

PATHS TO ACHIEVEMENT MOTIVATION OF WOMEN PHYSICS MAJORS IN INDIA: MEDIATIONAL ROLES OF CAREER VALUES AND FAMILY VALUES

Paromita Ghosh

Department of Home Science, University of Calcutta, Kolkata (India)

paromitahsc@rediffmail.com

Aim of the study was to compare mediational roles of career and family values in causal pathways from variables viz. college, year of study and facets of locus of control to achievement motivation. Participants were random sample of 300 women Physics majors of West Bengal (India). A general information schedule and three standardized instruments were used to collect data from participants. Path analysis revealed feeble mediational roles of career and family values. Participants' achievement motivation seemed to reduce with increment in year of study. Internal locus of control facilitated achievement motivation.

INTRODUCTION

In India, women's engagement with science encounters difficulty. Patrifocal culture resulting in gendered socialization poses problem. Women's intellect is generally undervalued; they are denied autonomy and groomed for domesticity. Society considers science careers unsuitable for women as these require more time, money and effort. Among sciences, Physics is regarded highly abstract therefore masculine. So Physics major is not preferred for women in India. Often they are prevented from choosing it. Besides, many women leave the subject (Chandra et al., 2009; Hazari & Potvin, 2005). Thus it is worthwhile to study causal trajectories of achievement motivation of women majoring in Physics. It may suggest ways of sustaining or augmenting their achievement motivation so that underachievement and attrition are reduced. Such path analytic investigations are scarce in India. The present study tries to plug the lacuna. With achievement motivation as dependent variable, search for pertinent predictors led to variables like college, year of study, locus of control, career values and family values of women Physics majors. Various aspects of college experience e.g. teaching, teacher-student interaction, student-involvement in college activities and peer culture have been found to influence students' achievement motivation (Astin, 1993; Haque, 2014; Pascarella & Terenzini, 1991). Year of study refers to the duration a major (in this case Physics) was studied and hence it's influence on pupil's achievement motivation. Slump in achievement motivation over undergraduate years was noted. Achievement motivation of German freshmen (mostly STEM students of either gender) was found to drop over the first semester due to change in reference groups, disillusionment and increased task-difficulty (Dresel & Grassinger, 2013). Researches in India generally reveal close relation between locus of control and achievement motivation of females (Ghosh, 2013; Sreekala, 2010; Vasudeva & Lehal, 1986). Sreekala (2010) reported that high school students' achievement motivation rose with enhancement in tendency of attributing personal causation. Vasudeva and Lehal (1986) studied college women and found that self-oriented sex-role attitudes were associated with internal locus of control and higher need for achievement. Ghosh (2013) reported that volitional choice of a science major by women undergraduates fuelled their achievement motivation while imposed discipline-choice hampered it. Most researches affirm positive association between career values and achievement motivation of women (Perron & St-Onge,

1991; Research Papers Center, 2010). Perron and St-Onge (1991) reported that majority of undergraduates (including women) stated that their main goal was to receive education and secure employment. They intended to start families after settling in careers. Research Papers Center (2010) recorded an investigation which confirmed powerful relationship between career values and achievement motivation of college students of either gender. There is repeated corroboration of inverse relation shared by family values and achievement motivation of women (Bhargava, 1985; Etzkowitz et al., 1994; Gupta & Sharma, 2002; Schweitzer et al., 2011). Bhargava (1985) found lack of achievement motivation due to family and socio-cultural pressures among female medical students in India. Etzkowitz et al. (1994) stated that in the USA women in science either focused on career or juggled family and career. The latter were stronger believers in family values but trailed the former in achievement motivation. Gupta and Sharma (2002) studied women scientists at the Indian Institutes of Technology and universities. Responses of these women manifested how primacy of family values obstructed achievement motivation. Schweitzer et al. (2011) worked with Canadian post-secondary students. Girls lacked career expectations as they intended to balance personal lives with careers.

