3

WHAT MOTIVATES FEMALES AND MALES TO PURSUE SEX-STEREOTYPED CAREERS?

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Why do females and males choose sex-stereotyped careers? Why is it that women are underrepresented in math-related careers? Are men underrepresented in English-related careers and if so, does it matter? There is a general consensus that more men are involved in highly math-related careers than women. This has prompted a large body of research directed toward understanding boys' and girls' mathematical participation. A prominent, productive, and highly influential theoretical framework developed to explain gendered math participation is the *expectancy-value model* developed by Eccles and her colleagues (e.g., Eccles (Parsons) et al., 1983; Wigfield & Eccles, 2000), which informs the present study. Ever since Lucy Sells (1980) first voiced concerns about female underparticipation in math courses, which then acts as a critical filter to limit their access to many high-status, high-income careers, researchers have argued that too many females prematurely restrict their educational and career options by discontinuing their mathematical education in high school (e.g., chaps. 1 and 2, this volume; Heller & Parsons, 1981; Meece, Wigfield, & Eccles, 1990) or soon after in postsecondary education, when fewer females

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than males elect to study math (Bridgeman & Wendler, 1991; Lips, 1992). In the Australian context, the plethora of government policy documents and reports targeting girls' math education signals a general concern with girls' lower mathematical participation during school (for an earlier review of these curricular and professional development initiatives, see Leder & Forgasz, 1992). Because many girls do not share equally in the advantages that are afforded to the mathematically well prepared, I regard lower female participation in math as socially important from both a utilitarian "waste of talent" perspective and a social justice perspective.

The concentration of boys in "masculine" career types has caused less consternation. Whether boys may not be pursuing their areas of interest and potential fulfillment has been less a topic for research concern or public interest (an issue posed in chap. 9, this volume). Is it because female underrepresentation in stereotypically male-dominated domains (such as math) leads to lower status and salary for women that researchers who are concerned with gender equity have focused on gendered participation in male- rather than female-dominated domains (as argued in chap. 7, this volume)? Over the past decade, there has been an increasing trend in educational research, policy initiatives, and the media to target boys' educational needs. Such discussions have invariably focused on boys' academic achievement and boys' disaffection with schooling together with a call for positive male role models among teachers to bring out the best in boys (e.g., House of Representatives Standing Committee on Education and Training, 2002; Lingard, Martino, Mills, & Bahr, 2002; Martin, 2002). In Australia, there has been insistent and vocal concern regarding boys' education and participation in domains sex-typed as feminine, calling for more efforts to encourage boys' involvement in those domains. A major example of this is the Inquiry Into the Education of Boys (House of Representatives Standing Committee on Education and Training, 2002; O'Doherty, 1994). I argue from both social justice and human resource perspectives that we should be concerned with the educational opportunities and outcomes of both boys and girls. Further, I argue the importance of retaining attention to girls' academic well-being alongside current emphases focused on boys. This chapter consequently provides a detailed examination of gendered participation in adolescents' educational and occupational choices in two domains—math and English—commonly perceived as sex stereotyped. I then focus on understanding what motivates girls and boys to pursue sex-stereotyped careers in these two domains.

GENDERED EDUCATIONAL CHOICES

Courses studied through school, particularly in senior high, can have important implications for adolescents' further educational and career options

(see chap. 4, this volume). If young women decide to opt out of senior high math (and young men out of English), they begin to limit certain types of career paths that are readily available to them. In the United States, gendered senior high math participation in terms of high-school course enrollments has been documented through the work of Eccles and her colleagues (e.g., Eccles, 1985; Eccles (Parsons), 1984; Updegraff, Eccles, Barber, & O'Brien, 1996), and in Australia other researchers have reviewed gendered trends in specialized math course taking (e.g., Leder, 1992; Leder, Forgasz, & Solar, 1996; Watt, 2006; Watt, Eccles, & Durik, 2006). However, the organizational structure of math courses in U.S. schools, where the majority of research in this area has been concentrated, does not lend itself as easily as does the New South Wales (NSW) Australian context to the study of gendered math enrollment choices. Senior high math participation in the United States has been primarily operationalized according to the number of senior high courses taken. In that context, a greater number of math courses does not necessarily imply participation in increasingly higher order and more complex mathematics. This is because courses are structured around topic areas rather than along an explicit underlying continuum of complexity. Although some topics are generally regarded as less difficult (e.g., general math, beginning algebra) and others as the most difficult (e.g., calculus, trigonometry), there is no formal classification of the difficulty levels for the various topic areas.

Ideally, what is required to assess level of senior high math participation is a context where students' course choices explicitly reflect the extent of their participation in increasingly complex and demanding mathematics. This permits a more fine-grained analysis of math participation than has been possible previously in the concentration of research in this area that has occurred in the United States. In NSW Australia, the extent of both mathematics and English participation can be effectively operationalized during senior high school years using a naturally occurring ordered metric. This provides an ideal location for studying gendered choices in terms of course enrollment.

In the State of NSW Australia, students attend secondary school in Grades 7 through 12. Syllabi exist for each of Grades 7 and 8, 9 and 10, and 11 and 12. In math, Grades 7 and 8 are focused largely on consolidation of material learned in Grades 3 through 6, whereas in Grades 9 and 10, students are streamed into levels of "advanced," "intermediate," or "standard" math on the basis of their demonstrated ability up to that point. In Grades 11 and 12, which lead up to a major external examination supplemented by within-school assessment results called the Higher School Certificate (HSC), students elect which subjects they wish to study. The HSC is a statewide series of externally set and assessed examinations undertaken in Grade 12 supplemented by within-school assessment tasks conducted through Grades 11 and 12. The combined assessment result determines access to university courses and to other educational programs. English is the only required HSC subject, although most students also elect to study math because this is perceived to be an important subject and is in fact an entry requirement for many tertiary courses. In addition to selecting which academic subjects they wish to study for the HSC, students also select the difficulty level within their chosen subjects that they wish to undertake. In math, the lowest difficulty level is "Maths in Practice" (MIP), followed by the still basic but more demanding "Maths in Society" (MIS), with the difficulty level increasing in unit value through "2-unit" (2U), "3-unit" (3U), and the most advanced "4-unit" (4U) math (MacCann, 1995).

In English, there is no formal classification into ordered course levels through Grades 9 and 10 as for math. However, a structure similar to the one for math exists for Grades 11 and 12 senior high English, when students select the level of English they wish to study. There are four courses from which students may choose, each of which is taken by groups of students who differ substantially in general academic ability. The least able students take "2-unit Contemporary" English, followed in ascending order of ability through "2-unit General," "2-unit Related," and "3-unit" English (MacCann, 1995). Unlike math, the latent "difficulty" metric in this case relates to the immediacy and relevance of course texts to current social context, with 2U Related and 3U English courses concerned primarily with classic literature and 2U Contemporary and 2U General courses focused on more contemporary works.

In general, within the NSW context, a greater proportion of boys than girls elects to study the highest 4U math course in senior years, and a greater proportion of girls than boys elects the lowest MIP and MIS courses. This is demonstrated by boys' and girls' HSC examination enrollments in each level of senior high school math (Figure 3.1A). Gendered enrollments depicted in Figure 3.1A span the entire period of this course structure, which was introduced in 1991 and continued until 2000. Within this time frame, a similar pattern of greater male participation in the most demanding Grade 12 math option in another Australian State, Victoria, has also been documented (Forgasz & Leder, 2001).

Conversely, statewide HSC English course enrollments show that greater proportions of girls than boys undertake the 2U Related and 3U courses in senior high, and higher proportions of boys than girls study the lowest Contemporary level (Figure 3.1B). Again, the lowest English Contemporary course was only introduced in 1991, so the statistics are presented from this point onward. Clearly, within the NSW Australian context there remains a robust gender imbalance toward more males in math and more females in English in senior high enrollments.

