15 Transmitting educational values: parent occupation and adolescent development

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The unique culture of math and science professions is likely to influence how parents in these occupations interact with their children and what resources and encouragement they are willing and able to provide for them. Bourdieu (1977) conceptualized this intergenerational transmission of knowledge, skills, and interests as cultural capital. The requirements and expectations of parents' work environments impact parents' values; these values in turn influence parenting practices (Kohn, Slomczynski, and Schoenbach 1986; Mortimer and Kumka 1982) and the cultural capital parents provide for their children.

Parenting practices that challenge adolescents to do their best, encourage them to use their time wisely, and support post-secondary attendance and career choices are practices that most parents, regardless of their social status or income, value and engage in. The educational expectations that parents have for their children are typically quite high, with an overwhelming majority expecting their children to graduate from college (Schneider and Stevenson 1999). However, it is expected that parents employed in scientific fields interact differently with their adolescents in subtle ways, influenced by the distinct culture of their professions. In particular, these parents are likely to incorporate parenting behaviors in tune with the values and norms of their professions. Such differences should be apparent in daily interactions between parent and child as well as in the educational planning process, creating somewhat different cultural capital in these homes that influences adolescents' educational values as well as their psychological attributes (Ryu and Mortimer 1996).

In this chapter, day-to-day interactions and family dynamics are examined to understand how parents transmit educational values to their children. Family members typically have multiple interactions regarding educational goals, motivations, and time use, providing an opportunity to examine the process of transmission in detail. This chapter investigates whether the transmission process via parenting practices differs by occupational field and parent gender and what effect these practices have on adolescents' educational values, happiness and enjoyment at home and

at school, their motivation to succeed, and their sense of meeting their own expectations and the expectations of others.

Intergenerational transmission of values

The process of the intergenerational transmission of values and the effect of family characteristics on the occupational success of children and parents has been studied extensively. Drawing on the early work of Blau and Duncan (1967), two related strands of research have been developed that examine how families influence the formation and transmission of educational values. The first strand, based on the theory of status attainment, relates adolescents' educational expectations to parents' values and encouragement (Sewell, Haller, and Ohlendorf 1970). The second strand focuses more specifically on values that are specific to parents' work experiences and their influence on parenting practices. The association between value transmission and aspects of parents' jobs, such as prestige, occupational sector, and complexity of occupational tasks, has been studied in detail (Kohn 1969; Kohn and Schooler 1969; Mortimer 1975; Mortimer and Kumka 1982; Ryu and Mortimer 1996). However, no research has focused specifically on this process for science and mathematics professionals.

Examining how values are influenced by individuals' work experiences, Kohn and colleagues argue that personality and work are intertwined and have a reciprocal effect on one another (Kohn and Schooler 1969). This idea has been extended beyond the individual to the realm of the family to include attitudes about marital roles and labor division, parenting styles and practices and the nature of interactions between parents and children (Curtner-Smith, Bennett, and O'Rear 1995; Greenberger, O'Neil, and Nagel 1994; Klute et al. 2001; Kohn et al. 1986; Luster, Rhoades, and Haas 1989; Menaghan and Parcel 1995; Mortimer and Kumka 1982). While much of the previous research has examined job complexity, autonomy, or prestige, this chapter focuses on how the culture of parents' professions – specifically science and mathematics professions – affects value transmission from parent to adolescent.

The culture of science and its implications for parenting

Math and science professions have characteristics that are unique to their fields of expertise. Merton (1973) characterized the culture of science (including the discipline of mathematics) as valuing rational and logical thought and analysis. The values and norms of science are transmitted by example and precept and reinforced through sanctions within the

profession. Those engaged in professions such as engineering and mathematics internalize these values and norms through their educational and work experiences (Becker and Carper 1962). As parents, these professionals may model values and norms at home with their children through the habitus they have developed in part as a consequence of their professions.

Habitus, or an individual's view of the world and his or her place in it, influences how individuals use available cultural resources (Bourdieu 1977). A person's professional identity plays an important role in the development of his or her habitus. Individuals who are employed in science professions have had particular educational and professional experiences that are specific to their fields. These professionals have had the personal experience of early educational pre-planning and understand the significance of taking advanced mathematics and science courses at the secondary level. They are likely to value mathematics and science education, early and informed pre-planning of educational experiences, and scholastic achievement, particularly in the sciences. These particular values are modeled in the home via the parenting choices and activities these parents engage in with their children, providing their children with cultural capital that is influenced by their experiences as science professionals.

Because the field of science has traditionally been dominated by males, the effect of gender must also be considered. Research has shown that schools inequitably distribute resources among girls and boys and has examined the effects such inequities have on student achievement, self-esteem, educational attainment, and occupational choices (AAUW 1992). While the distribution of these resources is changing, and the gender gap between girls and boys appears to be closing, at least with respect to performance on national achievement tests (Dwyer and Johnson 1997), it could be argued that mothers who are math or science professionals were likely recipients of inequitable resources in schools, discouraged from pursuing math or science fields, or perhaps thwarted in their career advancement. These mothers may be particularly sensitive to gender issues and may take extra steps to ensure that their daughters and sons receive similar levels of support, encouragement, and resources for their schoolwork and future plans.

Values played out in the home: parenting practices and monitoring

The values and norms of parents are instantiated through their parenting and monitoring practices. Through their choice of parenting practices,

parents provide particular expressions of challenge and support to their children (Hauser, Powers, and Noam 1991). Parental support facilitates the transmission of values from parent to child (Mortimer and Kumka 1982). Other research has examined parental challenge as a measure of the quality of interaction between parent and adolescent, finding that children of supportive and challenging parents are more likely to succeed in school (Csikszentmihalyi and Schneider 2000).