Variables viz. college, year of study and locus of control were reportedly linked with career and family values of female undergraduates. Influence of college (through teacher-student interaction, role models etc.) on women's career values has been found (Almquist & Angrist, 1971; Astin, 1993; Pascarella & Terenzini, 1991). Mixed results have emerged from investigations on relations of year of study with career values (Armenio et al., 2012; Wilson et al., 2006). Armenio et al. (2012) detected rise in career expectations with increase in years of study at undergraduate level. But Wilson et al. (2006) failed to find significant difference in top-career ambitions and reasons for career choice between first and final year pharmacy students. Mitchell et al. (2008) held studying natural science major responsible for diminished importance of family among pupils. In this investigation, influences of college and year of study appear to mingle and manifest as student-engagement with major. Researches generally suggest that career-oriented women tend to display internal locus of control while externals are less career-oriented; strong family values seem consonant with external locus of control (Chanana, 2004; Marecek & Frasch, 1977; Vasudeva & Lehal, 1986). Chanana (2004) found lives of females in India to be largely controlled by authority figures. Vasudeva and Lehal (1986) reported that individualistic sex-role attitudes tended to be closely associated with self-determination among college women in India. Marecek and Frasch (1977) studied female undergraduates in the USA. It emerged that those with external locus of control expected to be less career-oriented and felt uncomfortable over violation of sex-role stereotypes. Survey of pertinent researches reveal paucity of studies conducted in India. Findings of those set in India concur with those conducted elsewhere. However studies in India highlight pronounced patrifocal culture; gendered socialization; consequent dominance of family over career values; deficits in autonomy and achievement motivation among females (Bhargava, 1985; Chanana, 2004, Chandra et al., 2009, Gupta & Sharma, 2002; Vasudeva & Lehal, 1986). Therefore results of the present study could be illuminating. As similar factors apparently influenced achievement motivation and career / family values; and these values in turn were found to influence achievement motivation, a path analytic study with career / family values as mediators was planned. It was intended to compare mediational roles of career and family values due to their conflicting roles (Bhargava, 1985; Etzkowitz et al., 1994; Gupta & Sharma, 2002; Perron & St-Onge, 1991; Research Papers Center, 2010; Schweitzer et al., 2011).

PRESENT STUDY: HYPOTHESES

Ho₁: Achievement motivation of women majoring in Physics cannot be predicted by their college, year of study, locus of control and career values.

Ho₂: Achievement motivation of women majoring in Physics cannot be predicted by their college, year of study, locus of control and family values.

METHODOLOGY

Participants

The sample comprised 300 women enrolled in Physics (Honours) courses in 22 colleges spread over 6 districts of West Bengal (a state in India) viz. Kolkata, North 24 Parganas, South 24 Parganas, Howrah, Hooghly and Nadia. Area sampling was used to randomly select colleges. From women Physics majors in these colleges, random sample was drawn for selection of participants. Participants were aged between 19 and 22 years. Students of all 3 years of study in college were included in the sample. But about 83% of participants were 1st year students. This was because most college authorities denied permission to collect data from senior students lest their classes were hampered. Consenting students participated in the study.

Operational Definitions of Variables

1. Achievement Motivation: Tendency to attempt to succeed in contest with others with some benchmark of merit set by the person (Deo & Mohan, 2011).
2. Career Values: Attitudes towards remunerated work, occupational interests and motivation to work capably (Tanwar & Singh, 1988).
3. Family Values: Attitudes towards marriage, family relationships and interest in home management (Tanwar & Singh, 1988).
4. College: Ethos of a particular college embodying unique combination of location, guiding philosophy, history, institutional type, type of affiliating university, infrastructural facilities, faculty strength and qualifications, student strength and background, level of performance of institution on curricular, co-curricular and employment prospect indicators etc. In this study, colleges were not categorized but each was regarded unique.
5. Year of Study: 1st (freshman), 2nd (sophomore) or 3rd (final) year in college indicating duration of student-engagement with a particular major – Physics (Honours) in this case.
6. Locus of Control: Belief about one's outcomes in life being controlled by internal or external determinants. It has the following 3 aspects: - Powerful Others: belief that one's outcomes are determined by powerful people; Chance Control: belief that one's outcomes are determined by random events; Individual Control: belief that one's outcomes are determined by oneself (Vohra, 1992).

Instruments

1. General Information Schedule: Devised by the author to collect participants' particulars.

2. Achievement Motivation Scale (Deo & Mohan, 2011): Has 50 statements with scale for responding. Covers academic motivation, need for achievement, achievement anxiety etc. Suited for persons aged at least 13 years.
3. Career and Family Values Scale (Tanwar & Singh, 1988): Has 40 statements with Likert scaling. 20 items each assess attitudes towards occupational and family lives of women. Devised for use with women undergraduates.
4. Levenson's Scale for Locus of Control, Indian Adaptation (Vohra, 1992): Has 24 statements on perceived control over personal outcomes. Statements can be responded to on Likert scale. 3 scores emerge –1 each for powerful others, chance and individual control. Devised for use with youth and adults.

Instruments were administered to women Physics majors in groups of about 20 students each. Data were collected at colleges.