GENDERED OCCUPATIONAL CHOICES

Measures of the math and English relatedness of adolescents' career intentions provide an important extension to understanding achievement-related

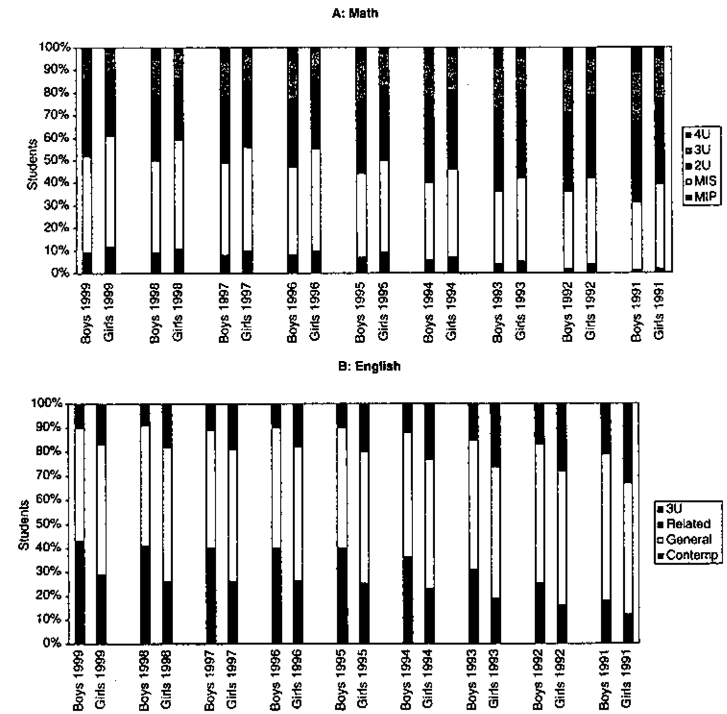

Figure 3.1. Gendered participation in senior high math (Panel A) and senior high English (Panel B) by course level in New South Wales, Australia, 1991–1999. 4U = 4-unit maths; 3U = 3-unit maths; 2U = 2-unit maths; MIS = Maths in Society; MIP = Maths in Practice; 3U = 3-unit English; Related = 2-unit Related English; General = General English; Contemp = Contemporary English. Adapted from Board of Studies (1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999).

choices beyond the high school years. Although limited career opportunities as a consequence of limited participation in mathematics have been widely recognized, there has been little study of relationships between these two aspects of participation, and there has been an absence of empirical work establishing relationships between adolescents' math-related motivations and participation in the form of mathematical career relatedness. There has been little or no work in the area of English, and the current study is the first to classify career aspirations according to their "English relatedness." Math and English career relatedness were operationalized using O*NET 98 data (U.S. Department of Labor Employment and Training Administration, 1998; for full details see Watt, 2002). Although a U.S. reference, this is a comprehensive database based largely on data supplied by occupational analysts from sources such as the *Dictionary of Occupational Titles* (for an overview, see Osipow & Fitzgerald, 1996). To develop data for this database, analysts evaluated and refined existing occupational data and then applied these data to the O*NET 98 content model. No such comprehensive Australian database is available in published form, and given that there is sufficient cultural similarity and career transferability across the two countries, the database was considered an appropriate basis from which to perform career categorizations.

Categorizations were based on the math and English career content of students' nominated career plans. For mathematics, the definition used in O*NET 98 is "using mathematics to solve problems." For English, content descriptors *writing* and *reading comprehension* were selected as representing career English relatedness, respective definitions for which were "communicating effectively with others in writing as indicated by the needs of the audience" and "understanding written sentences and paragraphs in work related documents." As a result, two classifications of students' nominated career plans were formed: The first categorized plans into one of four levels, which O*NET 98 terminology names "high," "average," "any," or "no" mathematical content; the second categorized plans into one of "high," "average," "any," or "no" writing and reading comprehension content (hereafter referred to as "English" content). Example career classifications for math are science, accounting, and engineering ("high"); business, computing, and veterinary medicine ("average"); hospitality, fashion, and trades ("any"); and sports, music, and journalism ("none"). For English, examples are science, journalism, and law ("high"); business, accounting, and psychology ("average"); music, fashion, and aviation ("any"); and sports, hospitality, and trades ("none").

EXPLAINING GENDERED EDUCATIONAL AND OCCUPATIONAL CHOICES

Expectancy-value theory is one of the major frameworks for achievement motivation, initially developed to explain students' gendered choices and achievement in relation to math (for an overview of this framework, see Eccles, 2005a, 2005b; Eccles (Parsons) et al., 1983; Wigfield & Eccles, 2000). Within it, success expectancies and the subjective valuation of success are the most proximal influences on achievement-related choices and behaviors, and these are in turn predicted by ability beliefs as well as perceived task demands.

Success expectancies have been defined by Eccles (Parsons) et al. (1983) as beliefs about how well one will perform on an impending task, and these are distinguished conceptually from *ability beliefs*, which are defined as perceptions of one's current competence at a given activity. However, Eccles and colleagues have not been able to empirically distinguish these ability and expectancies constructs (Eccles & Wigfield, 1995; Wigfield & Eccles, 2000). Elsewhere, I have argued that this is likely to be due to ability perceptions having mostly been operationalized through broad questions that ask students to rate their performance in different domains (see Eccles & Wigfield, 1995). As a consequence, their responses may in part depend on evaluations of their performance and in part on evaluations of their aptitude (see Watt, 2002, 2004, 2006). It has been claimed that the concept of natural talent best represents the notion of ability as distinct from performance (Bornholt, Goodnow, & Cooney, 1994, based on Green, 1974). Empirical support for this distinction between talent and ability perceptions as commonly operationalized in the literature has been provided by Watt (2002, 2004). Because a student may feel she or he performs well on a certain task yet still not feel she or he has a talent or aptitude for it, talent perceptions are theoretically distinct from ability perceptions operationalized as competence beliefs. Higher order "self-perception" factors have also been validated for both math and English on the basis of component talent perceptions and success expectancies (for details, see Watt, 2002), and these are used in the present study rather than ability perceptions as measured in the expectancy-value framework.

Values relate to how a task meets individual needs (Eccles (Parsons) et al., 1983; Wigfield & Eccles, 1992), and here I focus on intrinsic and utility values. *Intrinsic value* refers to the enjoyment one gets from carrying out a given task, and *utility value* refers to how a task will be useful to an individual in the future (Wigfield & Eccles, 2000). The work of Eccles, Wigfield, and colleagues has demonstrated that expectancies and values predict achievement-related choices operationalized as course enrollment and also achievement (e.g., Eccles, 1985; Eccles, Adler, & Meece, 1984; Eccles (Parsons), 1984; Eccles (Parsons) et al., 1983; Meece, Eccles (Parsons), Kaczala, Goff, & Futterman, 1982; Meece et al., 1990; Wigfield, 1994; Wigfield & Eccles, 1992). Eccles and her colleagues have found values to emerge as powerful predictors of enrollment choices (e.g., Eccles, Adler, & Meece, 1984; Eccles (Parsons) et al., 1983; Updegraff et al., 1996), whereas expectancies better predict performance—findings that have also been supported by other researchers (e.g., Bong, 2001). Recent studies have additionally demonstrated a link between expectancies and enrollment choices (e.g., Simpkins, Davis-Kean, & Eccles, 2006; Watt, 2005).

There has been less empirical work within the expectancy-value framework connected with perceptions about the difficulty of a task (Eccles & Wigfield, 1995). Within the model, perceived task difficulty is posited to influence achievement-related outcomes through its influence on expectancies and values (Eccles (Parsons) et al., 1983; Wigfield & Eccles, 2000), although the researchers cited here have acknowledged that there has been little research directly addressing the relationship between perceived difficulty and task choice.

THE PRESENT STUDY

My goals in this study were, first, to use longitudinal data to establish the extent to which boys' math participation exceeded girls' and girls' English participation exceeded boys'—both for senior high course intentions and selections and for aspired careers. Second, I examine the nature and extent of gender differences in adolescents' prior achievement, self-perceptions, intrinsic values, utility values, and perceived task difficulty for both math and English. Finally, I model the influences of gender, self-perceptions, intrinsic and utility values, and perceived task difficulty on senior high and career math and English participation choices, taking into account adolescents' prior achievement in each domain.

