**Method**

**Sample**

The sample consisted of participants from the Longitudinal Study of American Youth (LSAY). The LSAY was funded by the National Science Foundation in 1986 to investigate the development of student achievement in the middle and high school, and the relationship of those patterns to career choices. The data was collected from a nationally representative probability sample of students recruited through their schools, which were selected from a probability sample of United States public school districts. Each year of the study, students took math and science achievement tests, as well as completed attitudinal questionnaires (Kimmel, & Miller, 2008). In the sample used for this study, participants were from the seventh grade cohort. The cohort included students from 52 middle schools across the nation in 1987. From each school approximately 60 students seventh graders were selected at random. The sample was comprised of students who were predominantly white (70%), followed by African-American (11%), Hispanic (9%), Asian (4%), Native American (2%), and students who did not indicate any race/ethnicity (5%). There was an approximate equal split between female (48%) and male (52%) students. More than 95% of the original sample were surveyed in 2007, when the student were approximately 32 years old, about their career choices (Miller, & Kimmel, 2012). The current study included data from students who participated in an attitudinal survey, and mathematics and science achievement tests in 1987, and career attainment survey in 2007. The total sample size was 3,116.

**Measures**

**Mathematics and science attitudes**. Ten items were used to represent mathematics and science attitudes. Selection of these items reflected literature about social cognitive career theory which discussed student enjoyment of mathematics and science, and perceived usefulness and importance of mathematics and science in the future (Lent, & Brown, 2006). In particular, social cognitive career theory indicates that it is important to have the following constructs to be successful in math and science: self-efficacy, outcome expectations, interests, and goals.. There were two items that measured self-efficacy, “I enjoy math”, and “I enjoy science”. There were four items that measured outcome expectations, “Math is useful in everyday problems”, “Math helps a person think logically”, “Science is useful in everyday problems”, and “Science helps a person think logically”. There were another four items that measured interests and goals, “It is important to know math to get a good job”, “I will use math in many ways as an adult”, “It is important to know science to get a good job”, and “I will use science in many ways as an adult”.

Items about mathematics and science attitudes were used in this study to reflect prior research which indicates that most STEM careers require both mathematics and science knowledge, and attitudes are content-specific and measures should be tailored to the specific domain (Bandura, 1986; Hackett, & Betz, 1981; Lent, & Brown, 2006). Response options of the ten items used in our study were: strongly agree, agree, not sure, disagree, strongly disagree. These options were coded in a way such that higher values represented stronger agreement or more positive attitudes, and lower values represented less agreement or less positive attitudes.

**Mathematics achievement.** Student mathematics achievement was measured in the fall of twelfth grade (*M* = 68.74, *SD* = 15). Scores on the test were obtained using an Item Response Theory modeling (Lord, 1980) on a scale ranging from 0 to 100. Items on the math test were based on the National Assessment of Educational Progress (NAEP), and were designed to measure basic math skills, algebra, geometry, and quantitative literacy. Twelfth grade achievement was specified in the analysis as a proximal outcome variable.

**STEM career attainment.** In2007, respondents were surveyed regarding the industry of their current occupation. The item representing STEM career attainment was a dichotomized in a way that 1 indicates the respondent was currently employed in a STEM occupation, and 0 indicates she was not in a STEM occupation. The item was used in this study as a distal outcome variable with the definition of STEM careers including the full range of STEM occupations only except for social science occupations. Fifteen percent (*n*=287) of the sample was employed in a STEM or STEM support occupation.

**Interest in social issues.** Six items were used to create a composite variable representing interest in social issues. Those items were, “I have an interest in space exploration”, “I have an interest in agricultural issues”, “I have an interest in science issues”, “I have an interest in new technology”, “I have an interest in energy policy issues”, and “I have an interest in environmental quality”. Response options for each item were initially dichotomized: 1 represented “interested”, and 0 represented “not interested”. The mean of the six items was calculated to create a composite measure, and it was once again dichotomized: 1 represents “interested” only when all six items indicate “interested”, and 0 represents “not interested” otherwise.