RESULTS AND DISCUSSION

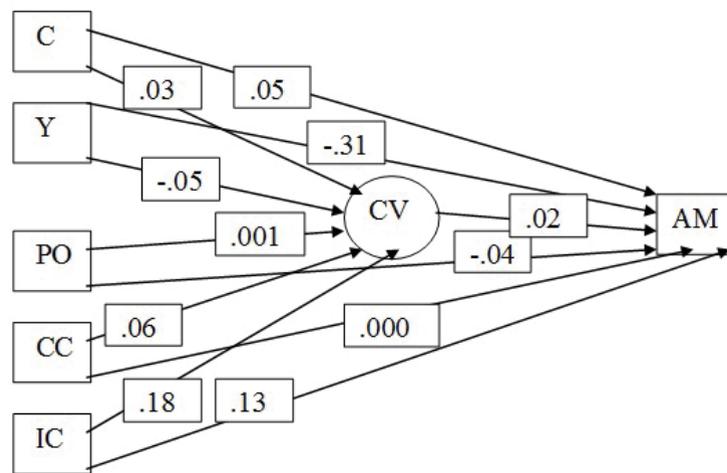


Figure 1: Causal pathways (bearing Beta values) to achievement motivation via career values of participant women physics majors [C: college; Y: year of study; PO: powerful others; CC: chance control; IC: individual control; CV: career values; AM: achievement motivation]

Figure 1 presents outcomes of primary and final steps in path analysis with career values of respondents as mediator and their achievement motivation as ultimate dependent variable. In the figure, values of standardized regression coefficient (Beta) appear. Causal pathways from predictors – college; year of study; perceived control exerted by powerful others, chance and the individual herself to the intermediary i.e. career values of participants are primarily charted. Then paths are traced from predictors viz. college; year of study; locus of control; and career values of participants to their achievement motivation. In the primary step, value of coefficient of multiple correlation ($R = .19$; $df 298$; $p < .01$) indicates that participants' career values bear significant relation with variables viz. college, year of study and three aspects of locus of control. Value of coefficient of multiple determination ($R^2 = .04$) suggests that only 4% of variance in participants' career values scores can be predicted by these variables. F-value of 2.22 ($df 5, 294$; $sig. .05$) shows that career values cannot be significantly predicted by the select variables. However, Figure 1 shows that individual control (belief that outcomes in life are self-governed) with Beta-value of .18 contributes the most to prediction of career

values of sampled women. This is congruent with Vasudeva and Lehal's (1986) finding that career oriented Indian women manifest internal locus of control. In final step of path analysis, R is .32 (df 298; $p < .01$) pointing out that achievement motivation of participating women Physics majors share somewhat strong and significant relation with variables viz. their college, year of study, facets of locus of control and career values. R² is .10 demonstrating that 10% of variance in sampled women's achievement motivation scores can be predicted by these variables. F-value of 5.50 (df 6, 293; sig. .000) indicates that achievement motivation of participant women Physics students can be significantly predicted by their college, year of study, aspects of locus of control and career values. Thus Ho1 is rejected; evidence points towards alternative hypothesis. This outcome agrees with those of Astin (1993), Dresel and Grassinger (2013), Ghosh (2013), Haque (2014), Pascarella and Terenzini (1991), Perron and St-Onge (1991), Research Papers Center (2010), Sreekala (2010) and Vasudeva and Lehal (1986). Figure 1 reveals that strongest determiner of participants' achievement motivation is year of study (Beta=-.31). It is followed by an aspect of locus of control viz. individual control (belief that outcomes in life are under own control) with Beta-value of .13. Negative sign of Beta value for year of study and it's coded categories indicate that participant women's achievement motivation apparently drops with more years of engagement with Physics major. This finding endorses that of Dresel and Grassinger (2013) which holds change in norm, disenchantment and elevated academic demands responsible for declining achievement striving. These issues probably plague the present sample and can be addressed by ensuring that women who are apt are drawn to Physics major; and the academic experience stimulates; includes; and promises bright prospect. The outcome – participants' achievement motivation are promoted by their perception of autonomy over events in their lives echo those of Ghosh (2013), Sreekala (2010) and Vasudeva and Lehal (1986). Plausibly tendency of self-determination leads to development of traits of independence and industry in women – traits which ignite desire for success.

