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ABSTRACT

In many upper-elementary school classrooms, students are given few decision-making prerogatives. In junior high school, it becomes increasingly rare for them to receive the decision-making opportunities they believe they should have. Both person-environment fit theory and pawn theory would predict that a failure to provide students with such opportunities in their mathematics classrooms will prompt them to devalue mathematics. This study tests this hypothesis. Students from 12 school districts in the Transitions in Early Adolescence Project in the Detroit area completed questionnaires in the fall and spring of two successive school years. Reported are data from 1,823 students in grade six during 1983-84 and in grade seven the next year. Assessed were student perceptions of actual and ideal decision-making opportunities in mathematics classrooms. Overall a substantial increase in constraints on students' decision-making prerogatives coincides with the transition to junior high school, and there is a steady increase in lack of decision-making across sixth and seventh grades. Students who experienced a lack of decision-making in their mathematics classrooms perceived mathematics to have less intrinsic and utility value than did students who had more decision-making experiences. Twenty-nine references are listed. (MNS)

Decision-Making in the Classroom and Early Adolescents' Valuing of Mathematics

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Decision-Making in the Classroom and Early Adolescents' Valuing of Mathematics

One of the major contributions that Jacquelynne Eccles has made to the literature concerned with achievement is her suggestion that achievement behavior cannot be adequately explained by models that are based primarily on expectancies and causal attributions. Although it is clear that expectancies and attributions do influence student effort and achievement in school subjects, students' beliefs concerning the value of each subject also influence the amount of effort they exert (e.g.,Eccles, Adler, & Meece, 1984; Eccles & Wigfield, 1985). When a students believes that a given subject is interesting or enjoyable and that the knowledge gained from studying the subject will help them reach long- or short-range goals that are important to them, then they are more likely to display the effort and persistence necessary to gain mastery of the subject. Furthermore, when students value a given subject, they are likely to continue striving to learn that subject even in the absence of extrinsic rewards or pressures for achievement.

As researchers have gained a greater appreciation of the role of subjective task value in influencing achievement, they have become interested in understanding the factors that determine a students task-related value perceptions. A partial list of factors that have been identified as influences on students' valuing of various school subjects are: a) social stereotypes, b) direct or indirect communications from socializers concerning the importance of the subject, c) classroom evaluation practices, and d) the complexity, novelty and difficulty of the curriculum used to teach the subject (Eccles, et al., 1984; Stipek, 1987). The present paper focuses on still another partial determinant of the value students place on the activities, assignments, and subject matter of a course: whether they are given the decision-making opportunites that they think they should have.

When students' are not given the role in classroom decision-making that they feel they should have, it makes them feel like they are being "pushed around" by the teacher. DeCharms (1968, 1976, 1984) has dubbed this experience of not having the choices one needs and wants as the pawn experience. He argues that giving students choices that fit their needs creates in them a feeling of freedom, encourages them to take personal responsibility for their learning, and gives them a feeling of ownership over their actions in the classroom. In contrast, when students are not given a meaningful role in decision-making, this decreases their interest and enjoyment in what they are learning and increases the likelihood that students will conclude that their coursework has little utility in helping them meet their goals. In other words, when there is a lack of fit between classroom decision-making and students' needs and ideals, students' perceptions of the intrinsic and utility value of their classwork will decline.

Classroom decision-making practices may especially influence value perceptions during adolescence. The term "adolescence" is derived from the Latin verb, adolescere, "to grow up". For adolescent students, one of the most salient prerogatives associated with being "grown up" is the opportunity to make decisions for one's self (e.g., Strang, 1957). Furthermore, a very common complaint of adolescents is that they are not allowed sufficient opportunities for choice and self-determination (e.g., Duvall, 1965; Lee, Statuto, & Kedar-Voivodas, 1983; Midgley & Feldlaufer, 1986; Reuman, Mac Iver, Klingel, Midgley, Feldlaufer, & Hermalin, 1984). Thus, it is appropriate that many theorists emphasize the early adolescent's need for autonomy (e.g., Grotevant, 1983; Havinghurst, 1951; Rank, 1945; Spranger, 1955; Youniss, 1980).

Unfortunately, in the classroom, this need for choice and self-governance is frequently ignored. In many upper-elementary school classrooms, students are given few decision-making prerogatives. The situation get even worse in junior high; as students make the transition to junior high school, it becomes increasingly rare for them to receive the decision-making opportunities that they believe they should have (Midgley & Feldlaufer, 1986).

Both person-environment fit theory (Hunt, 1975; Lewin 1935; Murray, 1938) and pawn theory (DeCharms, 1984) would predict that a failure to provide students with the decision-making opportunities that they think they should have in their mathematics classrooms will prompt them to devalue mathematics. This study tests this hypothesis. Furthermore, because the upper-elementary school students in this study were followed longitudinally across the transition to junior high school, this study is able to test whether the declines in decision-making fit that coincide with the transition to junior high school are partly responsible for post-transition declines in students' valuing of mathematics.