**Science opinion and knowledge.** A composite variable representing science opinion and knowledge consisted of three items, “Science and technology improve our lives”, “Scientists work for good of humanity”, and “Science and technology make life healthier”. Response options for each item were initially dichotomized: 1 represents “agree”, and 0 represents “do not agree”. The mean of the three items was taken to create a composite measure, and it was once again dichotomized: 1 represents “agree” only when all three items indicate “agree”, and 0 represents “do not agree” otherwise.

**Analysis**

We used latent transition analysis (LTA) to study the change in student math and science attitudes from 7th to 10th grade and 10th to 12th grade. LTA is a longitudinal model that describes stage sequential change process (Collins, 2006; Collins and Sayer, 2001). LTA models are a longitudinal extension of the latent class model (LCA; Nylund, 2007), where LCA is used at each time point to create groups of students, called latent classes, who have similar math and science attitudes and the LTA model then is used to model the change in these latent classes over time. The LTA model used in this model is specified using the recommended building process that helps to ensure correct model speciation (Nylund, Muthen, Nishina, Bellmore, Graham, 2008). This process starts by fitting LCA models at each time point (e.g., 7th, 10th, and 12th grade) independently and deciding on the number of latent classes. After deciding on the number of classes at each time point, the LTA model was specified using the class specification from the independent LCAs. No covariates are included in these modeling steps.

Once the unconditional LTA model was specified, auxiliary information in the form of covariates (i.e., gender and ethnicity) and distal outcomes (i.e., college major, STEM career) were included in the model. Recently methodological work suggest using a three-step method for including distal outcomes in mixture models (Asparouhov & Muthén, 2013; Vermunt, 2010), which ensures that both the measurement parameters in LCA and structural parameters in LTA are not unintentionally biased by the auxiliary variables. In a three-step LTA, there are several modeling steps involved that involve specifying each LCA model, fixing values in the LTA model and then including the auxiliary variables. For more information on specifying a three-step LTA model see Nylund-Gibson, Grimm, Quirk, & Furlong (in press).

All modes were estimated in the statistical software package Mplus 7.1 (Muthén & Muthén, 1998-2013) using full information maximum likelihood estimation. This approach allows for item-level missing data under the missing at random (MAR, see Little and Rubin, 1990; Rubin, 1987) assumption. Students who have data on at least one outcome variable at one time point are included in the analysis and only excluded if they were missing on covariates. The LTA model is considered a longitudinal mixture model, and as with all mixture models have well document problems with converging on local, versus global, likelihood solutions. As result, random start values that are generated in Mplus are used to ensure that the results are global ones.

Multiple indicators of model fit were used since, to date, there is no single statistical indicator that is a perfect indicator of which model fits best (Nylund, Asparouhov, & Muthén, 2007). The Bayesian Information Criterion (BIC; Schwartz, 1978), the most commonly used and trusted fit index for model comparison, where lower values of the BIC indicates better fit. In addition, we compared models that differed in the number of classes using the Lo-Mendell-Rubin (LMR) test and the bootstrap likelihood ratio test (BLRT) to evaluate if adding an additional class significantly improved model fit (for more on these fit indices, see Nylund et al., 2007). The entropy of the final model selected is reported in the text but not used for model fit since it is a measure that describes the overall classification of students into the latent classes assuming the model is correct and not intended for model selection.