Parents provide *support* to their adolescents by expressing love for them, which in turn fosters adolescents' feelings of well-being and security. Adolescents who perceive that their parents provide high levels of support are comfortable in their homes and feel loved and cared for by their parents. Parents *challenge* their adolescents by expressing high expectations to their teenager about how to use their time wisely, work hard, and be self-confident and independent. By challenging their adolescents, parents help provide an environment that is beneficial to their adolescents' development and transition to adulthood, encouraging them to become autonomous and self-directed individuals (Csikszentmihalyi and Schneider 2000).

High levels of both support and challenge have been shown to positively impact adolescents' experiences in school and with their families as well as the career planning process, likely facilitating the intergenerational transference of educational values. Csikszentmihalyi, Rathunde, and Whalen (1993) found that teenagers who experience high levels of parental support and challenge are more likely to approach tasks such as schoolwork and planning for the future competently and enthusiastically. Adolescents in these types of families also report high levels of self-esteem, optimism, and motivation, and feel that their current school and life engagements are important for their future goals (Rathunde, Carroll, and Huang 2000).

Parents also engage in a variety of parenting practices that are designed to control their children's behavior. Control, in the custodial sense, involves monitoring and supervising the teenager. Patterson and Stouthamer-Loeber (1984) describe parents who engage in high levels of monitoring as having an awareness of their child's companions and knowing where their children are and what they are doing most of the time. Parents who provide high levels of supervision rarely leave their adolescents at home alone and require their teenagers to obey firmly established curfews (Kurdek and Fine 1993; Thomson, McLanahan, and Curtin 1992).

This chapter focuses on the supervisory and monitoring behaviors of parents as they relate to the social and academic aspects of adolescent life. Since math/science-employed parents have themselves had to formulate

goals and persevere in their studies early in their school careers they are more likely to engage in direct supervision of their adolescents' school experiences. These parents are also more likely to employ stricter monitoring of their adolescents' time use and choice of social activities and to be involved in adolescents' academic decisions and activities (Ispa, Gray, and Thornburg 1984).

Unexplored student outcomes: mood, motivation, and self-esteem

In examining the transmission of educational values, this chapter investigates the impact of this process on the psychological characteristics of adolescents – characteristics that may help them weather the challenges and disappointments of high school. Previous research suggests that adolescents' success in meeting challenges in high school is associated with feelings of control and positive self-attitudes (Amato and Keith 1991). Students who are self-directed are able to monitor their own behaviors and feel efficacious and, thus, are more likely to succeed in meeting academic challenges (Finn and Rock 1997). Adolescents' mood, motivation, and self-esteem are also positively related to their success in advanced courses, extracurricular activities, and their ability to use time alone productively (Hektner and Asakawa 2000). These variables are the focus of analysis.

Wessman and Ricks (1966) formally define mood as the emotional shifts that represent an individual's personal orientation to the world. Conceptually, mood is indicative of an adolescent's engagement or interest in particular activities (Rathunde et al. 2000). High mood states suggest that the adolescent is experiencing positive affect and high energy. Mood has been found to be positively associated with high levels of family support in both middle-class adolescents and talented teenagers (Rathunde et al. 2000). In contrast, lower levels of mood or a high variability in mood could interfere with an adolescent's capacity for concentrated effort, especially at school (Larson, Csikszentmihalyi, and Graef 1980).

Along with mood, motivation plays an important role in adolescents' ability to meet challenges. A motivated adolescent is energized to achieve a specific goal or result. Deci and Ryan (1985) distinguish between two types of motivation: intrinsic and extrinsic. Extrinsic motivation results when forces outside the person encourage him or her to pursue a specific goal. In the case of adolescents, this extrinsic motivation could be parents' demands, or anticipated punishments or rewards for particular behaviors. Intrinsic motivation results when the person finds either the process or the end result to be enjoyable or interesting, which can be driven by the adolescent's long-term goals.

Adolescents' self-esteem also plays an important role in their academic success. Self-esteem is a reflection of the individual's own evaluation of his or her self-worth (Wylie 1979). Parents have been shown to have the largest effect on an adolescent's self-esteem (Yabiku, Axinn, and Thornton 1999). Further, research has found that adolescents who experience high levels of family support typically experience high levels of self-esteem (Rathunde et al. 2000).

Hypotheses

Hypothesis 1. Parents who are employed in math/science professions may be more directly involved in their adolescents' educational experiences and planning and may employ stricter monitoring of their adolescents' social and educational activities. Compared with parents in other occupations, math/science-employed parents will thus be more likely to be perceived by their teenagers as providing supportive home environments.

Hypothesis 2. These same parents are expected to provide more challenge to their teenagers because of the value that they themselves place on self-direction and autonomy. Because of their personal experiences within male-dominated occupations, mothers employed in math or science occupations may be more challenging of their adolescents than mothers in other occupations.

Hypothesis 3. Differences in parenting practices will affect adolescents' educational values. Specifically, adolescents who come from supportive and challenging family environments will be more likely to earn high grades and to have graduate school aspirations than adolescents from less challenging and supportive home environments. Although family support and challenge and parental monitoring practices are expected to vary by parent occupation, parenting practices are unlikely to account for all differences in the transmission of educational values. Consequently, parent's occupation (math/science versus other) is also expected to be a significant predictor of adolescent outcomes.

Hypothesis 4. Adolescents whose parents are employed in math or science professions are expected to have higher levels of mood, self-esteem, and motivation than adolescents whose parents are employed in other occupations (Rathunde et al. 2000).

Method

Sample

The sample consists of 315 families with adolescent children who participated in the 500 Family Study. Adolescents in the sample are almost evenly split between males and females. Most are between fourteen and seventeen years old and attend high school (grades nine through twelve). Almost 80 percent of the adolescents are white, approximately ten percent are African American, and the remaining students are Hispanic, Asian, or Native-American. The parents have similar demographic characteristics to those of the full sample.