METHOD

Sample and Setting

Participants ($N = 459$) spanned Grades 9 through 11 in a longitudinal design containing 43% girls and predominantly English-speaking background students (73%), with the largest ethnic subgroup being Asians (22%). Participants were from three upper middle class coeducational government secondary schools in northern metropolitan Sydney, matched for socioeconomic status according to the *Index of Education and Occupation* on the basis of census data (Australian Bureau of Statistics, 1991). Data were collected in February near the start of the Australian academic year from 1996 through 1998, when participants were in Grades 9 through 11. Achievement data were collected in the 1st year; intrinsic and utility values, self-perceptions, and perceptions of difficulty in the 2nd year; and participation choices for senior high and career intentions in all 3 years. At the final Grade 11 administration, course levels refer to the actual level students have selected rather than their aspired course levels. For English, some schools did not offer the 3U level until the final Grade 12, combining the 2U Related and 3U candidates through Grade 11. This was the case in schools involved in the present study, and consequently, Grade 11 actual HSC English courses did not include any 3U candidates.

Sixty-five percent of participants were present at all three time points, an additional 23% were present for two of the time points, and 12% participated only at the first time point. Table 3.1 shows the total numbers of participants who were present at each of the math and English administrations for each time point. People with missing data on all relevant variables for the present study were omitted, following which missing data were imputed for prior achievement, intrinsic and utility values, self-perceptions, and perceptions of difficulty, using *multiple imputation*—a methodology that accounts for

TABLE 3.1
Participation at Each Grade for Math and English

Grade	Total *N*	Math *n*	English *n*
9	459	415	429
10	418	393	387
11	368	358	360

the uncertainty in estimating missing data (Schafer, 1997). No imputations were made for missing data in educational and occupational choices that were measured at Grade 11 for the participants present at that wave (see Table 3.1). This resulted in reduced subsample sizes of 337 for the analysis predicting math course enrollments, 281 for math-related career plans, 351 for English course enrollments, and 273 for English-related career plans. Lower numbers for career plans were the result of a number of participants not knowing what careers they planned to pursue, and this "indecisive" group may be interesting to study in further research.

Instruments and Procedures

Questionnaires assessed students' self-perceptions (a composite of their comparative talent perceptions and success expectancies; for details, see Watt, 2002, 2004), values (intrinsic and utility values), and perceived task difficulty. These were measured at Grade 10—the year prior to students selecting senior high course levels. Items were those modified by Watt (2004) on the basis of those developed by Eccles and colleagues for success expectancies and values (see Wigfield & Eccles, 2000), and as discussed earlier, perceptions of talent were assessed instead of their perceptions of ability factor. Full details of modifications and good construct validity and reliability based on the present sample were reported by Watt (2002, 2004), and sample items are presented in Table 3.2. Correlations among constructs are summarized in Table 3.3. Prior achievement was measured using standardized Progressive Achievement Tests for math at Grade 9 (Australian Council for Educational Research, 1984) out of a possible total score of 28, and Tests of Reading Comprehension developed by the Australian Council for Educational Research (1987; Mossenson, Hill, & Masters, 1987, 1995) for English comprehension, out of a possible total score of 22.

Academic choices consisted of planned and actual senior high course levels as well as career intentions. Senior high plans were ascertained at Grades 9 and 10 by students checking boxes to indicate which levels of math and English they planned to study for Grade 11, and at Grade 11, students were asked which course levels they were actually studying. Career plans were assessed

TABLE 3.2
Sample Construct Items to Measure Student Perceptions

Construct	Sample item	Anchors
Self-perceptions		
Comparative talent perceptions	Compared with other students in your class, how talented do you consider yourself to be at math/English?	1 (*not at all*) to 7 (*very talented*)
Success expectancies	How well do you expect to do in your next math/English test?	1 (*not at all*) to 7 (*very well*)
Values		
Intrinsic value	How much do you like math / English, compared with your other subjects at school?	1 (*much less*) to 7 (*much more*)
Utility value	How useful do you believe math/English is?	1 (*not at all*) to 7 (*very useful*)
Task perceptions		
Perceived difficulty	How complicated is math/English for you?	1 (*not at all*) to 7 (*very complicated*)

Note. Underscorings appeared on the survey for emphasis.

using an open-ended question asking what career students intended pursuing; the mathematics and English relatedness of those plans was quantified as described earlier using O*NET 98 (U.S. Department of Labor Employment and Training Administration, 1998) into "none," "any," "average," and "high" for each of math and English.

The study was conducted with informed student and parent consent and approval of the school principals and formal university and departmental ethical bodies. Administration by the researcher was in the regular classroom to maximize ecological validity, with the exception of the final wave, which was administered to larger groups in each school's hall. The study formed part of my

TABLE 3.3
Pearson Correlations Among Prior Achievement, Perceived Difficulty, Intrinsic Value, Utility Value, and Self-Perceptions for Math and English

Factor	Prior achievement	Perceived difficulty	Intrinsic value	Utility value
Perceived difficulty	.02/–.18**			
Intrinsic value	.27**/.29**	–.44**/–.40**		
Utility value	.10*/.05	–.17**/–.03	.46**/.38**	
Self-perceptions	.24**/.33**	–.49**/–.55**	.57**/.63**	.32**/.22**

Note. Slashes separate correlations among constructs for math and English.
*$p < .05$. ** $p < .01$.

larger study investigating a broader range of perceptions about math and English (Watt, 2002).

Analyses

Gender differences in math and English participation choices at each grade were analyzed using dominance analysis (Cliff, 1993, 1996), summarized by the d statistic, which measures the extent to which one sample distribution lies above another. d is a point estimate of the population parameter δ (delta), where d is the difference in probabilities between any two randomly selected members, selected one from each group. d measures the probability that any selected member of group one will lie above any selected member of the second group. Proportions of each gender nominating courses and careers involving varying degrees of each of mathematics and English were of interest, so in randomly sampling girls and boys from each grade, d measures the probability that boys plan to pursue more highly mathematics-related careers than girls, minus the reverse probability. d then is the proportion of boys planning more highly math-related participation than girls, minus the reverse proportion; and conversely for English. This is a direct reflection of the overlap in the two sample distributions. The d statistic also makes no distributional assumptions, and so was appropriate to the present data (Cliff, 1993). Because the d distribution is asymptotically equivalent to the z distribution, to determine levels of statistical significance, d can be converted to a z score and compared with the appropriate critical value.

Initial explorations of gender differences in adolescents' prior achievement and motivations were tested separately for each of math and English using multivariate analysis of variance for Grade 9 achievement and Grade 10 self-perceptions, intrinsic and utility values, and perceived difficulty. Regression analyses then examined the influences of prior achievement, perceived difficulty, intrinsic and utility values, and self-perceptions on Grade 11 course selections and career intentions (prior multiple discriminant analyses established that one discriminant function explained 88% of the variability in Grade 11 math course selections, 94% in math-related career plans, 95% in English course selections, and 68% in English-related career plans; see Watt, 2002). Preliminary visual inspection of scatter plots indicated linear regression to be appropriate for relationships between boys' and girls' motivations and participation outcomes in all cases but one: A quadratic interaction of gender and utility value on math-related career plans appeared likely, and so this term was also modeled in the math regression analysis.[1]

[1]To model this effect, utility value was centered about zero, contrasts of –.5 and .5 represented boys and girls respectively, and Gender × Utility Value and Gender × Utility Value Squared were incorporated as predictors of math-related career choices.