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Table 1

*Descriptive Statistics for LSAY Survey Items*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Description* | *Grade* | *N* | *M* | *SD* |
| I enjoy math | 7 | 3060 | 0.69 | 0.46 |
| 10 | 2259 | 0.63 | 0.48 |
| 12 | 1560 | 0.55 | 0.50 |
| Math is useful in everyday problems | 7 | 3001 | 0.70 | 0.46 |
| 10 | 2238 | 0.63 | 0.48 |
| 12 | 1547 | 0.64 | 0.48 |
| Math helps a person think logically | 7 | 2998 | 0.64 | 0.48 |
| 10 | 2232 | 0.66 | 0.47 |
| 12 | 1544 | 0.68 | 0.47 |
| It is important to know math to get a good job | 7 | 3008 | 0.76 | 0.43 |
| 10 | 2239 | 0.67 | 0.47 |
| 12 | 1538 | 0.59 | 0.49 |
| I will use math in many ways as an adult | 7 | 3010 | 0.74 | 0.44 |
| 10 | 2248 | 0.65 | 0.48 |
| 12 | 1540 | 0.64 | 0.48 |
| I enjoy science | 7 | 3042 | 0.61 | 0.49 |
| 10 | 2250 | 0.58 | 0.49 |
| 12 | 1540 | 0.53 | 0.50 |
| Science is useful in everyday problems | 7 | 2988 | 0.40 | 0.49 |
| 10 | 2235 | 0.43 | 0.50 |
| 12 | 1530 | 0.46 | 0.50 |
| Science helps a person think logically | 7 | 2992 | 0.49 | 0.50 |
| 10 | 2234 | 0.51 | 0.50 |
| 12 | 1531 | 0.54 | 0.50 |
| It is important to know science to get a good job | 7 | 3012 | 0.40 | 0.49 |
| 10 | 2238 | 0.42 | 0.49 |
| 12 | 1532 | 0.37 | 0.48 |
| I will use science in many ways as an adult | 7 | 3043 | 0.46 | 0.50 |
| 10 | 2250 | 0.42 | 0.49 |
| 12 | 1539 | 0.42 | 0.49 |

Table 2

*Descriptive Statistics for Distal Outcomes*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Description* | *Grade* | *N* | *M* | *SD* |
| Mathematics achievement | 12 | 1168 | 68.74 | 15.00 |
| Science achievement | 12 | 1854 | 65.54 | 12.59 |
| Interest and support of sciencea | 12 | 2329 | 0.37 | 0.48 |
| Interest in space exploration | 12 | 1625 | 0.67 |  |
| Interest in agricultural issues | 12 | 1619 | 0.52 |  |
| Interest in science issues | 12 | 1619 | 0.74 |  |
| Interest in new technologies | 12 | 1625 | 0.78 |  |
| Interest in energy policy issues | 12 | 1618 | 0.65 |  |
| Interest in environmental quality | 12 | 1615 | 0.81 |  |
| Interest in medical discoveries | 12 |  |  |  |
| Science/technology improves our lives | 12 | 1549 | 0.65 |  |
| Scientists work for the good of humanity | 12 | 1536 | 0.44 |  |
| Science/technology makes life healthier | 12 | 2127 | 0.91 |  |
| STEM career attainment | --- | 1912 | 0.08d |  |

aTo create this variable, we averaged student responses to the 10 items listed below related to interest and support for science.

bProportion of students who expressed interest

cProportion of students who indicated that they agree or strongly agreed

dProportion of students who attained STEM career.