Measures

Adolescent measures Measures of adolescent mood, motivation, and self-esteem were constructed from student responses to the Experience Sampling Method (ESM). The items that were used in constructing measures of mood, motivation, and self-esteem employed Likert and semantic-differential scales. Because the chapter focuses on adolescents' responses to the ESM while they were with their parents and when they were at school, only ESM responses that were obtained in these two contexts were selected.

Graduate school plans and students' grades (from the student survey) were used as measures of adolescents' educational values. Because the educational expectations of adolescents in the sample are very high, plans to attend graduate or professional school (rather than college) is used as a measure of educational expectations. A student grade measure was constructed based on adolescents' self-reports of average grades received on their last report card.[1] Adolescent gender was added as a control variable in all models.

Family and parent measures Measures of support and challenge were constructed from adolescents' responses to a series of statements asking them about various aspects of their family environment. The eleven items measuring support inquired about the family's responsiveness to the adolescent.[2] The twelve items measuring challenge include encouragement of competitiveness, decision-making, and high expectations.[3] To construct the measures, a one-parameter logistic item response model was used.[4]

A measure of school guidance was constructed based on parents' responses about the guidance parents provide their children with school and career planning and their levels of involvement in their adolescent's school experiences and college plans.[5] This measure was constructed separately for mothers and fathers using the item response theory approach in order to allow for parental gender effects.[6]

A math/science career variable was constructed based on parents' responses to a question asking what kind of work they do. The descriptions of the parents' job titles were examined to determine (1) whether the career required substantial math and/or science training for entrance to that career; and (2) whether persons engaged in this career would be required to use math and/or science skills to fulfill their job duties. If both requirements were met, the parent was coded as math/science-employed – approximately 16 percent of the sample.[7]

Because different occupations vary in their work demands and environments, aspects of job characteristics and work environments are examined. These include work status, hours worked per week, hours spent commuting per week, hours spent working at home in the evenings, time away from family due to business travel, and opportunities to communicate with family members while at work.

The types and frequency of parents' interactions with their teenagers are also based on items from the parent survey. These include the frequency of shared activities, and the frequency parents talk with adolescents about everyday events, news and politics, dating, friends, and staying out late. Several measures of parents' expectations for their children are used, including expectations regarding adolescents' chances of graduating from high school, post-secondary educational attainment, getting married, owning a home, enjoying work and family life, and having a stable marriage.

Analytic approach

To address the hypotheses, this chapter follows a multi-step process. Descriptive analyses investigate potential work-related differences between parents in the two employment groups. How the parents interact with their adolescents on a daily basis are also examined. A more microscopic approach to these interactions is then taken to determine whether there are any gender-specific effects by parent's occupational field. Relationships among family support and challenge, parent occupation, parent and adolescent gender, adolescent educational values, and parent school guidance are examined.

To investigate the effects of parent occupation and parenting practices on adolescents' psychological attributes, the three measures of mood, motivation, and self-esteem are used as outcomes in three different hierarchical measurement models (HMM) (Maier 2000). The HMM was

developed to estimate measures using item response theory and models the effects of multilevel independent variables upon these measures simultaneously.

Results

What work and home look like for parents in different occupations

Features of parents' jobs and their work environments affect how much time parents can spend with teenagers, and time constraints can affect the socialization process. Descriptive analyses of work characteristics were conducted to examine variations in the work experiences of parents across different occupations.[8]

Overall, both groups of parents report similar experiences at work. Both groups put in similar work hours and commute times, and have similar part-time versus full-time status patterns. While at work, both groups feel comfortable conducting personal business and engage equally in these behaviors. Furthermore, both groups have similar business travel requirements. Generally, parents in each group are equally able to attend to their families' needs, if required, while at work. From these analyses, it appears that the time requirements of both groups are similar, and that parents in each group have the same time available to devote to the family once their work responsibilities are met.

To determine whether family interactions differed for these two groups, parents' expectations for their adolescents and their interactions with them were also examined. As expected, both groups of parents have high educational expectations for their teenagers, and most feel that their teenagers' opportunities will be better than their own opportunities were. Most also indicate that they believe their adolescents have a high chance of graduating from high school and college, getting married, owning a home, enjoying work and family life, and having a stable marriage. Overall, most parents foresee a successful future for their teenagers, and both groups of parents report that they engage in similar amounts of conversation and activities with their teenagers and use comparable monitoring practices.

However, as shown in table 15.1, there are subtle differences in the parenting practices between both groups. First, math/science-employed parents are more likely to engage in activities with their teenagers, such as hobbies and listening to music, than are the other parents (see table 15.1).[9] Although the two groups do not differ in the frequency of conversations they had with their teenager about such topics as time watching TV, where the teenager goes, and how they use their free time,

Table 15.1 *Parental communication patterns with adolescents*

	Parent employment		
	Math/Science	Other	
Sharing a hobby with teen			
Rarely/Never	49.3	57.6	
Less than once a week	44.9	29.4	
Once/Twice a week	5.8	11.1	
Every day/Almost daily	0.0	1.9	
N	69	377	
χ^2 (d.f. = 3)			8.00*
Listening to music together			
Rarely/Never	17.5	31.9	
Less than once a week	40.0	33.0	
Once/Twice a week	32.5	23.9	
Every day/Almost daily	10.0	11.2	
N	80	445	
χ^2 (d.f. = 3)			20.13***
Talking to teen about staying out late			
Never	10.3	17.6	
About once a month	39.7	34.1	
About twice a month	16.7	14.6	
About once a week	15.4	25.1	
Two–three times a week	17.9	8.6	
N	78	431	
χ^2 (d.f. = 3)			11.37*
Talking to teen about friends			
Never	8.9	16.9	
About once a month	43.0	34.6	
About twice a month	16.5	22.7	
About once a week	12.7	19.5	
Two–three times a week	19.0	6.3	
N	79	431	
χ^2 (d.f. = 3)			20.13**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

math/science-employed parents tend to talk more to their teenagers about how late they are allowed to be out at night and talk frequently with their teenager about the teenager's friends.