RESULTS

Gender Differences in Participation

Robust gender differences were evident in both planned and actual senior high math participation, where boys planned to participate in the higher levels of mathematics more than girls through Grades 9 and 10 and, further, selected and undertook higher level math than girls at Grade 11 (see Figure 3.2A). Projected career intentions also showed boys planned to pursue math-related careers more than girls (Figure 3.2B). These differences were remarkably robust in terms of their consistency across successive years ($\rho = .60$, .73 for HSC math course choices between Grades 9 to 10 and Grades 10 to 11;

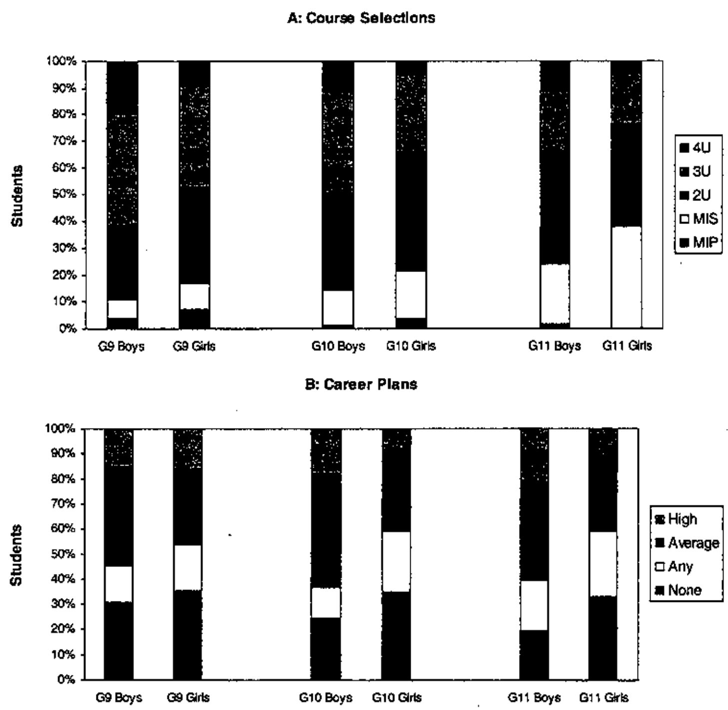

Figure 3.2. Gendered senior high planned and actual math course selections (Panel A) and gendered math-related career plans (Panel B). Grade 11 results in Panel A reflect students' actual course levels. G = grade; 4U = 4-unit maths; 3U = 3-unit maths; 2U = 2-unit maths; MIS = Maths in Society; MIP = Maths in Practice.

$\rho = .50$, .49 for math-related career plans). Differences in proportions favoring boys were statistically significant at each grade level for planned and actual senior high math course selections, with *d* ranging from .19 to .18 (see Table 3.3), indicating boys' HSC math choices were higher than girls' in 19% to 18% of paired comparisons. Significant *d* values favoring boys were also evident for math-related career plans, with *d* ranging from .21 to .23, except at Grade 9, where this effect did not achieve statistical significance (Table 3.4).

Conversely, for English, girls both planned and undertook significantly higher levels of English than boys, with *d* values ranging from −.15 through Grades 9 and 10 to −.32 by Grade 11 (see Table 3.3 and Figure 3.3A), indicating girls chose higher HSC levels of English than boys in 15% to 32% of paired comparisons. There was less stability in English course choices than was the case for math ($\rho = .45$, .36 for HSC English course choices between Grades 9 to 10 and Grades 10 to 11), although the second low correlation in particular is likely to relate to the fact that 3U English was not offered in participants' schools at Grade 11. Aspired careers were significantly more English-related for girls than for boys at the final time point (see Table 3.4 and Figure 3.3B), with a *d* value of −.13, although that gender difference was not statistically significant through earlier Grades 9 and 10. There was more stability in the English relatedness of career aspirations over time ($\rho = .57$, .56 for English-related career plans between Grades 9 to 10 and Grades 10 to 11).

Gender, Motivations, and Achievement

Boys rated their self-perceptions of mathematical talent and expected success significantly higher than girls did, $F(1, 440) = 24.36$, $p < .001$ (see Figure 3.4). This occurred despite equivalent levels of prior mathematical achievement for boys and girls, $F(1, 440) = .70$, $p = .40$ (boys: $M = 21.26$, $SD = 4.65$;

TABLE 3.4
Gender Differences in Academic Choices as Measured by the *d* Statistic for Senior High Courses and Career Choices Related to Math and English

		Math			English		
Academic choices	Parameter estimate	Grade 9	Grade 10	Grade 11	Grade 9	Grade 10	Grade 11
Senior high course level	*d*	.190*	.185*	.175*	−.149*	−.146*	−.324*
	σ	.055	.056	.059	.055	.055	.045
	z	3.455	3.304	2.966	−2.709	−2.655	−7.200
Career choice	*d*	.059	.225*	.207*	−.106	−.085	−.127*
	σ	.063	.061	.064	.062	.062	.064
	z	0.937	3.689	3.234	−1.710	−1.371	−1.984

Note. Positive values correspond to higher ratings for boys, negative values to higher ratings for girls.
*$p < .05$.

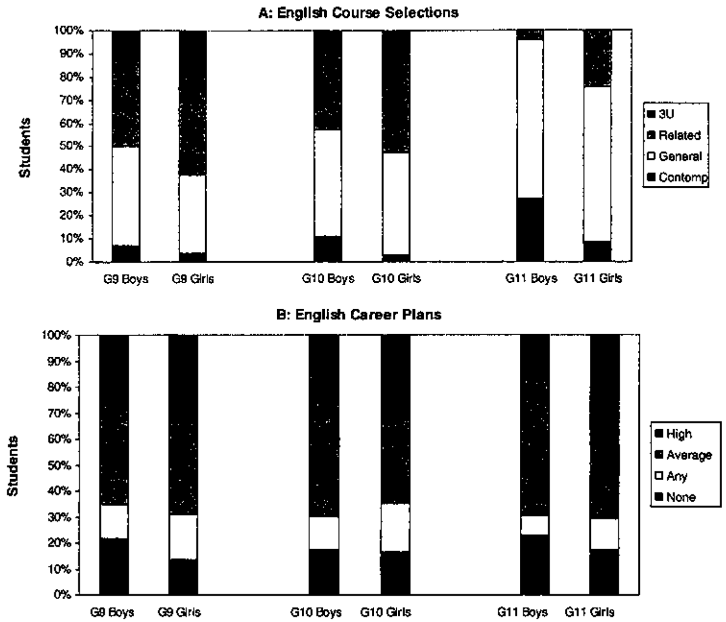

Figure 3.3. Gendered senior high planned and actual English course selections (Panel A) and gendered English-related career plans (Panel B). Grade 11 English course selections are actual rather than intended senior high selections. These schools did not offer 3-unit English commencement until Grade 12, explaining the lack of Grade 11 students electing the 3-unit level. G = grade; 3U = 3-unit English; Related = 2-unit Related English; General = General English; Contemp = Contemporary English.

girls: M = 21.62, *SD* = 4.34). Boys also rated their intrinsic value higher, $F(1, 440) = 15.36$, $p < .001$ (see Figure 3.4), and their perceptions about the difficulty of math lower than girls, $F(1, 440) = 5.61$, $p = .02$ (see Figure 3.4). Boys and girls rated the utility value of math similarly, $F(1, 440) = 1.77$, $p = .18$ (see Figure 3.4). For English, girls rated both their intrinsic and utility values statistically significantly higher than boys did, $F(1, 445) = 6.50$, $p = .01$, for intrinsic values; $F(1, 445) = 4.37$, $p = .04$, for utility values (see Figure 3.4), again despite equivalent English achievement scores, $F(1, 445) = 2.58$, $p = .11$ (boys: M = 13.65, *SD* = 5.09; girls: M = 14.44, *SD* = 5.19). Girls and boys held similar perceptions regarding the difficulty of English, $F(1, 445) = 1.12$, $p = .29$, and English-related self-perceptions, $F(1, 445) = .38$, $p = .54$.