Method

Sample

The sample examined here participated in a longitudinal investigation, called the Transitions in Early Adolescence Project. This project is concerned with the impact of change in the classroom and family environments of early adolescents on their achievement-related beliefs, motives, values, and behaviors. Students in the Transitions project completed questionnaires at school in the fall (between early October and late November) and spring (between late March and late April) of two successive school years (1983-84 and 1984-85). The occasions when students completed questionnaires will be called Waves 1 through 4.

Twelve school districts with varying educational practices were recruited for the Transitions project. The school districts are located in the Detroit metropolitan area and serve lower-middle and middle income communities. No participating school districts are rural or inner-city districts. Ten of the twelve districts are characterized by a student body that is at least 85 percent Caucasian; the remaining two districts are 60 percent and 5 percent Caucasian, respectively.

Participation in the Transitions project was voluntary. At the beginning of the 1983-84 school year, teachers in these districts were invited to participate if they taught fifth or sixth graders scheduled to make the transition to middle/junior high school the following year. The actual participation rate among these targeted teachers was 95 percent. In this way, teachers of 143 classrooms were recruited: 14 fifth grade classrooms, 107 sixth grade classrooms, and 22 classrooms containing students of more than one grade level. Students participated on a voluntary basis as well; 79 percent (3248/4110) of the students enrolled in targeted classrooms agreed to participate at Wave 1. Of these participating students, 80 percent (N = 2603) filled out a student questionnaire at all four waves of the longitudinal study. Sample attrition was due mostly to students moving out of the districts involved in the study.

Case selection. Only a subset of the student sample from the Transitions project is selected for the analyses reported here. The analysis sample is restricted to students who were sixth graders in elementary schools during the 1983-84 school year and seventh graders in junior high schools during the following school year. Students who changed classrooms or teachers during the school year are excluded, as are any students who failed to answer all questionnaire items measuring students' actual and ideal decision-making prerogatives at all four waves. The total number of students included by these criteria is 1823. The analysis sample is somewhat smaller still in those longitudinal analyses focusing on the relation between decision-making and students' math values, insofar as some students did not complete all questionnaire items measuring math values at all waves.

Measures

Survey questionnaires were administered to students in their math classrooms. Students' decision-making prerogatives in math were measured using five pairs of items adapted from Lee et al. (1983). Each yoked pair of items assessed student perceptions of actual and ideal decision-making opportunities in their math classrooms. For example:

Do you help to decide how much math homework you get?

Do you think you should help to decide how much math homework you get?

These items asked students about decision-making opportunities with respect to where they sit in math class, how much math homework they receive, what math they work on during class, what they work on in class after finishing their math assignments, and what the rules are in their class. Each item measuring actual decision-making prerogatives was coded (1) for students who said that they did not have the decision-making prerogative and (2) for students indicating that they did have the prerogative. Similarly, responses concerning ideal or preferred decision-making prerogatives were coded (1) for students who thought they should not have the prerogative and (2) for students who thought they should have the prerogative. For each yoked pair of items measuring actual and ideal prerogatives, students could be coded in one of four ways: (a) constrained discrepant, if students said they do not but should have a decision-making prerogative; (b) unconstrained discrepant, if they said they actually do but should not have the prerogative; (c) unconstrained congruent, if they said they actually do and should have a decision-making prerogative; or (d) constrained congruent, if they said they do not and should not have that prerogative.

In addition to the decision-making items, the student questionnaire assessed students' math-related beliefs, values, and behaviors. Four items were indicators of math intrinsic value and five items measured math utility value. These items, developed by Parsons (1980), are listed in the Appendix.

Confirmatory factor analyses were performed to establish that items intended to measure the same value were unidimensional, and items intended to measure distinct values showed discriminant validity (Reuman, 1986). For each value, a composite variable was created by summing students' responses to the multiple indicators of the value. The internal consistency reliabilities of the composites representing the intrinsic value and the utility value of math were .75 and .79, respectively.

Results

Longitudinal trends in decision-making fit

Each type of decision-making fit shows a distinct longitudinal trend as students make the transition to junior high school. At each wave, we counted how many (out of five) decision-making prerogatives students said they did or did not and should or should not have. Table 1 displays the mean (and standard deviation of the) frequency of each type of decision-making fit in the fall and spring of sixth grade (Waves 1 and 2, respectively) and again in the fall and spring of seventh grade (Waves 3 and 4). These descriptive statistics are computed for 1823 students who made the transition to junior high school and who answered all decision-making items at all waves. Longitudinal trends were assessed for each type of decision-making fit using repeated-measures MANOVA, with grade (sixth versus seventh), semester (fall versus spring), and the grade-by-semester interaction specified as within-subjects effects.

