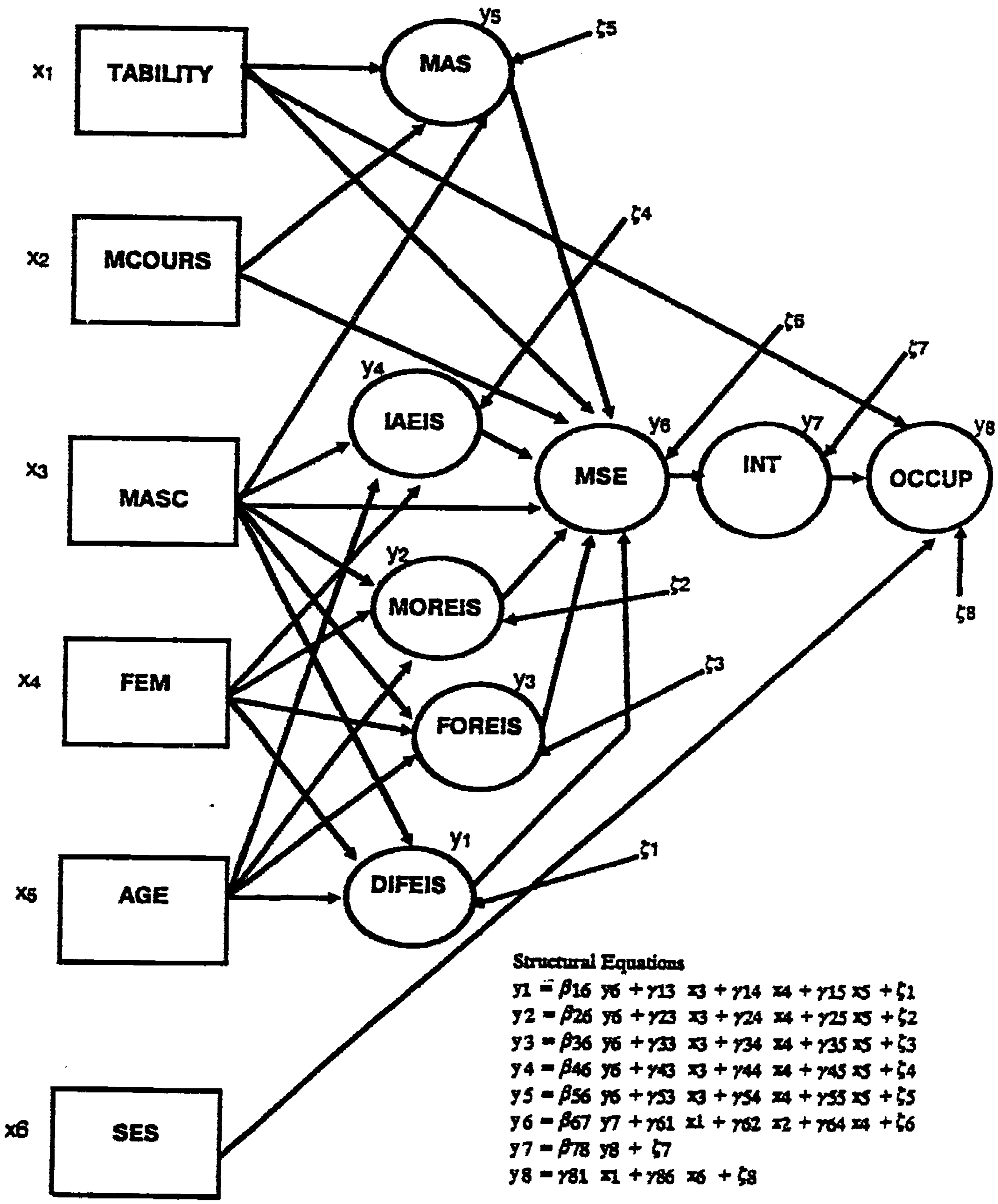
Effect	Causal Effects Direct	Indirect	Total	R^2 (reduced model)
On OCCUP				
Of INT	-.41	.00	.41	.14
Of SES	-.03	not included in reduced model		
Of TABILITY	.21	.00	.21	
On INT				
Of MSE	-.49	.00	.49	.24
On MSE				
Of MAS	-.61	.00	-.61	.51
Of IAEIS	.18	.00	.18	
Of FOREIS	.02	not included in reduced model		
Of MOREIS	-.04	not included in reduced model		
Of DIFEIS	-.12	not included in reduced model		
Of MASC	.32	.18	.50	
Of MCOURS	.37	.10	.47	
Of TABILITY	.44	.30	.74	
On MAS				
Of MASC	-.22	.00	.22	.29
Of MCOURS	-.17	.00	.17	
Of TABILITY	-.50	.00	-.50	
On IAEIS				
Of AGE	.16	.00	.16	.12
Of MASC	.28	.00	.28	
Of FEM	.15	.00	.15	
On FOREIS	This variable not included in reduced model			
Of AGE	-.37			
Of MASC	-.09			
Of FEM	.09			
On MOREIS	This variable not included in reduced model			
Of AGE	-.27			
Of MASC	-.03			
Of FEM	.03			
On DIFEIS	This variable not included in reduced model			
Of AGE	-.23			
Of MASC	-.14			
Of FEM	-.00			