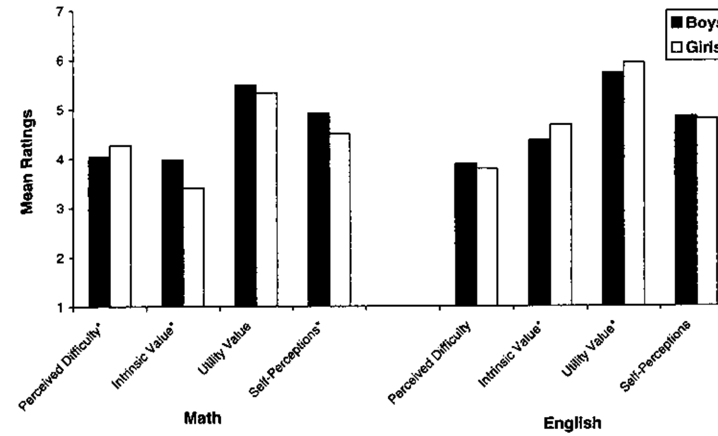

Figure 3.4. Gendered motivations related to math and English. *$F(1, 440)$, $p < .05$, for math; $F(1, 445)$, $p < .05$, for English.

Influences on Participation Choices

Multiple regression analyses modeled expectancy-value influences on math and English participation choices separately within each domain. The conceptual model that was empirically tested is represented diagrammatically in Figure 3.5. At the first step, the influence of gender on Grade 9 achievement was measured. This was followed by measurement of influences of gender and Grade 9 achievement on Grade 10 perceived difficulty; then gender, Grade 9 achievement, and Grade 10 perceived difficulty on each of Grade 10 self-perceptions, intrinsic value, and utility value; and finally the influences of gender, Grade 9 achievement, and Grade 10 perceived difficulty, self-perceptions, intrinsic value, and utility value on each of Grade 11 HSC course levels and Grade 11 aspired careers. The influence of Grade 11 course levels on Grade 11 aspired careers was also included. Paths with higher values, up to a value of ±1, denote the strongest relationships. For the goals of the present study, the paths of greatest interest were the ones that can impact on math and English participation in senior high and aspired careers: from intrinsic value, utility value, self-perceptions, perceived difficulty, prior achievement, and gender.

Math. Senior high math course levels selected by students at Grade 11 were influenced by prior mathematical achievement ($\beta = .31$), intrinsic value ($\beta = .20$), and self-perceptions related to math ($\beta = .15$; see Table 3.5). Students who had higher levels of prior achievement in math selected higher

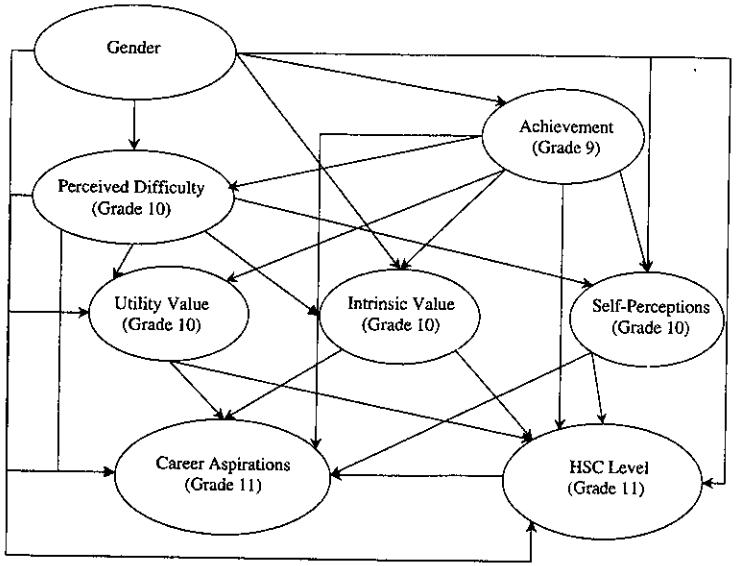

Figure 3.5. Conceptual model to predict participation choices. HSC = Higher School Certificate.

math course levels, and this was the strongest measured influence on their senior high enrollments. Students with higher intrinsic values ($\beta = -.20$) and self-perceptions of mathematical talent and success expectancies ($\beta = -.15$) also subsequently selected higher math course levels, even when their prior mathematical achievement was controlled.

Girls had lower math-related self-perceptions ($\beta = -.20$) and intrinsic value ($\beta = -.15$) than boys, and there was no gender effect on utility value. Prior achievement impacted positively on subsequent self-perceptions ($\beta = .21$) and intrinsic value ($\beta = .25$), although not utility value. Girls also perceived math as more difficult than boys ($\beta = .12$), and this in turn affected their lower math-related self-perceptions ($\beta = -.48$) and intrinsic ($\beta = -.43$) and utility ($\beta = -.14$) values, independent of their prior mathematical achievement. In this way, and as posited in the expectancy-value framework, task difficulty perceptions exerted weak negative indirect effects on senior high math participation choices, via their influence on self-perceptions and intrinsic value (indirect effects of $\beta = -.07$ and $\beta = -.09$, respectively), and did not themselves impact directly on math enrollment choices. Utility value did not affect senior high math enrollments, and, consequently, perceived difficulty did not exert an indirect effect on math enrollments via utility value.

TABLE 3.5
Summary of Regression Analyses Predicting Math-Related Educational and Occupational Participation

Dependent	Predictor	β	*B*	*SE*
Prior achievement (Grade 9; Adj. $R^2 = .00$)	Gender	.05	.46	.47
Perceived difficulty (Grade 10; Adj. $R^2 = .01$)	Gender	.12*	.25	.12
	Prior achievement	.01	.00	.01
Intrinsic value (Grade 10; Adj. $R^2 = .27$)	Gender	−.15**	−.50	.15
	Prior achievement	.25**	.09	.02
	Perceived difficulty	−.43**	−.66	.07
Utility value (Grade 10; Adj. $R^2 = .02$)	Gender	−.06	−.17	.14
	Prior achievement	.08	.02	.02
	Perceived difficulty	−.14**	−.17	.07
Self-perceptions (Grade 10; Adj. $R^2 = .32$)	Gender	−.20**	−.38	.09
	Prior achievement	.21**	.04	.01
	Perceived difficulty	−.48**	−.44	.04
Senior high math course enrollment (Grade 11; Adj. $R^2 = .24$)	Gender	−.09	−.16	.10
	Prior achievement	.31**	.07	.01
	Perceived difficulty	−.01	−.01	.06
	Intrinsic value	.20**	.12	.04
	Utility value	.02	.02	.05
	Self-perceptions	.15*	.15	.07
Math-related career plans (Grade 11; Adj. $R^2 = .21$)	Gender	−.05	−.10	.20
	Prior achievement	.03	.01	.02
	Perceived difficulty	.04	.04	.07
	Intrinsic value	.03	.02	.05
	Utility value	.09	.08	.06
	Gender × Utility Value	−.18	−.21	.14
	Gender × Utility Value Squared	.16	.07	.06
	Self-perceptions	.12**	.14	.09
	Senior high math course enrollment	.35*	.42	.08

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

The extent to which students intended pursuing a math-related career was directly impacted only by level of senior high math course enrollment ($\beta = .36$). This emphasizes the importance of retaining girls in the math "pipeline" through senior high school, because other measured motivational influences exerted indirect effects through their influences on senior high math course enrollments.

The anticipated quadratic interaction of gender and utility value did not attain statistical significance ($\beta = .16$, $p = .20$), although this may have related to low power. Consequently, analysis of variance was used on the basis of a triad split for utility values (cut-offs at values of 5.00 and 6.00) to improve statistical power. This analysis identified an interaction effect of gender and math utility value as shown in Figure 3.6, $F(2, 334) = 4.72$, $p = .01$ (boys: low $M = 1.13$, $SD = .86$; mid $M = 1.79$, $SD = .95$; high $M = 1.70$, $SD = .90$; girls: low $M = 1.07$,

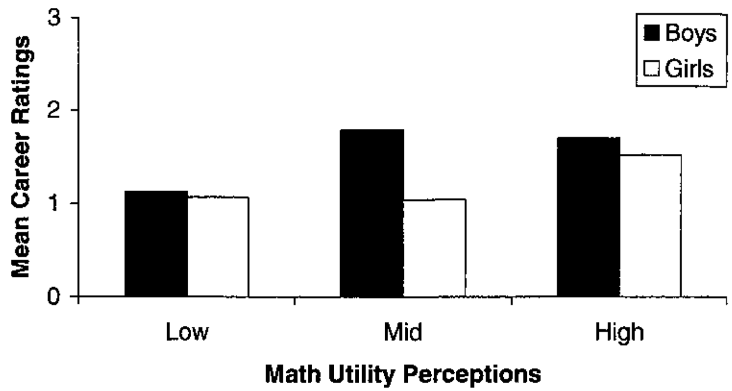

Figure 3.6. Math-relatedness of boys' and girls' career plans by level of math utility value.