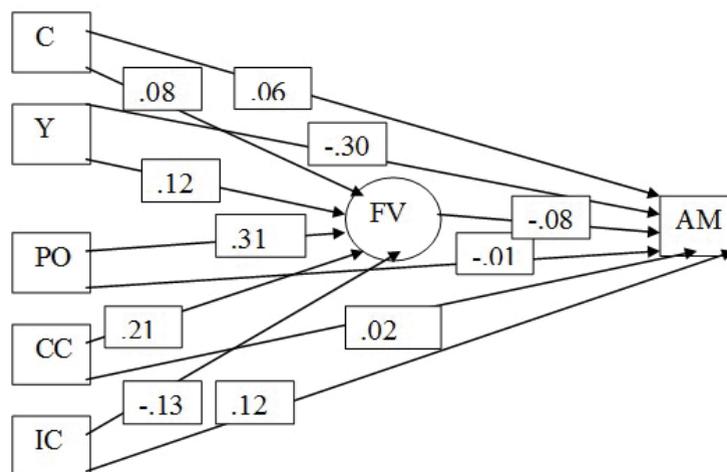


Figure 2: Causal pathways (bearing Beta values) to achievement motivation via family values of participant women physics majors [C: college; Y: year of study; PO: powerful others; CC: chance control; IC: individual control; FV: family values; AM: achievement motivation]

Results (Figure 2) pertain to primary and final steps of path analysis with family values of participants as mediator and their achievement motivation as eventual dependent variable. In

the primary step, R is .53 (df 298; $p < .01$) suggesting that participants' family values is associated significantly with variables viz. college, year of study and facets of locus of control. R^2 is .28 indicating that as much as 28% of variance in sampled women's family values scores can be predicted by these variables. F -value of 22.96 (df 5, 294; sig. .000) also shows that family values can be significantly predicted by the select variables. This finding is supported by those of Marecek and Frasch (1977) and Mitchell et al. (2008). Moreover, Figure 2 manifests that powerful others (belief that one's outcomes in life are controlled by authority figures) bearing Beta-value of .31 is prime determiner of extent of family values of sampled women majoring in Physics. This result agrees with those of Bhargava (1985), Chanana (2004), Gupta and Sharma (2002) and Marecek and Frasch (1977). The predictor viz. chance control (belief that outcomes in one's life are determined by random events) with Beta-value of .21 also contributes substantially to prediction of family values of sampled women. Thus externally controlled women revere family as power-hub and refuge. In the final step of path analysis, R is .32 (df 298; $p < .01$) indicating that achievement motivation of participating women Physics majors share fairly potent and significant relation with variables viz. their college, year of study, facets of locus of control and family values. R^2 is .11 showing that 11% of variance in sampled women's achievement motivation scores can be predicted by these variables. F -value of 5.73 (df 6, 293; sig. .000) suggests that achievement motivation of participant women Physics majors can be significantly predicted by their college, year of study, facets of locus of control and family values. Thus H_02 is rejected; alternative hypothesis seems tenable. This outcome agrees with those of Astin (1993), Bhargava (1985), Dresel and Grassinger (2013), Etzkowitz et al. (1994), Ghosh (2013), Gupta and Sharma (2002), Haque (2014), Pascarella and Terenzini (1991), Schweitzer et al. (2011), Sreekala (2010) and Vasudeva and Lehal (1986). Figure 2 shows that chief determinant of participants' achievement motivation is year of study (Beta=-.30). It is followed by individual control (belief that events in life are self-governed) with Beta-value of .12. Negative sign of Beta value for year of study and coding of the variable imply that sampled women's achievement motivation decreases with more years of involvement with Physics major. It supports Dresel and Grassinger's (2013) outcome and plausibly reflects students' disappointment which can be reduced by attracting suitable women to Physics; and making the course invigorating; inclusive; and a foundation for better future. The finding regarding participants' achievement motivation being facilitated by their perceived self-determination agrees with those of Ghosh (2013), Sreekala (2010) and Vasudeva and Lehal (1986). Autonomy seems to foster self-reliance and effort which possibly spawn aspiration for success.

CONCLUSION

Mediational roles of career and family values appear weak. Direct effect model seems justifiable. Year of study and perceived autonomy substantially influence achievement motivation of sampled women Physics majors. The result about year of study is based on the sample which comprises a minority of senior students. But stringent sampling and parametric testing ensured that the finding was dependable. So women Physics students' achievement motivation must be boosted through interactive teaching, peer study groups, collaborative projects and seminars on career prospects. These would reduce gradual disenchantment and uphold Physics as good career-choice for females. Besides, women Physics majors in India need greater autonomy for promoting their achievement strivings. Given the patri-focality in India, regular parental counselling should be organized by institutions so that women's lasting

involvement with Physics is encouraged. Guidance programmes must be nationally implemented so that diffidence of females in shaping their careers is dispelled.

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