Table 10

Summary of Overall Fit Information for Initial, Revised and Final Models of the Female Sample (n=170).

Model	χ^2	df	p	Goodness of Fit Index	Root Mean Square Residual	Coefficient of Determination Structural Equation	Squared Multiple Correlations[a] Equations	Modification Indices[a]	t-values[a]	Standardized Residuals[a]
Initial										
	56.98	21	.000	.918	.092	.449	OCCUP= .046 IAEIS= .122	INT/MAS 6.75 INT/MSE= 16.84 OCCUP/INT= 11.47 AGE/MAS= 10.70 MAS/INT= 7.24 MCOURS/INT= 8.33 TABILITY/INT= 11.47 OCCUP/THETA EPSILON=11.47	IAEIS/MSE= 1.11 MASC/MAS= -.831 FEM/IAEIS= .754 MCOURS/MAS= 1.536	INT/MSE= -4.72 MASC/INT= -3.22 TABILITY/MSE= -3.35 MASE/MAS= 2.79
Revised										
	21.34	9	.011	.951	.082	.447	OCCUP = .195	INT/MSE= 8.165 OCCUP/MSE= 3.22 MASC/INT= 8.78 MASC/OCCUP= 12.47		INT/MSE= -2.66 MASC/INT= -3.21
Final										
	8.11	8	.423	.981	.036	.519				

[a] Reported values are those which indicate a need for modification of the model.



Structural Equations

$y_1 = \beta_{16}\, y_6 + \gamma_{13}\, x_3 + \gamma_{14}\, x_4 + \gamma_{15}\, x_5 + \zeta_1$

$y_2 = \beta_{26}\, y_6 + \gamma_{23}\, x_3 + \gamma_{24}\, x_4 + \gamma_{25}\, x_5 + \zeta_2$

$y_3 = \beta_{36}\, y_6 + \gamma_{33}\, x_3 + \gamma_{34}\, x_4 + \gamma_{35}\, x_5 + \zeta_3$

$y_4 = \beta_{46}\, y_6 + \gamma_{43}\, x_3 + \gamma_{44}\, x_4 + \gamma_{45}\, x_5 + \zeta_4$

$y_5 = \beta_{56}\, y_6 + \gamma_{53}\, x_3 + \gamma_{54}\, x_4 + \gamma_{55}\, x_5 + \zeta_5$

$y_6 = \beta_{67}\, y_7 + \gamma_{61}\, x_1 + \gamma_{62}\, x_2 + \gamma_{64}\, x_4 + \zeta_6$