Constrained discrepance. The tendency for students to say they do not but should have decision-making prerogatives increases from the sixth- to the seventh grade [$F(1, 1822) = 115.38$; $p < .001$]. Constrained discrepance also increases from fall to spring semesters [$F(1, 1822) = 32.43$; $p < .001$]. The grade-by-semester interaction is not significant [$F(1, 1822) = .02$; $p = .87$].

Unconstrained discrepance. The tendency for students to say they do but should not have decision-making prerogatives decreases from sixth- to seventh grade [$F(1, 1822) = 135.00$; $p < .001$]. This type of decision-making fit shows a significant semester decline as well [$F(1, 1822) = 20.40$; $p < .001$] but no significant grade-by-semester interaction [$F(1, 1822) = 1.67$; $p = .20$].

Constrained congruence. The tendency for students to say they do not and should not have decision-making prerogatives shows a significant decline from the fall to spring semesters [$F(1, 1822) = 31.06$; $p < .001$], but no significant grade effect [$F(1, 1822) = 2.08$; $p = .15$] or grade-by-semester interaction [$F(1, 1822) = 1.65$; $p = .20$].

Unconstrained congruence. The tendency for students to say they do and should have decision-making prerogatives shows highly significant effects of grade [$F(1, 1822) = 605.02$; $p < .001$], semester [$F(1, 1822) = 221.16$; $p < .001$], and the grade-by-semester interaction [$F(1,1822) = 230.86$; $p < .001$]. Although unconstrained congruence shows a general decline from sixth- to seventh grade, we observe no semester decline in the sixth but a substantial semester decline in the seventh grade.

When we pool the frequencies of constrained discrepance and constrained congruence at each wave (3.39, 3.44, 3.82, and 3.80 at waves 1 through 4, respectively), we note overall a substantial increase in constraints on students' decision-making prerogatives that coincides with the transition to junior high school. When we pool the frequencies of constrained discrepance and unconstrained discrepance at each wave (2.07, 2.14, 2.25, and 2.34 at Waves 1 through 4, respectively), we note overall a steady increase in lack of decision-making fit across sixth and seventh grades.

Cluster Analyses

To assess the effects of decision-making congruence on students' valuing of math, we needed to compare groups of students who differed in the amount and/or type of decision-making congruence they were experiencing. Ward's (1963) hierarchical clustering procedure provided a conceptually straightforward way of partitioning our data set into groups of students who differed in decision-making fit. (Monte Carlo studies indicate that, along with average linkage methods, Ward's method outperforms most other clustering methods in its ability to find known groups in data [e.g., Kuiper & Fisher, 1975; Mojena, 1977]). At the first step in Ward's procedure, each student is defined as a "cluster" of its own. Then, at each subsequent step, clusters are combined on the basis of their similarity on the "clustering variables" (i.e., Ward's Method joins those clusters that result in the minimum increase in the within-group sum of squares. Thus, a "group" is defined as a cluster of individuals in which the variance among the members on the clustering variables is relatively small.)

Table 1

Longitudinal Trends in Decision-Making Fit

Across the Transition to Junior High School

Type of Decision-Making Fit	Wave 1	2	3	4
Constrained Discrepance	1.64	1.78	1.99	2.12
	(1.40)	(1.46)	(1.53)	(1.54)
Unconstrained Discrepance	0.43	0.36	0.26	0.22
	(0.66)	(0.63)	(0.55)	(0.52)
Constrained Congruence	1.75	1.66	1.83	1.68
	(1.35)	(1.36)	(1.47)	(1.46)
Unconstrained Congruence	1.17	1.19	0.92	0.42
	(1.04)	(1.06)	(0.87)	(0.64)

Note., Each cell displays the mean frequency of a particular type of decision-making fit. Standard deviations are given in parentheses. These descriptive statistics are computed for 1823 students who were sixth graders in 1983/84, seventh graders in 1984/85, and answered all decision-making items at all waves.