Other interesting patterns emerge when responses are examined separately for each group of parents by adolescent gender (see table 15.2). Parents employed in non-math/science careers have slightly different patterns of interaction with their male and female adolescents. They tend to

Table 15.2 *Parental communication patterns with male and female adolescents*

	Parent employment				
	Math/Science			Other	
	Male	Female		Male	Female	
Talking about news/politics						
Rarely/Never	0.0	4.7		3.8	6.8	
Less than once a week	17.1	16.3		19.5	24.3	
Once/Twice a week	40.0	51.2		46.7	52.3	
Every day/Almost daily	42.9	27.9		30.0	16.7	
N	35	43		210	222	
χ^2 (d.f. = 3)			3.40			11.86**
Preparing meals together with child						
Rarely/Never	25.7	16.3		37.9	24.7	
Less than once a week	34.3	46.3		29.9	32.3	
Once/Twice a week	31.4	30.2		28.0	37.7	
Every day/Almost daily	8.6	7.0		4.3	5.4	
N	35	43		211	223	
χ^2 (d.f. = 3)			1.61			9.70*
Decisions about dating						
Parents decide	2.9	4.5		4.8	8.1	
Parents decide after discussion	20.6	25.0		10.1	14.0	
Parents and adolescent decide	20.6	40.9		29.5	35.3	
Adolescent decides after discussion	20.6	18.2		22.2	19.9	
Adolescent decides	35.3	11.4		33.3	22.6	
N	34	44		207	221	
χ^2 (d.f. = 3)			7.86+			8.92+

+ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$

talk with sons more frequently about news and politics, and tend to prepare meals more often with their daughters. This suggests that this group of parents may be involving their daughters in more traditional gender roles. In addition, the analyses seem to indicate that the two groups of parents handle dating decisions with their sons and daughters somewhat differently.

The analyses presented in table 15.3 examine if the adolescents of parents in these two groups differ in their perceptions of support and challenge in the home. The results show no differences in support or

Table 15.3 *Mean of perceived challenge and support by adolescent gender*

	Challenge				Support			
	Male	Female	t	Effect size[a]	Male	Female	t	Effect size[a]
Adolescents – Full sample								
Mean	1.39	1.59	2.83	0.19	1.76	2.10	4.25*	0.28
N	146	167			146	167		
Adolescents of math/science fathers								
Mean	1.53	1.62	0.90	0.09	1.74	2.31	0.06	0.44
N	15	16			15	16		
Adolescents of non-math/science fathers								
Mean	1.43	1.66	2.58	0.23	1.84	2.20	3.04	0.30
N	93	100			93	100		
Adolescents of math/science mothers								
Mean	1.59	1.60	0.33	0.01	1.80	2.07	0.01	0.21
N	20	28			20	28		
Adolescents of non-math/science mothers								
Mean	1.38	1.60	2.84	0.21	1.77	2.12	3.83*	0.29
N	123	132			123	132		

[a] The effect size is calculated as Cohen's d (Cohen, 1988): $d = \frac{\bar{X}_1 - \bar{X}_2}{s_p}$

* $p < 0.05$

challenge provided to adolescents by parents between the two groups when examining the sample as a whole. There are also no differences in challenge and support by father's occupation. Regardless of occupational field, fathers do not differentiate between their male and female children in terms of support and challenge, nor do they offer significantly higher levels of support or challenge to their adolescents than non-math/science fathers.

When looking at mothers and daughters, however, some significant differences emerge. Overall, female adolescents report slightly higher levels of support than their male counterparts. An inspection of the means across occupational categories and parent and adolescent gender reveals that this difference may be attributable to the additional support provided by non-math/science mothers to their daughters.[10] Female adolescents with non math/science-employed mothers seem to get more support than male adolescents in these families. Research suggests that parental support acts as a conduit for the socialization and value transmission processes in the family (Mortimer and Kumka 1982). While this difference may seem beneficial for adolescent girls, the different environments that non-math/science mothers are providing for their adolescents may be communicating different sets of expectations for their sons and daughters.[11]

In the next set of analyses, logistic regression was used to examine the effects of support and challenge and parents' occupation on students' educational values, with student grades and graduate school plans serving as proxies. Grades represent the more immediate values that the adolescent holds, while graduate school aspirations indicate more long-range educational values. As previous research suggests, support and challenge are likely to be strongly related to adolescent educational values because of their effect on the value transmission process. Furthermore, the presence of math/science-employed parents in the home may influence adolescent educational values indirectly via the unique character of the transmission process in these homes. Because females typically earn higher grades than males (Alexander et al. 1982; Riordan 1998), adolescent gender is included as a control variable.