$y_7 = \beta_{78}\, y_8 + \zeta_7$

$y_8 = \gamma_{81}\, x_1 + \gamma_{86}\, x_6 + \zeta_8$

Figure 1. Proposed structural model

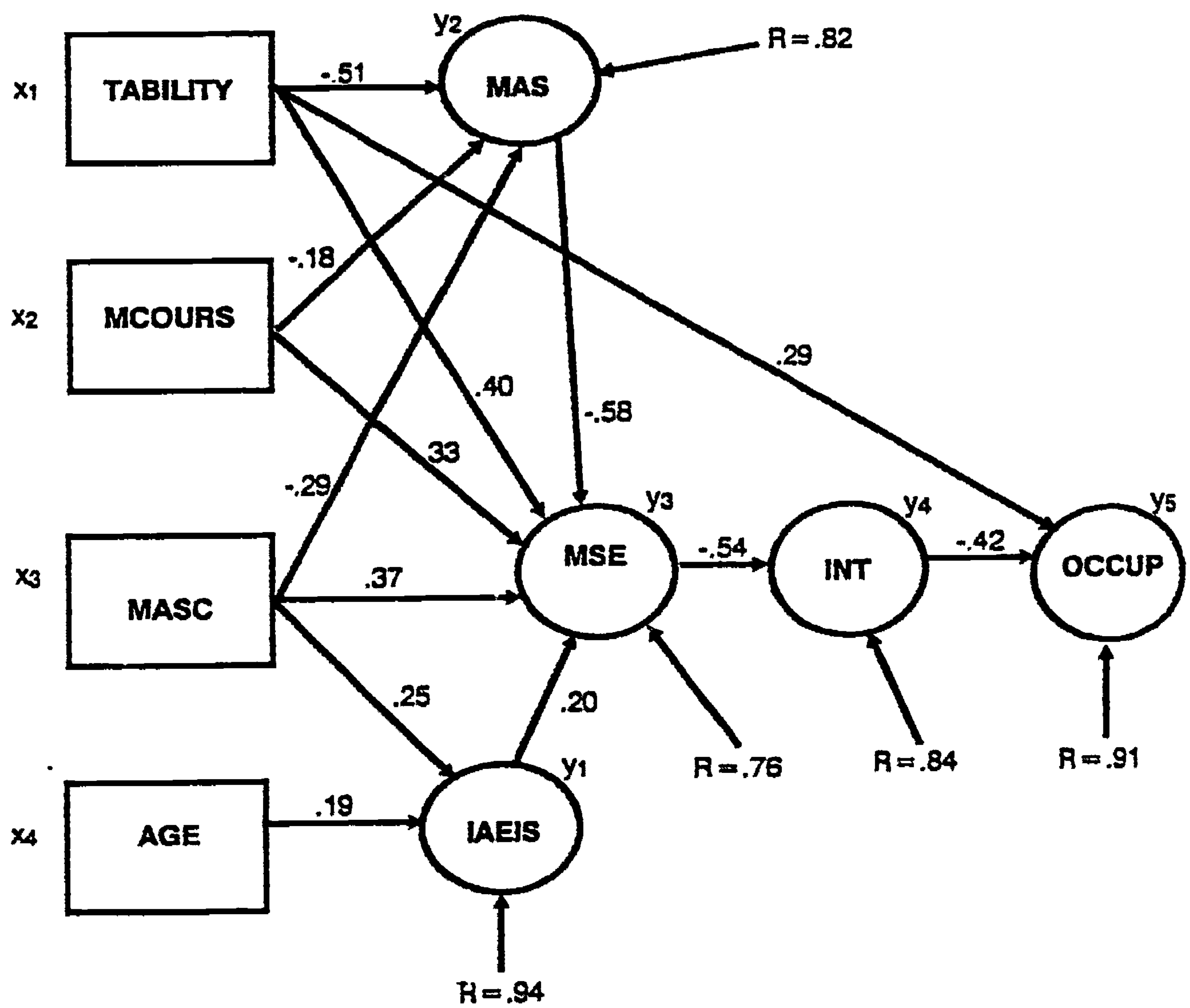


Figure 2. Reduced path model - whole sample