Table 2

*Latent Class Analysis Fit Statistics for Grades 7, 10, and 12*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Grade* | *Classes* | *Log Likelihood* | *# of Parameters* | *BIC* | *ABIC* | *VLMR p-value* | *BLRT p-value* | *Entropy* |
| 7 | 1 | -19319.60 | 10 | 38719.49 | 38687.72 | --- | --- | --- |
| 2 | -17198.43 | 21 | 34565.46 | 34498.74 | 0.00 | 0.00 | 0.80 |
| 3 | -16782.26 | 32 | 33821.44 | 33719.76 | 0.00 | 0.00 | 0.75 |
| 4 | -16587.89 | 43 | 33521.03 | 33384.40 | 0.00 | 0.00 | 0.69 |
| 5 | -16479.34 | 54 | 33392.24 | 33220.66 | 0.00 | 0.00 | 0.73 |
| 10 | 1 | -14929.94 | 10 | 29937.12 | 29905.35 | --- | --- | --- |
| 2 | -12538.67 | 21 | 25239.55 | 25172.83 | 0.00 | 0.00 | 0.86 |
| 3 | -12014.10 | 32 | 24275.37 | 24173.71 | 0.00 | 0.00 | 0.83 |
| 4 | -11775.68 | 43 | 23883.50 | 23746.88 | 0.00 | 0.00 | 0.78 |
| 5 | -11694.37 | 54 | 23805.84 | 23634.28 | 0.00 | 0.00 | 0.79 |
| 12 | 1 | -10339.03 | 10 | 20751.59 | 20719.83 | --- | --- | --- |
| 2 | -8392.68 | 21 | 16939.79 | 16873.08 | 0.00 | 0.00 | 0.86 |
| 3 | -7928.52 | 32 | 16092.39 | 15990.73 | 0.00 | 0.00 | 0.86 |
| 4 | -7742.22 | 43 | 15800.68 | 15664.08 | 0.00 | 0.00 | 0.81 |
| 5 | -7661.56 | 54 | 15720.25 | 15548.70 | 0.00 | 0.00 | 0.84 |

Table 3

*Item Probability Profiles by Grade Level and Latent Class Attitudinal Profile*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Positive* | *Qualified Positive* | *Indifferent* | *Dim* |
| **Grade 7** | **26%** | **27%** | **29%** | **18%** |
| I enjoy math | 0.85 | 0.73 | 0.66 | 0.44 |
| Math is useful in everyday problems | 0.96 | 0.88 | 0.62 | 0.20 |
| Math helps a person think logically | 0.97 | 0.71 | 0.58 | 0.17 |
| It is important to know math to get a good job | 0.98 | 0.91 | 0.70 | 0.32 |
| I will use math in many ways as an adult | 0.99 | 0.88 | 0.71 | 0.20 |
| I enjoy science | 0.87 | 0.42 | 0.73 | 0.35 |
| Science is useful in everyday problems | 0.90 | 0.10 | 0.46 | 0.07 |
| Science helps a person think logically | 0.94 | 0.25 | 0.56 | 0.11 |
| It is important to know science to get a good job | 0.87 | 0.08 | 0.50 | 0.07 |
| I will use science in many ways as an adult | 0.92 | 0.11 | 0.63 | 0.08 |
| **Grade 10** | **32%** | **23%** | **24%** | **21%** |
| I enjoy math | 0.82 | 0.75 | 0.52 | 0.32 |
| Math is useful in everyday problems | 0.94 | 0.86 | 0.45 | 0.14 |
| Math helps a person think logically | 0.95 | 0.81 | 0.57 | 0.16 |
| It is important to know math to get a good job | 0.96 | 0.87 | 0.54 | 0.16 |
| I will use math in many ways as an adult | 0.96 | 0.92 | 0.43 | 0.10 |
| I enjoy science | 0.89 | 0.37 | 0.67 | 0.20 |
| Science is useful in everyday problems | 0.90 | 0.11 | 0.44 | 0.03 |
| Science helps a person think logically | 0.93 | 0.28 | 0.58 | 0.04 |
| It is important to know science to get a good job | 0.91 | 0.09 | 0.42 | 0.02 |
| I will use science in many ways as an adult | 0.92 | 0.06 | 0.42 | 0.02 |
| **Grade 12** | **35%** | **21%** | **24%** | **20%** |
| I enjoy math | 0.80 | 0.64 | 0.40 | 0.19 |
| Math is useful in everyday problems | 0.96 | 0.88 | 0.46 | 0.04 |
| Math helps a person think logically | 0.98 | 0.79 | 0.61 | 0.11 |
| It is important to know math to get a good job | 0.89 | 0.81 | 0.38 | 0.06 |
| I will use math in many ways as an adult | 0.96 | 0.93 | 0.39 | 0.05 |
| I enjoy science | 0.89 | 0.28 | 0.60 | 0.10 |
| Science is useful in everyday problems | 0.93 | 0.14 | 0.45 | 0.00 |
| Science helps a person think logically | 0.97 | 0.29 | 0.58 | 0.04 |
| It is important to know science to get a good job | 0.81 | 0.06 | 0.32 | 0.00 |
| I will use science in many ways as an adult | 0.89 | 0.05 | 0.43 | 0.00 |

*Note*. Bolded value at the top of each section break represents the class size at each grade.