As shown in table 15.4, several variables are significantly associated with student grades. First, adolescents who experience more support are likely to receive higher grades in high school. For each standard deviation change in support, the odds of a student receiving grades in the next highest category increase by a factor of 1.39. Consistent with previous research, gender is also a significant predictor of student grades; female adolescents are almost twice (1.94) as likely as their male counterparts to have higher grades in school. Net of other variables in the

Table 15.4 *Unstandardized coefficients from logistic regression analyses of adolescent grades and graduate school aspirations*

Variable	Coefficient (S.E.)	
Grades		
Constant[a]	−1.7604***	(.262)
Constant2[b]	−0.4995*	(.241)
Family support	0.3320***	(.085)
Adolescent female	0.6609**	(.228)
Math/science mother	0.6054*	(.310)
-2log-likelihood	584.124	
Number of cases	282	
Graduate school aspirations		
Constant[c]	−0.4172*	(.202)
Family challenge	0.2384*	(.112)
-2 log-likelihood	433.146	
Number of cases	316	

[a] log-odds of attaining mostly As versus A/B or B or less
[b] log-odds of attaining A/B versus B or less
[c] log-odds of aspiring to attend graduate school versus not
* $p < .05$; ** $p < .01$; *** $p < .001$

model, having a math/science-employed mother significantly increases the likelihood of receiving higher grades. Those adolescents indicating that they have a mother employed in a math/science field are almost twice (1.83) as likely to have higher grades compared with those who do not have math/science-employed mothers. The effect of having a math/science-employed mother is almost 1.5 times that of an incremental change in support. The significant positive effect of this variable on student grades suggests that the subtle differences in the home environment identified in descriptive analyses may very well have a positive impact on the formation of short-term educational values, as indicated by student grades.

The impact of these variables on the formation of longer-term educational values, specifically aspirations to attend graduate school, is presented in the bottom half of table 15.4. Results indicate that female adolescents are just as likely as their male counterparts to report that they plan to attend graduate school. Further, having a math/science-employed parent has no significant effect on graduate school aspirations. Challenge, however, is positively and significantly associated with adolescents' graduate school aspirations. The odds that an adolescent plans to attend graduate school increase by 1.27 with each incremental increase in challenge.

Table 15.5 *Regression coefficients from linear analysis of support and challenge*

Variable	Model 1	Model 2
Support		
Constant	1.761***	1.794***
Female	0.338*	0.361+
Father school guidance		0.243**
Challenge		
Constant	1.508***	1.367***
Female	0.194	0.170
Father school guidance		0.211***

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Various aspects of the home environment and of parent–adolescent interactions were examined to determine which are predictive of perceived challenge and support. Results indicate that the school guidance provided by fathers has a substantial positive relationship with adolescents' reported levels of both support and challenge (see table 15.5). Support increases by a factor of 0.24 for every one point increase in father's school guidance, controlling for adolescent gender. The results for challenge are similar. These results indicate the important impact a father can have on support and challenge.[12]

The results of the descriptive and regression analyses provide some support for the claim that parents in math/science and other occupations differ in their parenting practices, and that these differences have effects on adolescents' educational values. As suggested by the descriptive analyses, non-math/science mothers appear to treat sons and daughters differently, offering greater support to their daughters. In addition, analyses of parent interactions suggest that non-math science parents engage in different types of activities with their sons and daughters (e.g., they are more likely to discuss news and politics with their sons and to engage in meal preparation with their daughters). In contrast, math/science-employed parents appear to be more egalitarian and are more likely to share activities with their teenagers and talk with them more frequently about friends and staying out late, suggesting that they engage in stricter monitoring practices.

Parents' occupations and parenting practices in turn affect adolescents' educational values. Adolescents of math/science employed mothers earn significantly higher grades. Although math/science employed fathers do not appear to differ in the levels of challenge and support they provide to adolescents, results of the regression analyses indicate that adolescents whose fathers provide greater school guidance are more likely to report high levels of support and challenge at home. Higher levels of support are associated with higher grades in school, and higher levels of challenge are associated with graduate school aspirations, suggesting the importance of father's school guidance in the transmission of educational values.

Teenagers' daily subjective experiences

To examine the relationship between adolescents' emotions and parents' occupations and parenting practices, adolescents' day-to-day experiences while they were with their parents or at school were analyzed using ESM data. Each of the emotion variables was modeled separately for adolescent interactions with their mothers and with their fathers to better capture the unique aspects of these two types of dyads.[13] Adolescents' graduate school aspirations was included in the models to examine the relationship between adolescent educational values and emotions. Adolescent gender was also added as a control variable.

Results indicate that mood is generally low when adolescents are at school or with parents; mood is lowest when adolescents are at school but improves slightly when teenagers are with either parent (see table 15.6). Having a math/science-employed mother has a positive effect on mood. This effect is greatest when the teenagers are at school or with their fathers. Having a math/science-employed father, however, seems to have a negative effect on adolescents' moods at school, regardless of adolescent gender; when the adolescents are with either parent, however, this negative effect disappears.

Self-esteem is generally negative while the teenager is at school or with parents (see table 15.7). As with mood, the mothers' math/science-employed status gives a modest positive boost to adolescents' self-esteem. Students' graduate school plans are marginally significant, suggesting that educational aspirations may also play a minor positive role in adolescent self-esteem.

As with mood and self-esteem, adolescent motivation at school is negative, although to a greater extent than the other two measures (see table 15.8). Unlike mood or self-esteem, none of the variables in this model are significant predictors of motivation. The adolescents' motivation at school is low and persistent, as modeled by parent occupation, adolescent gender, and graduate school plans. Most likely, motivation is closely tied to experiences that the adolescents are engaged in while at school, which are not included in the model.