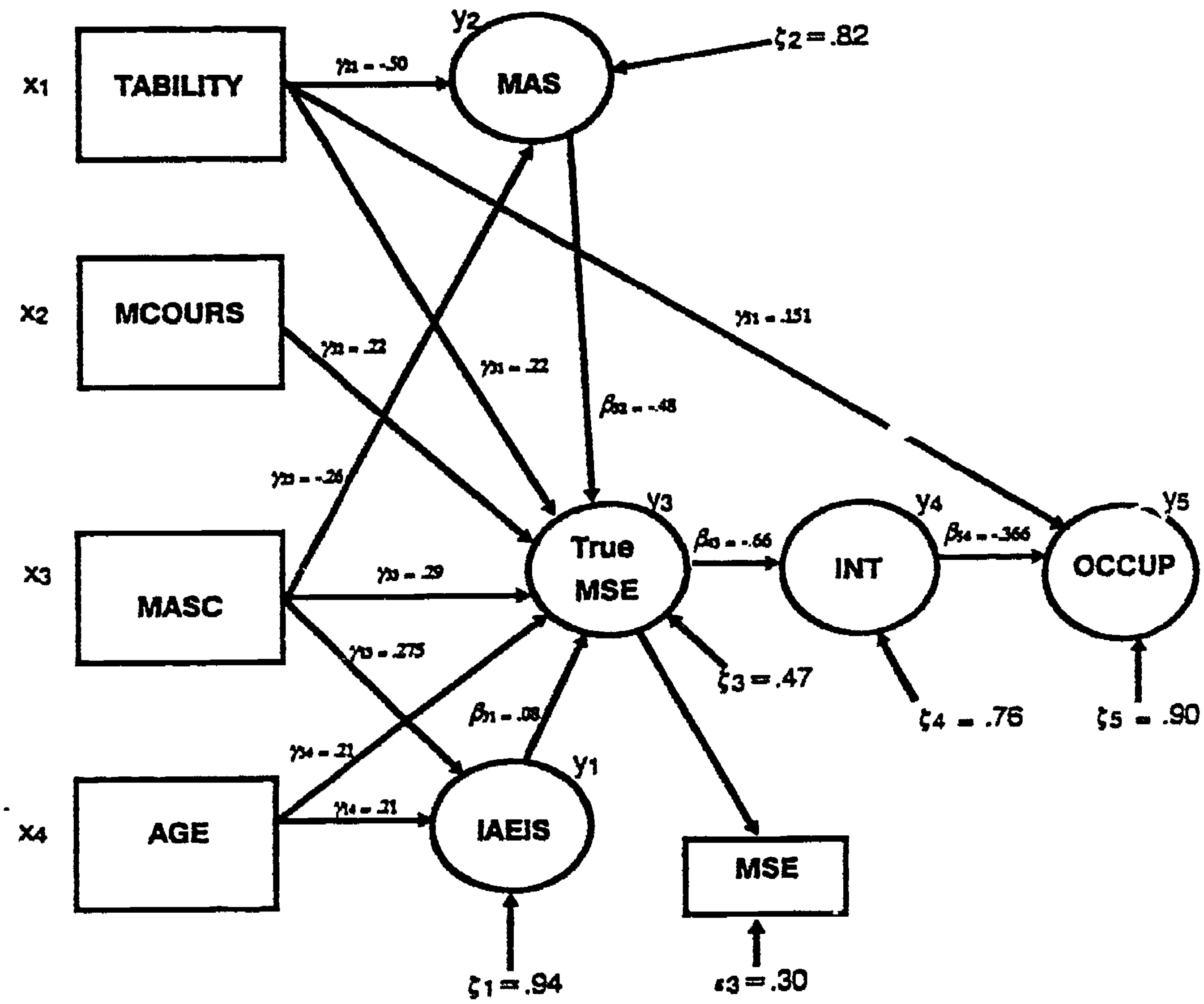


Figure 3. Final structural model - whole sample

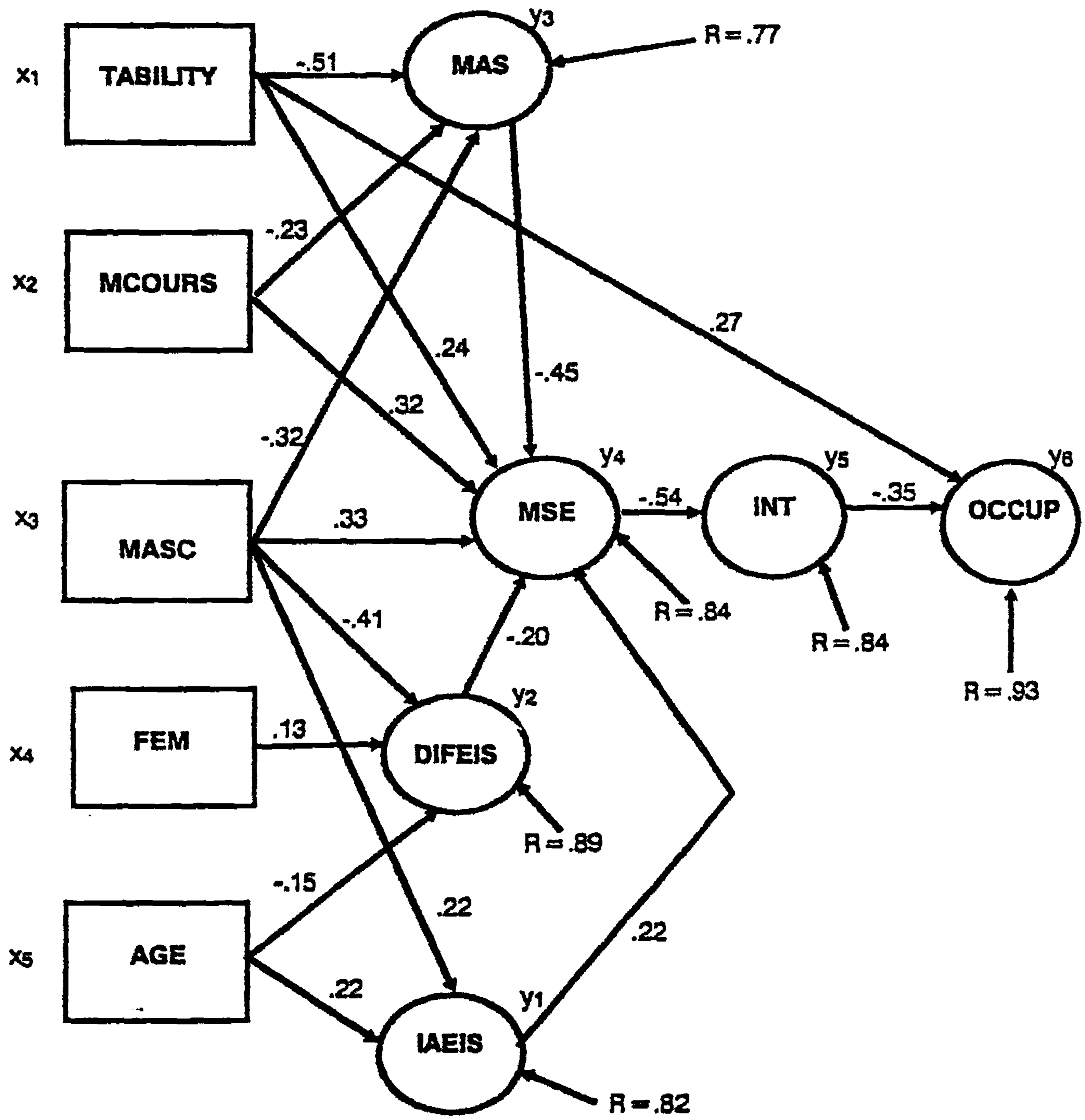