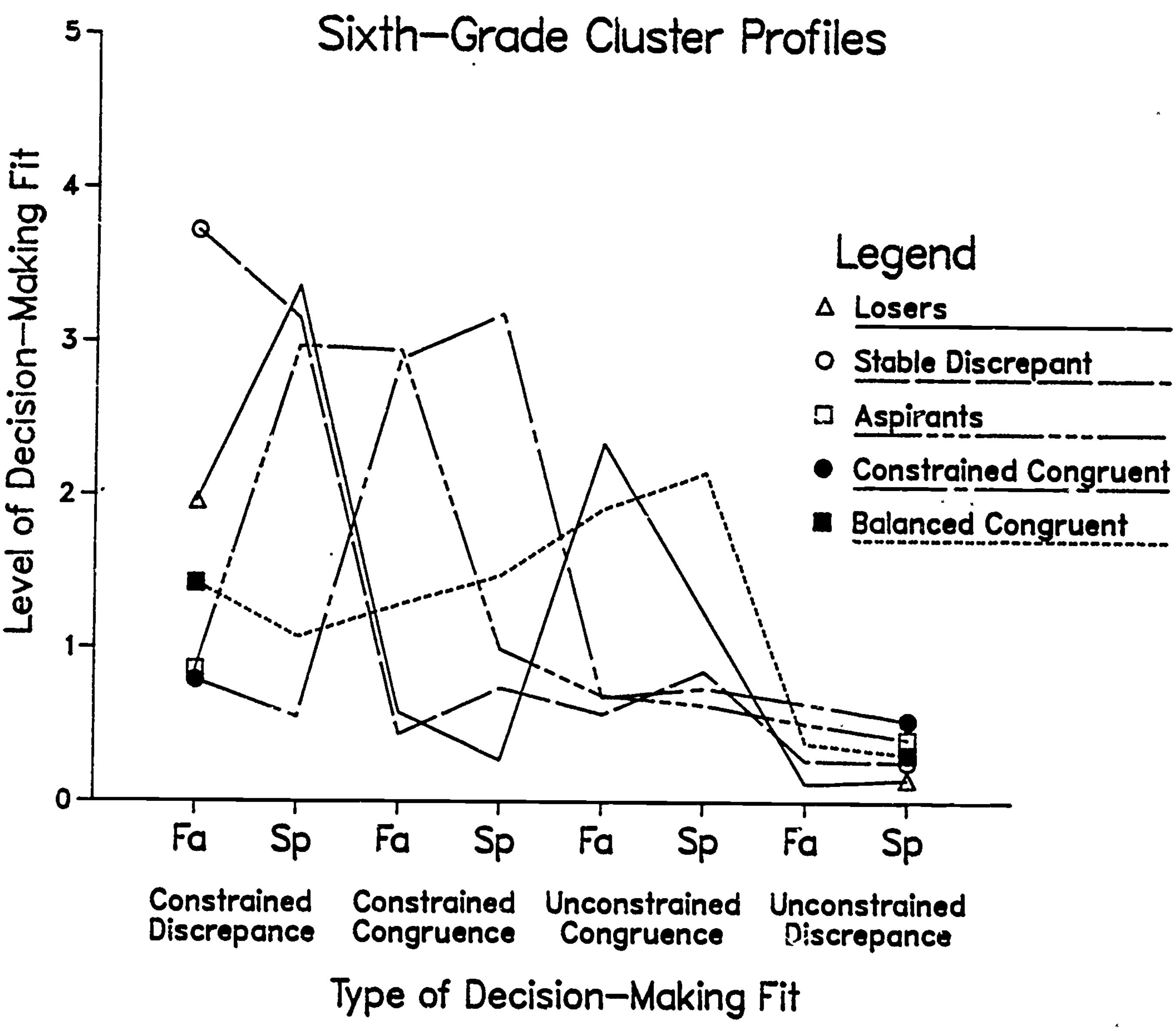
In the cluster analyses reported here, the clustering variables were simple counts (for each student at each wave) of the number of decision-making areas in which the student was experiencing each type of person-environment fit: constrained discrepance, unconstrained discrepance, constrained congruence, unconstrained congruence. Two cluster analyses were performed: one based on students' decision-making fit during the fall and spring of sixth-grade and one based on students' fit during both semesters of seventh-grade. (Actually, because of the linear dependence that exists among the four measures of decision-making fit at each wave, only three of the measures from each wave were needed to cluster students. The unconstrained discrepance measure was arbitrarily selected as the measure to omit at each wave.)

Selecting the number of clusters. When using a hierarchical clustering method to group individuals, one must decide when to stop combining clusters (i.e. How many clusters does one need to reproduce the "natural" groupings in the data?). The sooner one stops combining clusters, the more homogeneous are the individuals within each of the resulting groups. On the other hand, the earlier one stops combining clusters, the more likely it is that many of the resulting groups will differ only in trivial ways. Generally, one tries to select a parsimonius stopping point, one that yields a relatively small number of distinct, well-separated groups (e.g., a stopping point that distinguishes the major types of person-environment fit found in the data, but does not distinguish among minor subtypes.) In the cluster analyses that are reported here, the most parsimoius stopping point in which the resulting clusters met the following criteria was selected: 1) on the average, over 50% of the variance in the person-environment fit measures must be "between-cluster variance", (i.e., the average R-SQR one obtains when predicting students' person-environment fit measures based upon their cluster membership must be greater than .50) 2) the ratio of the smallest between-cluster distance to the largest within-cluster distance must be greater than 1.0 (i.e., the distance between the two most similar individuals assigned to different clusters must be larger than the two most different individuals assigned to the same cluster) and, 3) the "amalgamation coefficient" for the step immediately following the stopping point must show a large jump in size (relative to coefficients at earlier steps) suggesting that two relatively dissimilar clusters are combined if one fails to stop. Application of these three criteria resulted in selection of five clusters at both the sixth- and seventh-grade years.1