Table 15.6 *Results of hierarchical measurement modeling for mood*

Variable	Coefficient	Standardized coefficient	95% credibility interval
Mood at School			
Intercept	−0.712*		(−0.77, −0.65)
Math/science Mother	0.225*	0.083	(0.15, 0.31)
Math/science Father	−0.114*	−0.040	(−0.21, −0.02)
Female	−0.019	−0.009	(−0.08, 0.04)
Plans to attend graduate school	0.058	0.029	(0.00, 0.12)
Var.epsn	0.140		(0.11, 0.17)
Tau	0.117		(0.08, 0.16)
Mood with mother			
Intercept	−0.679*		(−0.78, −0.59)
Math/science Mother	0.166*	0.061	(0.04, 0.24)
Math/science Father	0.043	0.015	(−0.10, 0.18)
Female	−0.033	−0.016	(−0.13, 0.06)
Plans to attend graduate school	0.026	0.013	(−0.06, 0.12)
Var.epsn	0.167		(0.13, 0.22)
Tau	0.098		(0.06, 0.15)
Mood with father			
Intercept	−0.637*		(−0.74, −0.54)
Math/science Mother	0.213*	0.078	(0.07, 0.35)
Math/science Father	−0.002	−0.001	(−0.16, 0.16)
Female	−0.025	−0.012	(−0.13, 0.08)
Plans to attend graduate school	−0.033	−0.016	(−0.14, 0.07)
Var.epsn	0.154		(0.11, 0.21)
Tau	0.150		(0.09, 0.23)

* $p < 0.05$

Results of these analyses provide some support for the hypothesis that parent occupation has an effect on adolescents' psychological characteristics. First, although adolescent mood is generally low at school and with parents, it is significantly higher for those with a math/science-employed mother. However, the hypothesis that adolescent mood would be higher in families with a math/science-employed mother or father is borne out only for math/science-employed mothers. Math/science-employed fathers seem to have a slightly negative effect on adolescents' mood, and only when they are at school; when teenagers are at home with their mothers or fathers, this effect disappears. Math/science-employed mothers also have a positive effect on the adolescents' self-esteem, but only when they are at school. There is no evidence to support the hypothesis that adolescents with parents in math or science fields have higher levels of motivation than their peers.

Table 15.7 *Results of hierarchical measurement modeling for self-esteem*

Variable	Coefficient	Standardized coefficient	95% credibility interval
Self-esteem at school			
Intercept	−0.296*		(−0.35, −0.24)
Math/science Mother	0.106*	0.040	(0.024, 0.19)
Math/science Father	−0.089	−0.031	(−0.18, 0.00)
Female	−0.037	−0.018	(−0.10, 0.02)
Plans to attend graduate school	0.085*	0.042	(0.026, 0.15)
Var.epsn	0.112		(0.09, 0.14)
Tau	0.119		(0.09, 0.16)
Self-esteem with Mother			
Intercept	−0.229*		(−0.32, −0.14)
Math/science Mother	0.013	0.005	(−0.11, 0.14)
Math/science Father	0.045	0.016	(−0.09, 0.18)
Female	−0.039	−0.019	(−0.13, 0.05)
Plans to attend graduate school	0.054	0.027	(−0.03, 0.14)
Var.epsn	0.056		(0.13, 0.22)
Tau	0.150		(0.10, 0.21)
Self-esteem with Father			
Intercept	−0.196*		(−0.29, −0.11)
Math/science Mother	0.112	0.042	(−0.02, 0.25)
Math/science Father	−0.148	−0.052	(−0.30, 0.00)
Female	−0.056	−0.027	(−0.15, 0.04)
Plans to attend graduate school	−0.006	−0.003	(−0.09, 0.11)
Var.epsn	0.067		(0.04, 0.11)
Tau	0.144		(0.09, 0.21)

* $p < 0.05$

Table 15.8 *Results of hierarchical measurement modeling for motivation*

Variable	Coefficient	Standardized coefficient	95% credibility interval
Motivation at school			
Intercept	−0.850*		(−0.94, −0.77)
Math/science mother	0.079	0.029	(−0.04, 0.20)
Math/science father	−0.139	−0.049	(−0.28, 0.00)
Female	−0.017	−0.008	(−0.10, 0.07)
Plans to attend graduate school	0.058	0.028	(−0.03, 0.15)
Var.epsn	0.384		(0.31, 0.46)
Tau	0.109		(0.07, 0.16)

* $p < 0.05$

Additional analyses were conducted to determine whether the effects found for adolescent mood and self-esteem might be a consequence of factors other than the parent's math/science employment status, such as parent's mood or educational attainment. Results indicate that parents generally report positive moods when they are with their adolescents, regardless of parent occupation or adolescent gender.[14] To determine whether math/science employment status might be an artifact of educational attainment, the model for adolescent mood was re-run, replacing the math/science-employed status of each parent with the educational attainment of each parent (coded as having a masters degree or higher versus a lower level of educational attainment). No significant effect was found.[15] As in the original model, adolescents generally experience fairly negative moods while at school.

Conclusion

From these analyses, it can be seen that parents influence their adolescents in a variety of ways. The subtle nature of family dynamics and the many facets of parent monitoring behaviors required the use of a variety of analytic techniques to thoroughly explore the relationships between parents and adolescents. Three major themes about the transmission of educational values emerge from these analyses.

While differences in support and challenge were expected to be related to parent's occupation, no such differences were found for fathers. Regardless of occupation, fathers provide their daughters and sons with similar levels of support and challenge. For fathers in both occupational categories, perceived challenge and support are positively associated with fathers' school guidance. By taking the time to discuss course-taking and plans for college, fathers not only provide support for their teenagers but also encourage them to achieve. The significant effect of such paternal guidance may be due to its infrequency. Such discussions are more likely to occur on *a daily basis* between mothers and adolescents. Fathers may involve themselves after a majority of the discussions have taken place with the mother. If fathers involve themselves early on in their adolescents' educational planning and goal-setting, they are able to bring additional benefits to their adolescents to aid in goal formation and planning.

Results suggest that mothers' parenting practices do differ by occupation. First, math/science-employed mothers offer their male and female teenagers the same levels of challenge and support. The daughters of these mothers are reaping benefits from this equitable treatment that their peers are not experiencing. By providing their daughters with the same home environments as they do for their sons, these mothers are communicating similar expectations of them. These mothers may also play an important role in encouraging their daughters to pursue math–science careers. Seymour and Hewitt (1997) show that female students readily respond to parental influence in choosing to pursue math or science coursework, majors, and occupations. Math/science-employed mothers also seem especially able to boost their adolescents' mood and self-esteem at school. Daughters of non-math/science mothers receive more support than their brothers, which may communicate different expectations for sons and daughters.