Figure 4. Reduced path model for males

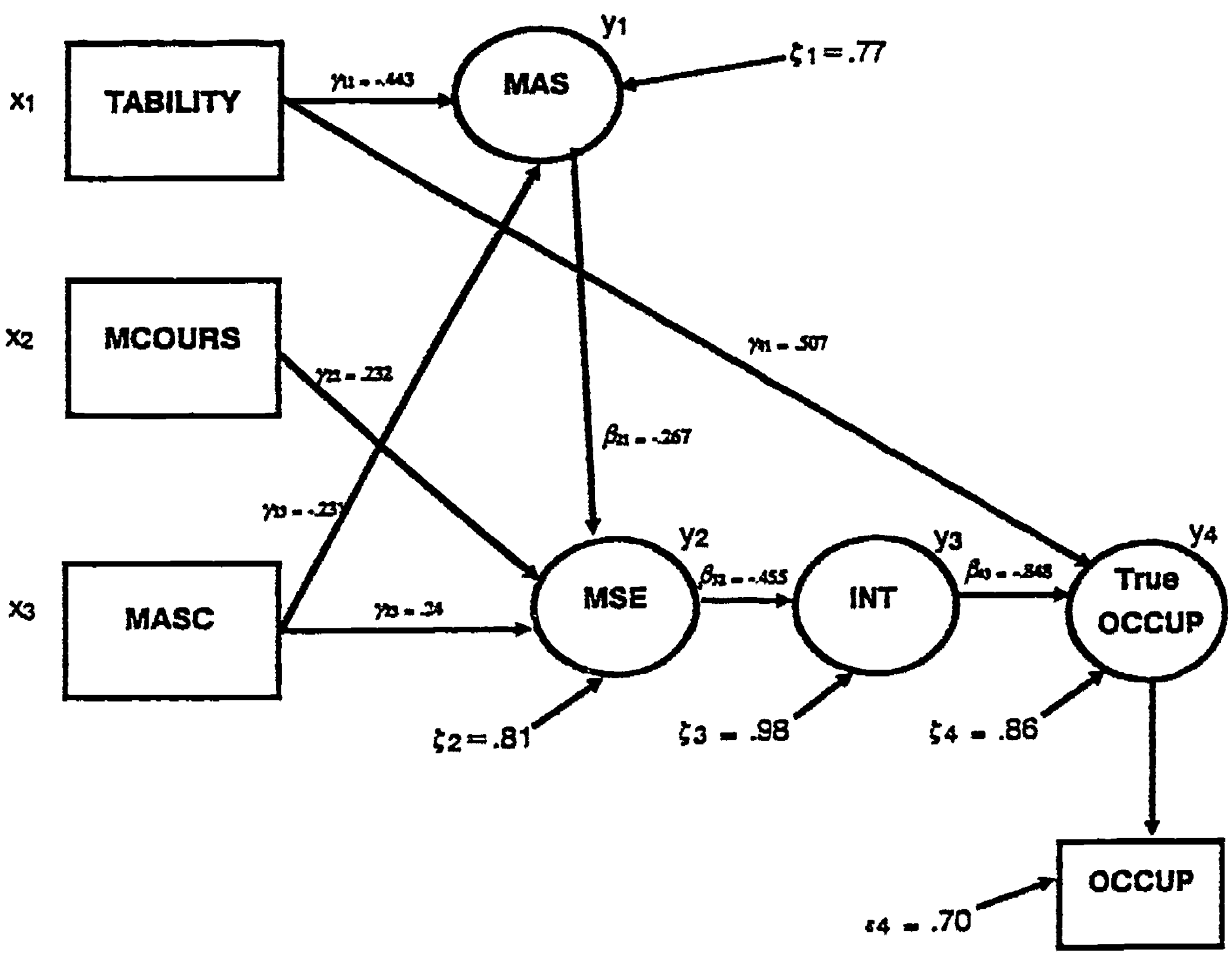


Figure 5. Final structural model for males