<u>Sixth grade clusters</u>. The five clusters of students, depicted in Figure 1, can be described as follows:

"Stable Constrained Discrepant" students receive fewer decision-making opportunities than they feel entitled to throughout the sixth grade. That is, they exhibit high levels of

FIGURE 1



Sixth-Grade Cluster Profiles
Level of Decision-Making Fit
0
1
2
3
4
5
Legend
Losers
Stable Discrepant
Aspirants
Constrained Congruent
Balanced Congruent
Fa
Sp
Fa
Sp
Fa
Sp
Fa
Sp
Constrained Discrepance
Constrained Congruence
Unconstrained Congruence
Unconstrained Discrepance
Type of Decision-Making Fit

constrained discrepance and low levels of every other variety of person-environment fit).

In contrast, "Constrained Congruent" students have low levels of constrained discrepance but high levels of constrained congruence throughout sixth grade. These students do not have much of a voice in decision-making in their math class but they don't feel they should have such a voice.

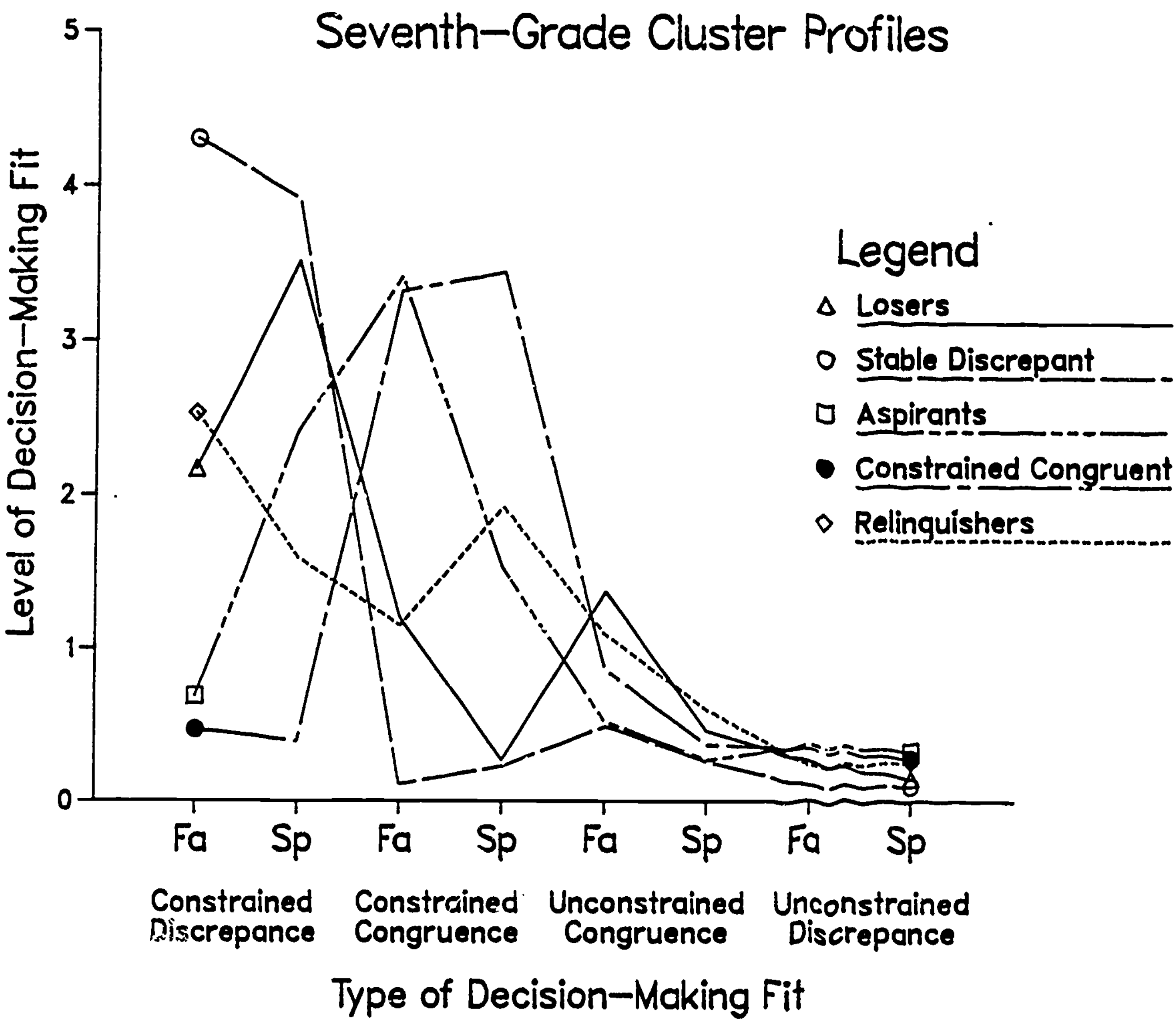
"Balanced Congruent" students have moderate levels of both types of congruence (unconstrained and constrained). Thus, for these students, the overall match between classroom decision-making practices and the students' ideals is relatively high.