$SD = 1.04$; mid $M = .89$, $SD = .81$; high $M = 1.52$, $SD = 1.00$). The interaction effect was due to boys with mid math utility values having math-related career plans that were statistically significantly higher than those of girls with mid utility values, $F(1, 103) = 26.39$, $p < .001$; boys and girls within each of the low, $F(1, 122) = .12$, $p = .73$, and high, $F(1, 165) = 1.35$, $p = .25$, utility value groups had similarly math-related career plans. Among boys, those with mid and high utility values planned similarly math-related careers, whereas those with low utility values planned significantly less math-related careers, $F(2, 221) = 10.52$, $p < .001$ (Tukey's honestly significant difference post hoc tests showed the low group differed from each of the mid and high groups with $p < .001$, and the mid and high groups were similar with $p = .79$). Among girls, those with low and mid utility values planned careers of similar math relatedness, whereas those with high utility values planned significantly more highly math-related careers than either the mid or low utility value groups, $F(2, 169) = 6.54$, $p = .002$ (Tukey's honestly significant difference post hoc tests showed the high group differed from each of the low [$p = .02$] and mid [$p = .002$] groups, and the low and mid groups were similar with $p = .63$). This implies that highly math-related career choices for girls were based on utility value only when this was high, whereas boys with both high and mid levels of utility value planned highly math-related careers.

English. A similar series of regressions was run for the English-related HSC and career outcomes. English senior high courses at Grade 11 were predicted by prior English achievement ($\beta = .33$), gender ($\beta = .29$), and intrinsic value ($\beta = .17$; see Table 3.6). Prior achievement and intrinsic values were the strongest measured influences on English course selections, with participants

TABLE 3.6
Summary of Regression Analyses Predicting English-Related Educational and Occupational Participation

Dependent	Predictor	β	*B*	*SE*
Prior achievement (Grade 9; Adj. $R^2 = .02$)	Gender[a]	.13*	1.31	.53
Perceived difficulty (Grade 10; Adj. $R^2 = .04$)	Gender	−.02	−.03	.10
	Prior achievement	−.22**	−.04	.01
Intrinsic value (Grade 10; Adj. $R^2 = .16$)	Gender	.04	.11	.13
	Prior achievement	.22**	.06	.01
	Perceived difficulty	−.30**	−.42	.07
Utility value (Grade 10; Adj. $R^2 = .00$)	Gender	.08	.19	.12
	Prior achievement	.04	.01	.01
	Perceived difficulty	.03	.04	.07
Self-perceptions (Grade 10; Adj. $R^2 = .33$)	Gender	−.12**	−.22	.08
	Prior achievement	.24**	.04	.01
	Perceived difficulty	−.47**	−.44	.04
Senior high English course enrollment (Grade 11; Adj. $R^2 = .30$)	Gender	.29**	.33	.05
	Prior achievement	.33**	.04	.01
	Perceived difficulty	.02	.01	.03
	Intrinsic value	.17**	.07	.03
	Utility value	.02	.01	.02
	Self-perceptions	.08	.05	.04
English-related career plans[b] (Grade 11; Adj. $R^2 = .03$)	Gender	.09	.19	.13
	Prior achievement	−.05	−.01	.02
	Intrinsic value	−.12	−.10	.07
	Utility value	.13*	.12	.06
	Self-perceptions	.14†	.17	.09
	Senior high math course enrollment	.11	.21	.13

Note. Preliminary analyses indicated a significant difference between the full sample and the regression analysis subsample on prior achievement, $F(1, 443) = 8.09$, $p = .005$, where the regression subsample scored higher; and a difference on utility values approached statistical significance, $F(1, 443) = 3.41$, $p = .066$, where the regression subsample scored lower. Controlling for prior achievement led to significant gender differences on self-perceptions, and nonsignificance on intrinsic values.
[a]The gender difference favoring boys for prior English achievement ($\beta = .13$) is not interpreted given the table note above and findings of no gender difference in the full sample.
[b]Perceived difficulty was excluded as a predictor at this step because it produced spurious effects—a direct positive effect ($\beta = .18$) and an indirect negative effect via self-perceptions ($\beta = -.11$) on English-related career plans—despite a nonsignificant bivariate Pearson correlation with English-related career plans ($r = .08$, $p = .22$).
†$p = .066$. *$p < .05$. **$p < .01$.

who had higher levels of prior English achievement and higher intrinsic values selecting higher levels of HSC English. Girls also chose higher English levels—with statistical control for prior achievement and motivational factors.

Gender differences were evident on English-related self-perceptions ($\beta = -.12$), with girls having higher self-perceptions related to English than boys (also see Table 3.6, note a). Prior English achievement positively predicted subsequent self-perceptions ($\beta = .24$) and perceptions of English as being less difficult ($\beta = -.22$). Difficulty perceptions affected intrinsic value ($\beta = -.30$)

and self-perceptions (β = −.47), with lower perceptions regarding the difficulty of English promoting more positive interest and ability-related beliefs. Perceived difficulty had negative but weak flow-on effects to senior high course choices through its effect on intrinsic value (β = −.05), with higher difficulty perceptions influencing lower course levels. As posited in the expectancy-value theory, perceived difficulty did not impact directly on course choices, but indirectly through its relation to intrinsic values.

The English relatedness of participants' career plans was predicted equally by self-perceptions (β = .14) and utility value (β = .13; see Table 3.6, note b), with those students who believed themselves to be more talented in English, expected greater success in English, and perceived English as more useful aspiring toward careers involving more English-related skills. When student motivations were included in the model, there was no direct impact of level of HSC English to English-related career plans. Unlike math, then, English course level did not mediate the relations between adolescents' English-related motivations and their career plans.

DISCUSSION

Robust gender differences exist within the educational and occupational choices among this sample of Australian adolescents. Boys both planned and subsequently undertook higher levels of math in senior high school. Boys also planned more highly math-related careers. Conversely, girls planned and undertook higher levels of senior high English than boys and aspired to careers that were more English-related. These gendered educational and occupational choices were substantially explained by adolescents' motivations over and above their levels of math and English achievement.

Explaining Gendered Math Participation

Math-related self-perceptions and intrinsic values emerged as the key predictors of students' subsequent choices for math participation in senior high course selections. This finding is exactly as predicted by the expectancy-value model of Eccles and her colleagues (Eccles (Parsons) et al., 1983; Wigfield & Eccles, 2000). As with studies conducted by Eccles and her colleagues (see Eccles (Parsons) et al., 1983), no direct influence of task difficulty perceptions on choice outcomes was identified. Girls' perceptions of math as more difficult did, however, have flow-on effects to their lower math-related self-perceptions and intrinsic value, which in turn impacted on their lower senior high math course participation.

Math-related career plans were strongly impacted by adolescents' senior high math course level. There was also an interaction effect of gender and utility value. Girls who valued math as highly useful were more likely than other

girls to aspire to highly math-related careers. Boys, on the other hand, who valued math as moderately to highly useful, were equally likely to aspire to highly math-related careers. For girls, then, valuing math as highly useful is likely to lead to the choice of a math-related career. For boys, moderate valuing of math is just as likely to lead to math-related career intentions. Perceptions of the utility of math are therefore more salient in girls' aspirations toward math-related careers. As argued by Eccles and her colleagues (e.g., Eccles, 1984; Eccles, Midgley, & Adler, 1984; Eccles (Parsons), 1984; Eccles (Parsons) et al., 1983; Ethington, 1991; Meece et al., 1990), values are indeed indicative of educational and occupational choices in math. Intrinsic value predicted senior high math participation, and the interaction of utility value with gender predicted math-related career plans. Different kinds of value were therefore relevant for different participation choices.