Parental monitoring practices are also used in slightly different ways by math/science-employed parents and parents in other careers. Because these practices are an important mechanism for transmitting values, math/science-employed parents are engaging in somewhat different socialization patterns than the other parents. Parents employed in math/science occupations tend to be stricter with their adolescents than parents in other occupations. These stricter monitoring practices reflect the high expectations they have for their children in concrete ways. This is not to say that non-math/science-employed parents are not expressing high expectations for their children; after all, descriptive analyses indicate that all parents are optimistic and hopeful about their adolescents' future success. However, by employing stricter monitoring practices, the math/science-employed parents are communicating high expectations and providing challenges on a daily basis.

The sample analyzed consists of highly educated and high-status parents who are able to provide their adolescents with a wide range of opportunities and resources. One might expect that if any group of parents were to engage in the equitable treatment of their sons and daughters, it would be this group of parents. The finding that math/science mothers treat their sons and daughters in similar ways while mothers who work in equally high status professions such as the law or business treat their sons and daughters differently is somewhat surprising. Both groups of mothers are highly educated and high achieving, yet pervasive differences in the way these two groups socialize their adolescents can be identified.

These findings suggest that the reproduction of social stratification may be influenced not only by social class, but also by parent occupation, specifically the mother's occupation. By engaging in differential treatment of their teenagers, non-math/science-employed mothers are reinforcing traditional gender roles. As a result, these mothers are helping to reproduce the stratification structure for their sons and daughters.

These results suggest that the transmission of educational values and parent–adolescent socialization dynamics are tied more closely to the occupational experiences of parents than one may expect. Research with a larger and more representative sample is needed to determine whether the socialization of sons and daughters differs by parent occupation in families that are more diverse with respect to race, educational attainment, and income.

NOTES

1. Because the majority of responses fell within two categories, the variable was recoded into three categories: mostly As; about half As and half Bs; and mostly Bs or below.
2. The items for support:
   1. Others notice when I'm feeling down, even if I don't say anything.
   2. I feel appreciated for who I am.
   3. If I have a problem, I get special attention and help.
   4. I do things I like to do without feeling embarrassed.
   5. I am made to feel special on birthdays and holidays.
   6. No matter what happens, I know I'll be loved and accepted.
   7. We enjoy having dinner together and talking.
   8. We compromise when our schedules conflict.
   9. We are willing to help each other out when something needs to be done.
   10. We try not to offend and hurt each other's feelings.
   11. Our home is full of things that hold special memories.
3. The items for challenge:
   1. We enjoy playing competitive games.
   2. We express our opinions about current events, even when they differ.
   3. We ask each other's ideas before making important decisions.
   4. It's important to be self-confident and independent to earn respect.
   5. Family members expect to be good at what they do.
   6. Individual accomplishments are noticed.
   7. I'm given responsibility for making important decisions affecting my life.
   8. I'm expected to do my best.
   9. I try to make other family members proud.
   10. I'm encouraged to get involved in extracurricular activities.
   11. I'm respected for being a hard worker.
   12. I'm expected to use my time wisely.
4. For construction of the measures of support and challenge, all items were required to have an outfit statistic of 1.35 or less. The distribution of the challenge measures had a mean of 1.47 and a standard deviation of 1.03; the measure of support had a mean of 1.91 and a standard deviation of 1.46.
5. The items for parent school guidance variable:
   How often do you or your spouse talk to your teen about:
   1. Which course or programs to take at school.
   2. School activities or events of particular interest to your teen.
   3. Things your teen has studied in class.
   4. Your teen's grades.
   5. Your teen's plans and preparations for the ACT or SAT tests.
   6. Your teen going to college.
   7. Your teen's career plans.
6. The school guidance measure has a mean of 0.21 and a standard deviation of 1.01 for mothers and a mean and standard deviation of 0.19 and 1.08, respectively, for fathers.
7. The following job titles were coded as math/science: medicine or health manager; accountant; auditor; agricultural or food scientist; biological or life scientist; medical scientist; physician; dentist; registered nurse; economics teacher; mathematics teacher; computer science teacher; medical science teacher; economist; psychologist; technical writer; radiologist; biological technician; and computer programmer.
8. Because differences in work experiences were not statistically different between these two groups of parents, the results were not tallied in a table.
9. Only statistically significant results are shown in table 15.1.
10. The differences in table 15.3 appear to be rather small. However, the measures of support and challenge are on a standardized normal scale, making even seemingly small differences among means meaningful. Cohen's effect size measure can be applied directly to the differences in means between groups.
11. Because of the small number of math/science-employed parents in the sample, additional analyses were conducted to explore whether the patterns of support and challenge observed for these parents would change if the sample sizes and variances of the measures were comparable to those of the non-math/employed parents. Results of these analyses indicate that all patterns except one would remain the same given a larger sample size and smaller variance. If the sample size of math/science-employed fathers were increased to match that of the non-math/science fathers, the difference in the support they offer their sons and daughters would be statistically significant, with daughters receiving more support from these fathers. In contrast to the greater support offered to daughters by non-math/science mothers, this pattern of cross-gender support between math/science fathers and their daughters might work counter to traditional gender roles.
12. The measures of support, challenge, and father school guidance are standardized and yield small but significant effects sizes, using Cohen's d.
13. For a more detailed description of this methodology, see Maier (2000) and Gelman et al. (1995). To determine whether the value of any coefficient is statistically different from zero, one must examine the limits of the 95 percent credibility interval to determine if zero lies within this range. If the posterior distribution of a parameter approximates the shape of a normal distribution (as was the case with these analyses), the bounds of the 95 percent credibility interval are essentially the 2.5 percent and 97.5 percent quantiles of the data. Statistically significant coefficient estimates are flagged with an asterisk in the tables. Additionally, standardized coefficients are presented so that direct comparisons of predictive variables can be made.