In the final two clusters, students experience an escalation of constrained discrepance between the fall and the spring. For "Losers", this escalation of discrepancy is precipitated by a loss of actual prerogatives during the school year. (In the fall, Losers have moderate levels of unconstrained congruence and moderate levels of constrained discrepance. By the spring, unconstrained congruence is largely eliminated by the revocation of prerogatives and is replaced by high levels of constrained discrepance.) For "Aspirants", the increased discrepancy within the sixth grade year is due to an escalation of students' ideals. (In the fall, Aspirants have high levels of constrained congruence and low levels of constrained discrepance. By the spring, however, the students have become dissatisified with the high level of constraint they are experiencing.)

Seventh grade clusters. The five clusters found in year 2 are depicted in Figure 2. Because of the low levels of actual prerogatives given to students at the beginning of junior high school, unconstrained congruence is rarely found in seventh grade. As a result, there is no Balanced Congruent cluster in seventh grade. In its place, a new cluster of students, the "Relinquishers" appears. Relinquishers have moderate levels of constrained discrepance and low levels of constrained congruence at the beginning of the year. These students relinquish some of their ideals as the year progresses. As a result, their constrained congruence increases to moderate levels and their constrained discrepance drops. The Constrained Congruent, Stable Constrained Discrepant, Losers, and Aspirants clusters all reappear in seventh grade.

The cross-classification of students based on sixth- and seventh-grade clusters. So far, we have said nothing a out the relative frequency of the various clusters. Similarly, the association between one's sixth-grade cluster and one's seventh-grade cluster has not been considered. Table 2 reports the observed frequency table obtained when students are cross-tabulated based on their cluster assignments during sixth- and seventh-grade. As can be seen from the column totals of this

FIGURE 2



Seventh-Grade Cluster Profiles
Level of Decision-Making Fit
0
1
2
3
4
5
Legend
Losers
Stable Discrepant
Aspirants
Constrained Congruent
Relinquishers
Fa
Sp
Fa
Sp
Fa
Sp
Fa
Sp
Constrained Discrepance
Constrained Congruence
Unconstrained Congruence
Unconstrained Discrepance
Type of Decision-Making Fit

Table 2

Seventh-Grade Cluster by Sixth-Grade Cluster: Observed Frequencies

Seventh-Grade Clusters	Sixth-Grade Clusters					
	Losers	Stable Constrained Discrepant	Aspirants	Constrained Congruent	Balanced Congruent	Total
Losers	65	85	44	62	106	362
Stable Constrained Discrepant	47	109	35	40	58	289
Aspirants	9	18	38	91	55	211
Constrained Congruent	16	36	37	249	138	476
Relinquishers	43	94	88	102	158	485
Total	180	342	242	544	515	1823

table, 58% ([544 + 515]/1823) of the students experienced high levels of decision-making fit during both semesters of sixth-grade; 30% were in the constrained congruent cluster and 28% were in the balanced congruent cluster. In contrast, inspection of the row totals reveal that only 26% of the students (constrained congruent students) experienced decision-making fit at both semesters of seventh-grade. In other words, 73% of the students perceived moderate or high levels of constrained discrepance during the fall and/or spring of seventh-grade.

An inspection of the frequencies in each cell of the cross-tabulation suggest that there is a significant association between one's sixth-grade cluster and one's seventh-grade cluster (Chi-Sqr [16] = 351.30, $p < .0001$). However, measures of predictive association suggest that the knowledge of a student's sixth-grade cluster only moderately improves our ability to predict that student's seventh-grade cluster. For example, an uncertainty coefficient of .06 indicates a 6% reduction in uncertainty in predicting a student's seventh-grade cluster if one knows the student's sixth-grade cluster.

The patterns in the data that contribute to this 6% reduction in uncertainty (and which produce the significant chi-square) can be seen in Table 3 which reports the differences between observed frequencies and expected frequencies. Membership in the losers cluster in sixth-grade decreases the probability that one will be

Table 3

Seventh-Grade Cluster by Sixth-Grade Cluster: Observed - Expected Frequencies

	Sixth-Grade Clusters				
Seventh-Grade Clusters	Losers	Stable Constrained Discrepant	Aspirants	Constrained Congruent	Balanced Congruent
Losers	29**	17*	-4	-46**	4
Stable Constrained Discrepant	18*	55***	-3	-46**	-24*
Aspirants	-12*	-22**	10	28*	-5
Constrained Congruent	-31**	-53***	-26*	107***	4
Relinquishers	-5	3	24*	-43*	21