Previous analyses involving the current data have established that boys maintained higher intrinsic value for math as well as higher math-related self-perceptions than girls throughout adolescence (see Watt, 2004). Because the present study has identified the importance of these factors in math participation choices, for both senior high and planned careers, girls' lower perceptions are particularly problematic. Despite performing similarly, why is it that boys come to be more interested in and like math more than girls? How do girls come to perceive themselves as having less talent and to have lower expectations of mathematical success than boys?

Throughout adolescence, these boys and girls had similarly declining perceptions for the utility of math (see Watt, 2004). It may be most important to guard against girls' declining math utility values because of the different ways that utility value influenced math-related career plans for boys and girls. Because the usefulness of math emerged as a salient concern in girls' career choices, educators could fruitfully focus on explicating the high utility value of math (in general, in the workplace, and in the everyday world) to enhance the likelihood of girls pursuing highly math-related careers.

In the NSW Australian system, selecting what level of math to undertake in senior high school is the first point where students have a real choice regarding the difficulty level of math that they wish to pursue. Girls chose to opt out of more difficult levels of math at this first opportunity. Consistent with the notion of math as a critical filter, these choices in turn had strong implications for young adults' intentions to pursue math-related careers. Because senior high math enrollment selections exerted the strongest influence on math-related career plans, it appears that there should be particular concern about girls opting out of the math pipeline at that point.

Explaining Gendered English Participation

English-related intrinsic values emerged as a key predictor of choices for English participation in senior high course enrollments, with perceived difficulty exerting an indirect effect through its influence on intrinsic values (similar to math and consistent with expectancy-value theory). Unlike math, English-related self-perceptions did not predict HSC English course selections, and gender continued to significantly predict English senior high course levels when the motivation variables were included in the model. Thus, motivations and prior achievement did not fully explain the gender difference by which girls elect to participate more in English—so other factors must also be at play.

English-related career plans were impacted equally by English-related self-perceptions and utility values. Students who believed themselves more talented and likely to succeed in English and students who regarded English as more useful were those aspiring to highly English-related careers. Self-perceptions predicted aspired career but not senior high course level, and utility values demonstrated a relationship with English-related career plans uncomplicated by gender—boys and girls were both more likely to plan pursuing more highly English-related careers when they perceived English as more useful. The combination of English-related self-perceptions and utility values fully mediated the gender difference in adolescents' English-related career plans, with no remaining gender effect once these motivations were included in the analyses.

As was the case with math, and as predicted by expectancy-value theory, self-perceptions and values were most important in explaining adolescents' gendered English participation. Again, different types of value were important for different types of choice. As for math, English-related intrinsic values predicted English senior high course enrollments, whereas utility values influenced English-related career plans. Unlike math, English-related self-perceptions did not impact senior high course selections but did contribute to career plans. English-related self-perceptions and utility values impacted directly on career plans involving English rather than their influence operating through senior high English participation.

It is interesting to note that these findings suggest that the pipeline argument may be less relevant for explaining a continued pattern of lower English participation rates for boys relative to girls. To encourage boys to aspire to participate in English-related careers, it appears to be most important to directly target their ability-related beliefs and their conceptions regarding the utility of English. Because boys and girls demonstrated similar levels of English achievement, I suggest that it is a dangerous aim to enhance boys' ability-related beliefs at the expense of girls', leading to boys overestimating their English-related abilities relative to girls. On the basis of the findings of this study, I recommend targeting boys' lower English values, particularly their utility values.

It may also be less important to worry about boys' lower participation in senior high English courses because that does not subsequently determine the English relatedness of their aspired careers. If this were an issue of concern, however, it is boys' lower liking for and interest in English that would be most

useful to address. That said, I reiterate that other factors are also at play in explaining boys' lower senior high English course enrollments. The other chapters in this volume elaborate on many additional important aspects to consider in understanding gendered participation choices, such as family influences, lifestyle goals, social contexts, and biological influences.

Previous analyses involving these data have demonstrated that girls have higher intrinsic and utility values for English than boys throughout secondary school, although boys and girls exhibit similar English-related self-perceptions over this period (see Watt, 2004). If it is a concern that boys are not pursuing English-related occupations that could lead to their potential personal satisfaction and fulfillment, findings from this study suggest that targeting boys' lower values for English throughout secondary school will foster their aspirations toward those careers.

CONCLUSIONS AND POLICY IMPLICATIONS

Operationalizing the extent of boys' and girls' math and English participation choices, both for senior high course selections and for career intentions, has enabled a more fine-grained analysis of the extent of gendered participation in these two traditionally sex-stereotyped domains. Across a sample of upper middle class secondary school students in metropolitan Sydney, Australia, it is clear that robust and persistent gender imbalances in math and English participation choices remain. The magnitude of these gender differences may be even greater among lower socioeconomic groups, where the push to excel academically may perhaps be less. A limitation of the study is its reliance on career intentions rather than actual future career choices, which is an important area of extension for future research.

Should similar participation of men and women in sex-stereotyped domains be the goal? Shapka, Domene, and Keating (2006) contended that the prestige of men's and women's occupations may be the more important dimension to consider rather than the type of occupation. Either way, the persistent gender imbalance in choices for math and English participation appears extraordinarily robust across contexts and time, and remains a social phenomenon, regardless of whether it is considered a social problem. To promote greater male participation in English-related careers, a focus on boys' lower utility values regarding English through secondary school promises to be the most fruitful direction. For math, given current shortages of people entering math-related careers in general, it is clearly important to target both boys' and girls' choices for math participation. Key to addressing this problem will be a focus on girls' liking for and interest in math, their self-perceptions of mathematical talent and expectations for success, and their valuation of the utility of math. Continued investigations into the origins and sources of gender differences in math- and English-related values and self-perceptions promise to shed further light on the resilient issue of gendered participation in sex-stereotyped careers.

REFERENCES

Australian Bureau of Statistics. (1991). *Index of education and occupation* (Catalogue No. 2912.0). Sydney, Australia: Author.

Australian Council for Educational Research. (1984). *Progressive achievement tests of mathematics*. Melbourne, Australia: Author.

Australian Council for Educational Research. (1987). *TORCH tests of reading comprehension*. Melbourne, Australia: Author.

Board of Studies. (1991). *1991 Higher School Certificate examination statistics*. Sydney, Australia: Author.

Board of Studies. (1992). *1992 Higher School Certificate examination statistics*. Sydney, Australia: Author.

Board of Studies. (1993). *1993 Higher School Certificate examination statistics*. Sydney, Australia: Author.

Board of Studies. (1994). *1994 Higher School Certificate examination statistics*. Sydney, Australia: Author.

Board of Studies. (1995). *1995 Higher School Certificate examination statistics*. Sydney, Australia: Author.

Board of Studies. (1996). *1996 Higher School Certificate examination statistics*. Sydney, Australia: Author.

Board of Studies. (1997). *1997 Higher School Certificate examination statistics*. Sydney, Australia: Author.

Board of Studies. (1998). *1998 Higher School Certificate examination statistics*. Sydney, Australia: Author.

Board of Studies. (1999). *1999 Higher School Certificate examination statistics*. Sydney, Australia: Author.

Bong, M. (2001). Role of self-efficacy and task-value in predicting college students' course performance and future enrollment intentions. *Contemporary Educational Psychology, 26*, 553–570.

Bornholt, L. J., Goodnow, J. J., & Cooney, G. H. (1994). Influences of gender stereotypes on adolescents' perceptions of their own achievement. *American Educational Research Journal, 31*, 675–692.