Table 4

*Unconditional Latent Transition Probabilities*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Conditional on Grade 7* | Transitioning to Grade 10 | | | |
|  | Positive | Qualified Positive | Indifferent | Dim |
| Positive | 0.52 | 0.18 | 0.20 | 0.10 |
| Qualified Positive | 0.24 | 0.39 | 0.16 | 0.22 |
| Indifferent | 0.26 | 0.14 | 0.37 | 0.23 |
| Dim | 0.13 | 0.17 | 0.21 | 0.50 |
| *Conditional on Grade 10* | Transitioning to Grade 12 | | | |
| Positive | 0.64 | 0.08 | 0.17 | 0.12 |
| Qualified Positive | 0.21 | 0.54 | 0.08 | 0.18 |
| Indifferent | 0.20 | 0.09 | 0.49 | 0.22 |
| Dim | 0.07 | 0.16 | 0.20 | 0.58 |

Table 5

*LTA Trajectories Based on Grades 7, 10 and 12 Latent Class Attitudinal Profiles*

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Grade 7* | | | | *Grade 10* | | | | *Grade 12* | | | |
| *LTA Trajectory* | *P* | *QP* | *I* | *D* | *P* | *QP* | *I* | *D* | *P* | *QP* | *I* | *D* |
| Stay High (19%) |  |  |  |  |  |  |  |  |  |  |  |  |
|  | X |  |  |  | X |  |  |  | X |  |  |  |
|  | X |  |  |  |  | X |  |  | X |  |  |  |
|  | X |  |  |  |  |  | X |  | X |  |  |  |
|  | X |  |  |  |  |  |  | X | X |  |  |  |
| Stay Medium (16%) |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | X |  |  |  | X |  |  |  | X |  |  |
|  |  | X |  |  |  |  | X |  |  | X |  |  |
|  |  | X |  |  |  |  |  | X |  | X |  |  |
|  |  | X |  |  | X |  |  |  |  | X |  |  |
| Stay Low (25%) |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | X |  | X |  |  |  |  |  | X |  |
|  |  |  | X |  |  | X |  |  |  |  | X |  |
|  |  |  | X |  |  |  | X |  |  |  | X |  |
|  |  |  | X |  |  |  |  | X |  |  | X |  |
|  |  |  | X |  | X |  |  |  |  |  |  | X |
|  |  |  | X |  |  | X |  |  |  |  |  | X |
|  |  |  | X |  |  |  | X |  |  |  |  | X |
|  |  |  | X |  |  |  |  | X |  |  |  | X |
|  |  |  |  | X | X |  |  |  |  |  | X |  |
|  |  |  |  | X |  | X |  |  |  |  | X |  |
|  |  |  |  | X |  |  | X |  |  |  | X |  |
|  |  |  |  | X |  |  |  | X |  |  | X |  |