*Freeman-Tukey Deviate $\geq$ 2 **Freeman-Tukey Deviate $\geq$ 4 ***Freeman-Tukey Deviate $\geq$ 6 in the constrained congruent or aspirant clusters in seventh-grade and increases the probability that one will be in the losers cluster or the stable constrained discrepant cluster. Likewise, a stable constrained discrepant student in sixth-grade is less likely than average to end up in the constrained congruent or aspirant clusters and is more likely to end up in the loser and stable constrained discrepant clusters. Aspirants in sixth-grade are more likely than average to become relinquishers in seventh-grade but are relatively unlikely to be constrained congruent. Constrained congruent students in sixth-grade are much more likely than average to be constrained congruent in seventh-grade. They are less likely than other students to become stable constrained discrepant or losers or relinquishers. Finally, sixth-graders who experience balanced congruence (a mixture of unconstrained and constrained congruence) are less likely than average to become stable constrained discrepant in seventh-grade.

Effects of Cluster on Students' Valuing of Math

We used repeated-measures MANOVAs to test the effects of two between-subject factors (sixth grade cluster, seventh grade cluster) and two within-subject factors (school-year, semester) on each measure of students' valuing of math.2

Intrinsic Value

The MANOVA summary table can be found in Table 4. Each of the factors included had a significant effect on students'

Table 4

Effects of Sixth-Grade Cluster (C6), Seventh-Grade Cluster (C7), Year of Observation (YR), and Semester of Observation (SEM) on Students' Valuing of Mathematics

Effect	df_1	F(Intrinsic Value)	F(Utility Value)
C6	4	8.91***	6.34***
C7	4	21.40***	13.82***
C6 X C7	16	.54	.47
YR	1	76.58***	116.21***
C6 X YR	4	8.13***	1.11
C7 X YR	4	20.94***	15.02***
C6 X C7 X YR	16	.95	.95
SEM	1	35.76***	31.22***
C6 X SEM	4	.37	2.62*
C7 X SEM	4	2.57*	2.30
C6 X C7 X SEM	16	.72	.86
YR X SEM	1	13.96***	1.58
C6 X YR X SEM	16	3.92**	3.22**
C7 X YR X SEM	4	5.33***	2.76*
C6 X C7 X YR X SEM	16	2.19**	.65

NOTE. -- For F(Intrinsic Value), df_2 = 1692. For F(Utility Value), df_2 = 1715.

*$p < .05$.

**$p < .01$.

***$p < .001$.

perceptions of the intrinsic value of math. For example, main effects of schoolyear and semester reflected the fact that, on the average, students valuing of math decreased markedly both within and between each school year. However, the highest order interaction, sixth grade cluster x seventh grade cluster x year x semester, was significant. This indicates that the effect of each factor depends on which levels of the other factors are present. For example, the effect of being in a particular person-environment fit category during seventh-grade on one's valuing of math depends somewhat on one's person-environment fit in sixth grade, and on the year and semester under consideration. Because this highest-order interaction is weak and not fully interpretable, in discussing the results we emphasize some of the lower order interactions (e.g., the seventh-grade cluster x year x semester interaction).

Effects of Seventh-Grade Cluster

Bonferroni comparisons were used to test the simple effects of seventh-grade cluster holding constant sixth-grade cluster, year and semester. (In these type of comparisons, the overall error rate for contrasts made within a given sixth-grade cluster, year, and semester is controlled by adusting the critical alpha level to take account of the number of comparisons being made.)

Effects on students who were constrained congruent in sixth grade. Figure 3 depicts the intrinsic valuing of math displayed