14. A HMM modeling parent mood with adolescent gender and math/science-employment status of mother and father had a single statistically significant coefficient for the intercept (0.108).
15. A HMM modeling adolescent mood with MS/Ph.D. mom, MS/Ph.D. dad, graduate school aspirations, and adolescent gender had two statistically significant coefficients: the intercept (−0.64) and graduate school aspirations (0.064).

Commentary

Jeylan T. Mortimer

The earliest studies of intergenerational occupational mobility proceeded by cross-classifying categorical occupational variables expressing origin and destination states (e.g., Rogoff 1953). Blau and Duncan's landmark study (1967) greatly facilitated the analysis of intergenerational mobility by expressing occupational variability by a single continuous dimension of occupational prestige. Educational attainment was shown to be the crucial mediator of the effects of socioeconomic origins on occupational destinations (Duncan, Featherman, and Duncan 1972). Building on this path-breaking work, subsequent research has incorporated social psychological variables, including significant other influences, educational achievement, and educational and occupational aspirations and plans. The large body of research in this tradition has immensely enriched our understanding of the process of stratification.

But lost in the shift in conceptualization of work from categorically diverse occupational positions to continuously varying occupational prestige was the rich variation in types of work and dimensions of work experience that could potentially have profound implications for familial socialization and child achievements. Though researchers have continued to draw attention to other dimensions of work, besides its prestige, that have important consequences for the attainment process (e.g., Kohn 1969; Mortimer 1974, 1975; Ryu and Mortimer 1996), influencing intergenerational value transmission and mobility, the unidimensional consideration of work, as a social status or prestige hierarchy has remained dominant in studies of educational and occupational attainment.

Maier, by focusing on differences in home environments and child-rearing practices in math/science and other middle-class families, continues this line of inquiry and challenge to the dominant stratification paradigm. The distinctive patterns of communication, activities, challenge, and support for children that she describes among parents who have math/science related and other occupations draw attention to an important non-vertical feature of work (akin to what was earlier called the situs dimension of occupational structure, see Morris and Murphy 1959). As she observes, persons in scientific and technical occupations have undergone a demanding process of professional socialization emphasizing

logical thinking, efficacious action, and positive orientations to learning and knowledge. Their own occupational experiences and tasks are perceived, by themselves and others, as difficult and challenging.

Kohn and Schooler (1983) observed that psychological orientations and values developed in the work sphere extend beyond this particular domain, coming to influence attitudes and behaviors in multiple spheres. As part of this "generalization" process, parents try to transmit psychological orientations to their children that they have found to be conducive to success in their own work. If the same process extends to scientists and technical workers, it is likely that they would approach child-rearing in a manner paralleling their own work experiences, viewing this familial task as challenging, perhaps difficult, and deserving of their full engagement. Consistent with these speculations, Maier brings forth evidence that scientific/technical parents are more engaged in activities with their children and in monitoring their adolescent offspring than other middle-class parents (table 15.1). Paralleling the sciences' universalistic achievement values, there are indications that gender is a more prominent consideration in non-science/math parents' activities and interactions with their children (table 15.1).

Maier further observes that science/math consequences for parenting are conditioned by the gender of the parent. Whereas fathers are found to provide similar levels of support and challenge to sons and daughters irrespective of their occupations, math/science mothers appear to be slightly less sex-typed than other others in their treatment of their children (table 15.2). Furthermore, math/science mothers are found to promote adolescent children's grades (table 15.3) and to enhance their moods and self-esteem when they are at school (tables 15.5 and 15.6), consequences that would likely promote the children's future success in the educational sphere. The fact that having a math/science mother is related to more positive moods when the adolescent child is with mothers and fathers as well (table 15.5) would perhaps also strengthen the efficacy of both math/science parents as transmitters of educationally relevant and other values (assuming that good adolescent moods promote receptivity to parental socialization attempts). Interestingly, math/science fathers do not appear to enhance adolescents' grades and mood state in these ways, perhaps because fathers are more likely than mothers to inhabit "separate worlds" of work and family, being less engaged in, and responsible for, the family realm.

These findings also bear directly on long-term debates regarding the effects of maternal employment on children. Because math/science occupations are particularly engaging and time consuming, one might think that mothers pursuing such demanding careers would be relatively disengaged from their children, and that their children would respond by expressing negative moods. To the contrary, the general pattern of findings in this study indicates that children of math/science mothers may be particularly advantaged.

Given the increasing prominence of scientific and technical occupations in the US labor force, and increasing prevalence of women in these fields (though they are still the minority), one might expect increases in the salutary patterns of child-rearing found to be distinctive in math/science families, thereby contributing to children's achievement. But while Maier's study is instructive, the relatively small number of math/science parents in her sample limits the scope of the analysis, particularly the capacity to introduce a variety of pertinent controls. While all families in this study are described as middle and upper-middle-class, the analyses do not control for socioeconomic differences (in education, income, and occupational prestige) that might account for the patterns that are highlighted here. Furthermore, the non-math/science mothers in this study, despite their high levels of education, may be more likely to adhere to traditional, gender-linked work patterns, involving part-time employment, positions of lesser responsibility, and the capacity to be unpaid partners in supporting their husbands' careers. A larger sample of math/science mothers would perhaps enable investigation of these and other potential sources of spuriousness.

Notwithstanding these limitations, this research breaks new ground in exploring the manifold ways that pursuit of a scientific or technical career may impact parenting style and adolescent children's educational achievement. Maier's findings indicate the fruitfulness of further research focused on dimensions of occupational variability, occupational subcultures, and family socialization practices across a wide span of the class structure.