|  |  |  |  | X | X |  |  |  |  |  |  | X |
|  |  |  |  | X |  | X |  |  |  |  |  | X |
|  |  |  |  | X |  |  | X |  |  |  |  | X |
|  |  |  |  | X |  |  |  | X |  |  |  | X |
| Start High and End Low (8%) | X |  |  |  | X |  |  |  |  |  | X |  |
|  | X |  |  |  |  | X |  |  |  |  | X |  |
|  | X |  |  |  |  |  | X |  |  |  | X |  |
|  | X |  |  |  |  |  |  | X |  |  | X |  |
|  | X |  |  |  | X |  |  |  |  |  |  | X |
|  | X |  |  |  |  | X |  |  |  |  |  | X |
|  | X |  |  |  |  |  | X |  |  |  |  | X |
|  | X |  |  |  |  |  |  | X |  |  |  | X |
| Start High and End Medium (4%) | X |  |  |  | X |  |  |  |  | X |  |  |
|  | X |  |  |  |  | X |  |  |  | X |  |  |
|  | X |  |  |  |  |  | X |  |  | X |  |  |
|  | X |  |  |  |  |  |  | X |  | X |  |  |
| Start Low and End High (6%) |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | X |  | X |  |  |  | X |  |  |  |
|  |  |  | X |  |  | X |  |  | X |  |  |  |
|  |  |  | X |  |  |  | X |  | X |  |  |  |
|  |  |  | X |  |  |  |  | X | X |  |  |  |
|  |  |  |  | X | X |  |  |  | X |  |  |  |
|  |  |  |  | X |  | X |  |  | X |  |  |  |
|  |  |  |  | X |  |  | X |  | X |  |  |  |
|  |  |  |  | X |  |  |  | X | X |  |  |  |
| Start Low and End Medium (4%) |  |  | X |  | X |  |  |  |  | X |  |  |
|  |  |  | X |  |  | X |  |  |  | X |  |  |
|  |  |  | X |  |  |  | X |  |  | X |  |  |
|  |  |  | X |  |  |  |  | X |  | X |  |  |
| Start Medium and End High (7%) |  | X |  |  | X |  |  |  | X |  |  |  |
|  |  | X |  |  |  | X |  |  | X |  |  |  |
|  |  | X |  |  |  |  | X |  | X |  |  |  |
|  |  | X |  |  |  |  |  | X | X |  |  |  |
| Start Medium and End Low (11%) |  | X |  |  | X |  |  |  |  |  | X |  |
|  |  | X |  |  |  | X |  |  |  |  | X |  |
|  |  | X |  |  |  |  | X |  |  |  | X |  |
|  |  | X |  |  |  |  |  | X |  |  | X |  |
|  |  | X |  |  | X |  |  |  |  |  |  | X |
|  |  | X |  |  |  | X |  |  |  |  |  | X |
|  |  | X |  |  |  |  | X |  |  |  |  | X |
|  |  | X |  |  |  |  |  | X |  |  |  | X |