Bridgeman, B., & Wendler, C. (1991). Gender differences in predictors of college mathematics performance and in college mathematics course grades. *Journal of Educational Psychology, 83*, 275–284.

Cliff, N. (1993). Dominance statistics: Ordinal analyses to answer ordinal questions. *Psychological Bulletin, 114*, 494–509.

Cliff, N. (1996). Answering ordinal questions with ordinal data using ordinal statistics. *Multivariate Behavioral Research, 31*(3), 331–350.

Eccles, J. S. (1984). Sex differences in achievement patterns. In T. B. Sonderegger (Ed.), *Nebraska Symposium on Motivation: Vol. 32. Psychology and gender* (pp. 97–132). Lincoln: University of Nebraska Press.

Eccles, J. S. (1985). A model of student enrollment decisions. *Educational Studies in Mathematics, 16*, 311–314.

Eccles, J. S. (2005a, Winter). Studying gender and ethnic differences in participation in math, physical science, and information technology. *New Directions in Child and Adolescent Development, 110*, 7–14.

Eccles, J. S. (2005b). Subjective task value and the Eccles et al. model of achievement-related choices. In A. J. Elliot & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 105–121). New York: Guilford Press.

Eccles, J. S., Adler, T. F., & Meece, J. L. (1984). Sex differences in achievement: A test of alternate theories. *Journal of Personality and Social Psychology, 46*, 26–43.

Eccles, J. S., Midgley, C., & Adler, T. (1984). Grade-related changes in the school environment: Effects on achievement motivation. In J. G. Nicholls (Ed.), *Advances in motivation and achievement: The development of achievement motivation* (Vol. 3, pp. 283–331). Greenwich, CT: JAI Press.

Eccles, J. S., & Wigfield, A. (1995). In the mind of the actor: The structure of adolescents' achievement task values and expectancy-related beliefs. *Personality and Social Psychology Bulletin, 21*, 215–225.

Eccles (Parsons), J. S. (1984). Sex differences in mathematics participation. In M. W. Steinkamp & M. L. Maehr (Eds.), *Advances in motivation and achievement: Vol. 2. Women in science* (pp. 93–137). Greenwich, CT: JAI Press.

Eccles (Parsons), J., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., et al. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motivation* (pp. 75–146). San Francisco: Freeman.

Ethington, C. A. (1991). A test of a model of achievement behaviors. *American Educational Research Journal, 28*, 155–172.

Forgasz, H. J., & Leder, G. C. (2001). The Victorian Certificate of Education—A gendered affair? *Australian Educational Researcher, 28*(2), 53–66.

Green, D. R. (1974). *The aptitude–achievement distinction*. Monterey, CA: McGraw-Hill.

Heller, K. A., & Parsons, J. E. (1981). Sex differences in teachers' evaluative feedback and students' expectancies for success in mathematics. *Child Development, 52*, 1015–1019.

House of Representatives Standing Committee on Education and Training. (2002). *Boys: Getting it right. Report on the inquiry into the education of boys*. Retrieved August 1, 2007, from http://www.aph.gov.au/house/committee/edt/eofb/report/fullrpt.pdf

Leder, G. C. (1992). Mathematics and gender: Changing perspectives. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 597–622). New York: Macmillan.

Leder, G., & Forgasz, H. (1992). Gender: A critical variable in mathematics education. In B. Atweh & J. Watson (Eds.), *Research in mathematics education in Australasia 1988–1991* (pp. 67–95). University of Technology, Queensland: Mathematics Education Research Group of Australasia.

Leder, G. C., Forgasz, H. J., & Solar, C. (1996). Research and intervention programs in mathematics education: A gendered issue. In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (Vol. 2, pp. 945–985). Dordrecht, the Netherlands: Kluwer.

Lingard, B., Martino, W., Mills, M., & Bahr, M. (2002). *Addressing the educational needs of boys* (Rep. to Department of Education, Science and Training). Canberra, Australia: Commonwealth Department of Education, Science and Training.

Lips, H. M. (1992). Gender- and science-related attitudes as predictors of college students' academic choices. *Journal of Vocational Behavior, 40*, 62–81.

MacCann, R. (1995). Sex differences in participation and performance at the NSW Higher School Certificate after adjustment for the effects of differential selection. *Australian Journal of Education, 39*, 163–188.

Martin, A. J. (2002). *Improving the educational outcomes of boys: Final report to ACT Department of Education, Youth and Family Services*. Retrieved August 1, 2007, from http://www.decs.act.gov.au/publicat/pdf/Ed_Outcomes_Boys.pdf

Meece, J. L., Eccles (Parsons), J. S., Kaczala, C., Goff, S. B., & Futterman, R. (1982). Sex differences in math achievement: Toward a model of academic choice. *Psychological Bulletin, 91*, 324–348.

Meece, J. L., Wigfield, A., & Eccles, J. S. (1990). Predictors of math anxiety and its consequences for young adolescents' course enrollment intentions and performances in mathematics. *Journal of Educational Psychology, 82*, 60–70.

Mossenson, L., Hill, P., & Masters, G. (1987). *Tests of reading comprehension: Test booklet B*. Melbourne: Australian Council for Educational Research.

Mossenson, L., Hill, P., & Masters, G. (1995). *Tests of reading comprehension manual*. Burwood, Victoria: Australian Council for Educational Research.

O'Doherty, S. (1994). *Challenges and opportunities: A discussion paper* (Rep. to the Minister for Education, Training and Youth Affairs on the Inquiry into Boys' Education 1994 by the New South Wales Government Advisory Committee on Education, Training and Tourism). Sydney, Australia: Ministry of Education, Training and Youth Affairs.

Osipow, S. H., & Fitzgerald, L. F. (1996). *Theories of career development* (4th ed.). London: Allyn & Bacon.

Schafer, J. L. (1997). *Analysis of incomplete multivariate data*. London: Chapman & Hall.

Sells, L. W. (1980). Mathematics: The invisible filter. *Engineering Education, 70*, 340–341.

Shapka, J. D., Domene, J. F., & Keating, D. P. (2006). Trajectories of career aspirations through adolescence and young adulthood: Early math achievement as a critical filter. *Educational Research and Evaluation, 12*, 347–358.

Simpkins, S. D., Davis-Kean, P. E., & Eccles, J. S. (2006). Math and science motivation: A longitudinal examination of the links between choices and beliefs. *Developmental Psychology, 42*, 70–83.

Updegraff, K. A., Eccles, J. S., Barber, B. L., & O'Brien, K. M. (1996). Course enrollment as self-regulatory behavior: Who takes optional high school math courses? *Learning and Individual Differences, 8*, 239–259.

U.S. Department of Labor Employment and Training Administration. (1998). *O*NET: The occupational information network*. Washington, DC: U.S. Government Printing Office.

Watt, H. M. G. (2002). *Gendered achievement-related choices and behaviours in mathematics and English: The nature and influence of self-, task- and value perceptions*. Unpublished doctoral dissertation, University of Sydney, Sydney, Australia.

Watt, H. M. G. (2004). Development of adolescents' self perceptions, values and task perceptions according to gender and domain in 7th through 11th grade Australian students. *Child Development, 75*, 1556–1574.

Watt, H. M. G. (2005, Winter). Explaining gendered math enrollments for NSW Australian secondary school students. *New Directions for Child and Adolescent Development, 110*, 15–29.

Watt, H. M. G. (2006). The role of motivation in gendered educational and occupational trajectories related to math. *Educational Research and Evaluation, 12*, 305–322.

Watt, H. M. G., Eccles, J. S., & Durik, A. M. (2006). The leaky mathematics pipeline for girls: A motivational analysis of high school enrollments in Australia and the USA. *Equal Opportunities International, 25*, 642–659.

Wigfield, A. (1994). Expectancy-value theory of achievement motivation: A developmental perspective. *Educational Psychology Review, 6*, 49–78.

Wigfield, A., & Eccles, J. (1992). The development of achievement task values: A theoretical analysis. *Developmental Review, 12*, 265–310.

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25*, 68–81.