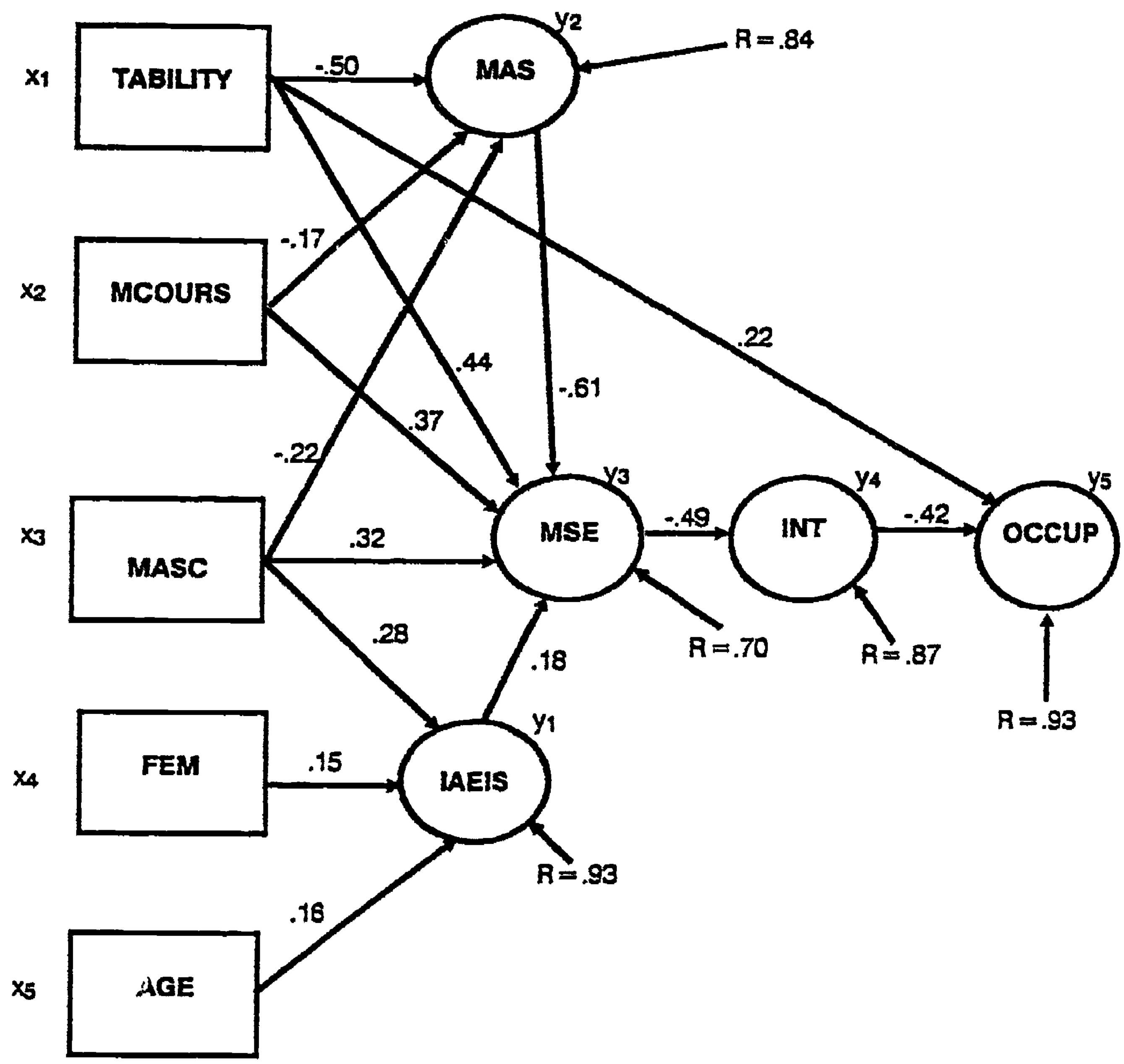


Figure 6. Reduced path model for females