*Note*. P = Positive; QP = Qualified Positive; I = Indifferent; D = Dim

Table 6

*Percent of Students Classified in LTA Trajectory by Covariates*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Gender* | | *Ethnicity* | |
| *LTA Trajectory* | Female | Male | Underrepresented Minority | Not Underrepresented Minority |
| Stay High | 15 | 22 | 22 | 18 |
| Stay Medium | 20 | 13 | 18 | 15 |
| Stay Low | 23 | 26 | 25 | 24 |
| Start High and End Low | 7 | 9 | 7 | 9 |
| Start High and End Medium | 4 | 4 | 4 | 4 |
| Start Low and End High | 6 | 6 | 6 | 6 |
| Start Low and End Medium | 5 | 3 | 5 | 3 |
| Start Medium and End High | 8 | 6 | 5 | 8 |
| Start Medium and End Low | 12 | 10 | 8 | 13 |

Table 7

*Log Odds Coefficients and Odds Ratios for LTA Trajectory with Covariates*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Logit* | *SE* | *est/SE* | *Odds Ratio* |
| Stay Medium |  |  |  |  |
| Female | 0.76\*\*\* | 0.12 | 6.12 | 2.13 |
| Underrepresented Minority | -0.12 | 0.14 | 0.16 | 1.17 |
| Stay Low |  |  |  |  |
| Female | 0.25\* | 0.11 | 2.20 | 1.28 |
| Underrepresented Minority | -0.20 | 0.13 | -1.50 | 1.06 |
| Start High and End Low |  |  |  |  |
| Female | 0.12 | 0.15 | 0.81 | 1.13 |
| Underrepresented Minority | -0.50\*\* | 0.19 | -2.64 | 0.88 |
| Start High and End Medium |  |  |  |  |
| Female | 0.34 | 0.20 | 1.71 | 1.40 |
| Underrepresented Minority | -0.13 | 0.23 | -0.58 | 1.38 |
| Start Low and End High |  |  |  |  |
| Female | 0.24 | 0.17 | 1.38 | 1.27 |
| Underrepresented Minority | -0.22 | 0.20 | -1.08 | 1.19 |
| Start Low and End Medium |  |  |  |  |
| Female | 1.00\*\*\* | 0.21 | 4.75 | 2.73 |
| Underrepresented Minority | 0.24 | 0.22 | 1.07 | 1.97 |
| Start Medium and End High |  |  |  |  |
| Female | 0.71\*\*\* | 0.16 | 4.41 | 2.20 |
| Underrepresented Minority | -0.65\* | 0.21 | -3.06 | 0.79 |
| Start Medium and End Low |  |  |  |  |
| Female | 0.51\*\*\* | 0.14 | 3.76 | 1.67 |
| Underrepresented Minority | -0.66\*\*\* | 0.18 | -3.78 | 0.73 |

Note: Comparison group is “Stay High.”

\**p* < .05. \*\**p* < .01. \*\*\**p* < .001.

Table 8

*Descriptives for LTA Trajectory by Distal Outcome*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *LTA Trajectory* | *Mathematics Achievement* | *Science Achievement* | *Interest and Support of Science* | *STEM Career Attainmenta* |
| Stay High | 74.80  (14.53) | 70.89  (12.78) | 0.52  (0.50) | 16 |
| Stay Medium | 69.13  (11.58) | 64.80  (10.15) | 0.41  (0.49) | 6 |
| Stay Low | 61.85  (15.75) | 61.60  (12.91) | 0.40  (0.49) | 2 |
| Start High and End Low | 69.21  (14.77) | 65.67  (12.76) | 0.28  (0.45) | 6 |
| Start High and End Medium | 68.76  (13.79) | 62.70  (12.63) | 0.27  (0.45) | 7 |
| Start Low and End High | 69.80  (14.06) | 68.46  (12.44) | 0.43  (0.50) | 17 |
| Start Low and End Medium | 63.29  (12.37) | 61.19  (11.51) | 0.27  (0.45) | 3 |
| Start Medium and End High | 76.06  (12.90) | 69.15  (12.39) | 0.40  (0.49) | 14 |
| Start Medium and End Low | 64.83  (15.33) | 63.62  (11.27) | 0.22  (0.41) | 3 |

*a*Percent of students who attained STEM career. *Note*. Standard deviation in parentheses.

Table 9

*Log Odds Coefficients and Odds Ratios for LTA trajectory with Distal Outcomes*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Logit* | *SE* | *est/SE* | *Odds Ratio* |
| Stay Medium |  |  |  |  |
| Mathematics Achievement | -0.03\*\*\* | 0.01 | -3.83 | 0.99 |
| Science Achievement | -0.05\*\*\* | 0.01 | -5.95 | 0.96 |
| Interest and Support of Science | -0.43\*\* | 0.15 | -2.83 | 0.65 |
| STEM Career Attainment | -1.14\*\*\* | 0.29 | -3.94 | 0.32 |
| Stay Low |  |  |  |  |
| Mathematics Achievement | -0.06\*\*\* | 0.01 | -8.60 | 0.95 |
| Science Achievement | -0.07\*\*\* | 0.01 | -9.32 | 0.94 |
| Interest and Support of Science | -0.48\*\*\* | 0.13 | -3.61 | 0.62 |
| STEM Career Attainment | -2.05\*\*\* | 0.35 | -5.82 | 0.13 |
| Start High and End Low |  |  |  |  |
| Mathematics Achievement | -0.03\*\*\* | 0.01 | -3.66 | 0.99 |
| Science Achievement | -0.04\*\*\* | 0.01 | -4.93 | 0.96 |
| Interest and Support of Science | -1.03\*\*\* | 0.18 | -5.81 | 0.36 |
| STEM Career Attainment | -1.14\*\* | 0.36 | -3.19 | 0.32 |
| Start High and End Medium |  |  |  |  |
| Mathematics Achievement | -0.03\*\* | 0.01 | -3.07 | 0.99 |
| Science Achievement | -0.06 | 0.01 | -5.94 | 0.94 |
| Interest and Support of Science | -1.06\*\*\* | 0.24 | -4.39 | 0.35 |
| STEM Career Attainment | -0.91\* | 0.45 | -2.02 | 0.40 |
| Start Low and End High |  |  |  |  |
| Mathematics Achievement | -0.03\*\* | 0.01 | -3.03 | 0.99 |
| Science Achievement | -0.02\* | 0.01 | -2.17 | 0.98 |
| Interest and Support of Science | -0.35 | 0.19 | -1.87 | 0.70 |
| STEM Career Attainment | 0.08 | 0.27 | 0.28 | 1.08 |
| Start Low and End Medium |  |  |  |  |
| Mathematics Achievement | -0.06\*\*\* | 0.01 | -5.37 | 0.96 |
| Science Achievement | -0.07\*\*\* | 0.01 | -6.64 | 0.93 |
| Interest and Support of Science | -1.06\*\*\* | 0.25 | -4.30 | 0.35 |
| STEM Career Attainment | -1.91\*\* | 0.73 | -2.61 | 0.15 |
| Start Medium and End High |  |  |  |  |
| Mathematics Achievement | 0.01 | 0.01 | 0.84 | 1.03 |
| Science Achievement | -0.01 | 0.01 | -1.66 | 0.99 |
| Interest and Support of Science | -0.48\*\* | 0.18 | -2.70 | 0.62 |
| STEM Career Attainment | -0.18 | 0.28 | -0.65 | 0.84 |
| Start Medium and End Low |  |  |  |  |
| Mathematics Achievement | -0.05\*\*\* | 0.01 | -6.53 | 0.97 |
| Science Achievement | -0.05\*\*\* | 0.01 | -7.11 | 0.95 |
| Interest and Support of Science | -1.34\*\*\* | 0.18 | -7.91 | 0.26 |
| STEM Career Attainment | -1.94\*\*\* | 0.44 | -4.43 | 0.14 |

\**p* < .05. \*\**p* < .01. \*\*\**p* < .001. *Note*. Comparison group is “Stay High.”

|  |  |
| --- | --- |
| Positive in Grade 7 | Qualified Positive in Grade 7 |
| Indifferent in Grade 7 | Dim in Grade 7 |

*Figure 1*. Student trajectories. Numbers in circles refer to percent of students in each attitudinal profile. Numbers above arrows indicate the percentage of students who transition from one attitudinal profile to another. The numbers for the Grade 10 to Grade 12 trajectory indicate the most common transition.

|  |  |
| --- | --- |
| Positive in Grade 7 | Qualified Positive in Grade 7 |
| Indifferent in Grade 7 | Dim in Grade 7 |

*Figure 2*. Minority student trajectories. Numbers in circles refer to percent of students in each attitudinal profile. Numbers above arrows indicate the percentage of students who transition from one attitudinal profile to another. The numbers for the Grade 10 to Grade 12 trajectory indicate the most common transition.

|  |  |
| --- | --- |
| Positive in Grade 7 | Qualified Positive in Grade 7 |
| Indifferent in Grade 7 | Dim in Grade 7 |

*Figure 3*. Underrepresented minority student trajectories. Numbers in circles refer to percent of students in each attitudinal profile. Numbers above arrows indicate the percentage of students who transition from one attitudinal profile to another. The numbers for the Grade 10 to Grade 12 trajectory indicate the most common transition.