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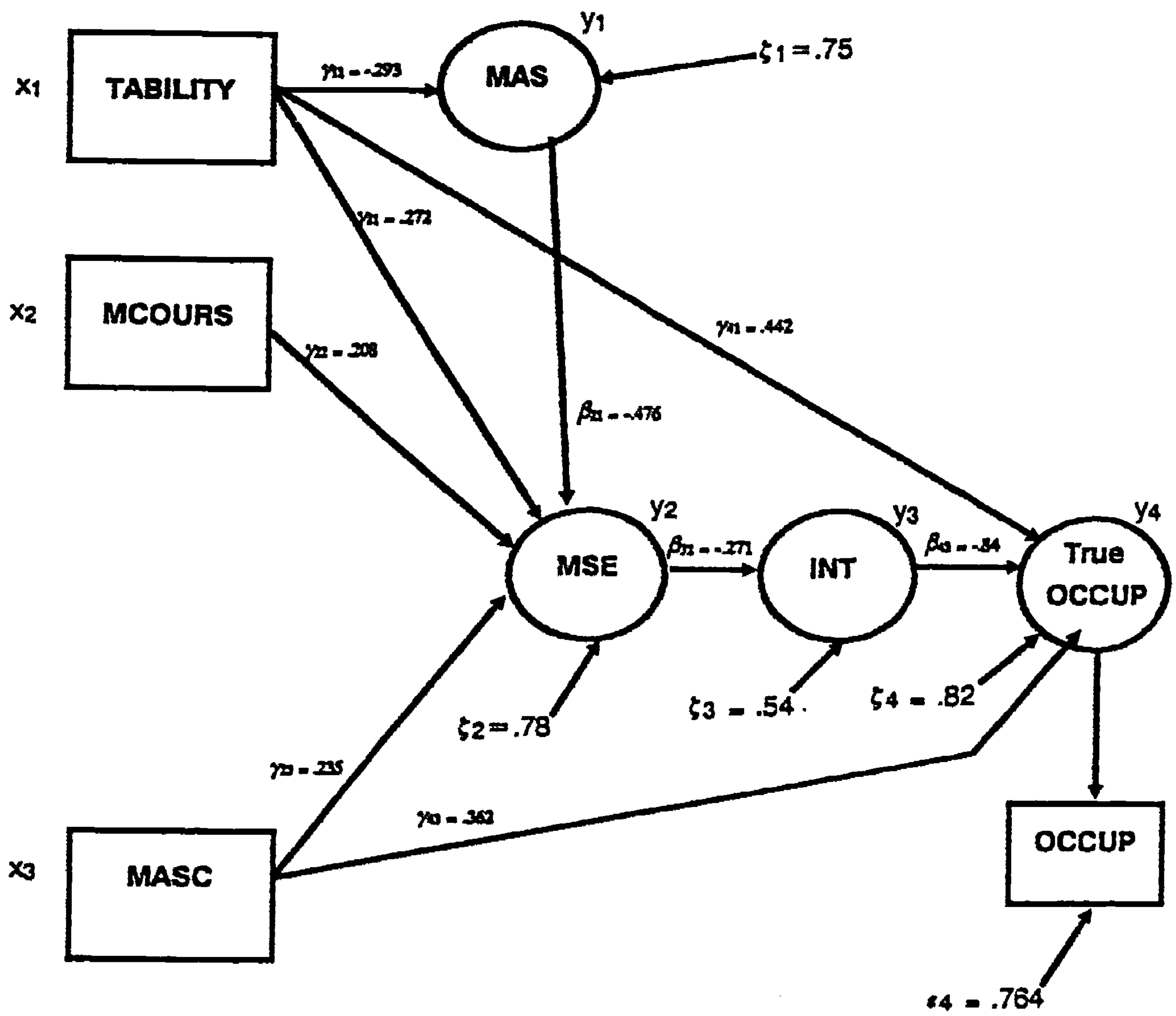

Figure 7. Final structural model for females