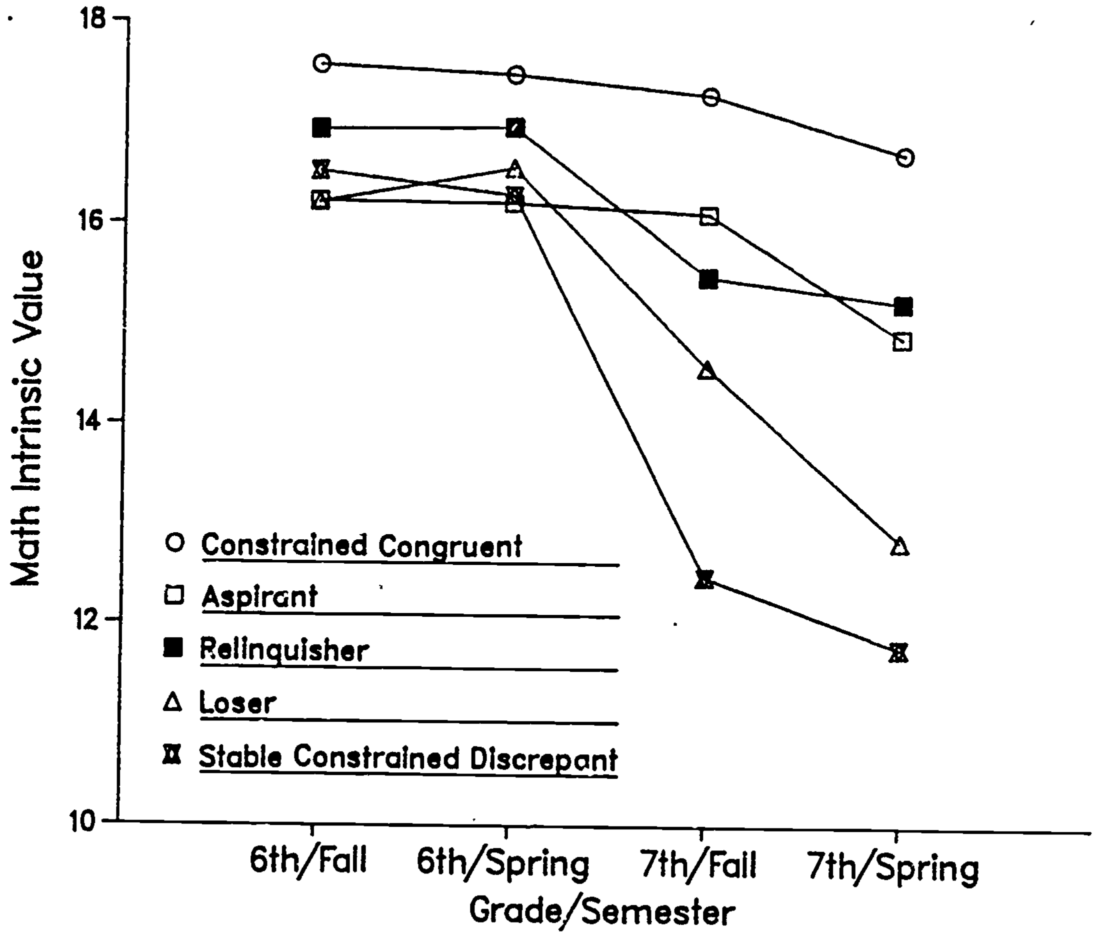


Figure 3. Effects of Seventh-Grade Cluster on Perceived Intrinsic Value of Math by Students who were Constrained Congruent in Sixth Grade.

Summary of Bonferroni Comparisons

6th/Fall and 6th/Spring: No significant differences among means.

7th/Fall: Constrained Congruent > Relinquisher, Loser, Stable Constrained Discrepant

Aspirant, Relinquisher > Stable Constrained Discrepant

7th/Spring: Constrained Congruent > Aspirant, Relinquisher~, Loser, Stable Constrained Discrepant

Aspirant > Loser~, Stable Constrained Discrepant

Relinquisher > Loser, Stable Constrained Discrepant

Note. A "~" indicates that the relevant comparison is only marginally significant ($p < .10$). For all other comparisons listed, $p < .05$.

by students who were all in the constrained congruent cluster in sixth-grade but who were in various clusters at seventh grade. The results of Bonferroni comparisons among the means at each wave are summarized in the bottom half of the figure. The comparisons in the fall and spring of sixth-grade indicate that students' cluster membership in seventh-grade was not significantly-related to students' valuing of math in sixth-grade; the sixth-grade means for students who ended up in different seventh-grade clusters were not significantly different. However, students' cluster in seventh-grade was related to valuing of math in seventh-grade.

Consider the comparisons among the means in the fall of seventh grade. As hypothesized, those students who have low levels of person-environment discrepance in the fall of seventh-grade (Constrained Congruent or Aspirant students) display significantly higher valuing of math than do students who have high levels of discrepance at this point (Stable Constrained Discrepant students). Relinquishers and Losers have moderate levels of discrepance in the fall. It was therefore expected that their valuing of math would be lower than that of Constrained Congruent and Aspirant students but would be higher than that of Stable Constrained Discrepant Students. This expectation was confirmed, but some of the relevant comparisons were not statistically significant.

Comparisons among the intrinsic value means in the spring of seventh grade are also consistent with expectations. Students who have remained or become highly discrepant (Stable Constrained Discrepants and Losers) value math less than students who have remained highly congruent (Constrained Congruents) or who have shifted from low moderate to high moderate congruence (Relinquishers). Aspirants (who have become moderately discrepant) value math less than the Constrained Congruent students but still value math more than Stable Constrained Discrepant students.

Effects on students who were Balanced Congruent students in sixth-grade. Figure 4 depicts the intrinsic valuing of math displayed by students who were Balanced Congruent in sixth-grade and summarizes comparisons among these students based on their person-environment fit cluster in seventh grade. The findings are similar to those found for students who were Constrained Congruent in sixth grade. The valuing of math in sixth grade among Balanced Congruent students who end up in different seventh-grade clusters does not vary significantly. In contrast, comparisons among seventh-grade clusters in the fall and spring of seventh grade indicate that, at each semester, students who experience high congruence between actual and ideal decision-making opportunities report higher valuing of math than do students who experience a wide discrepancy between actual opportunities and the

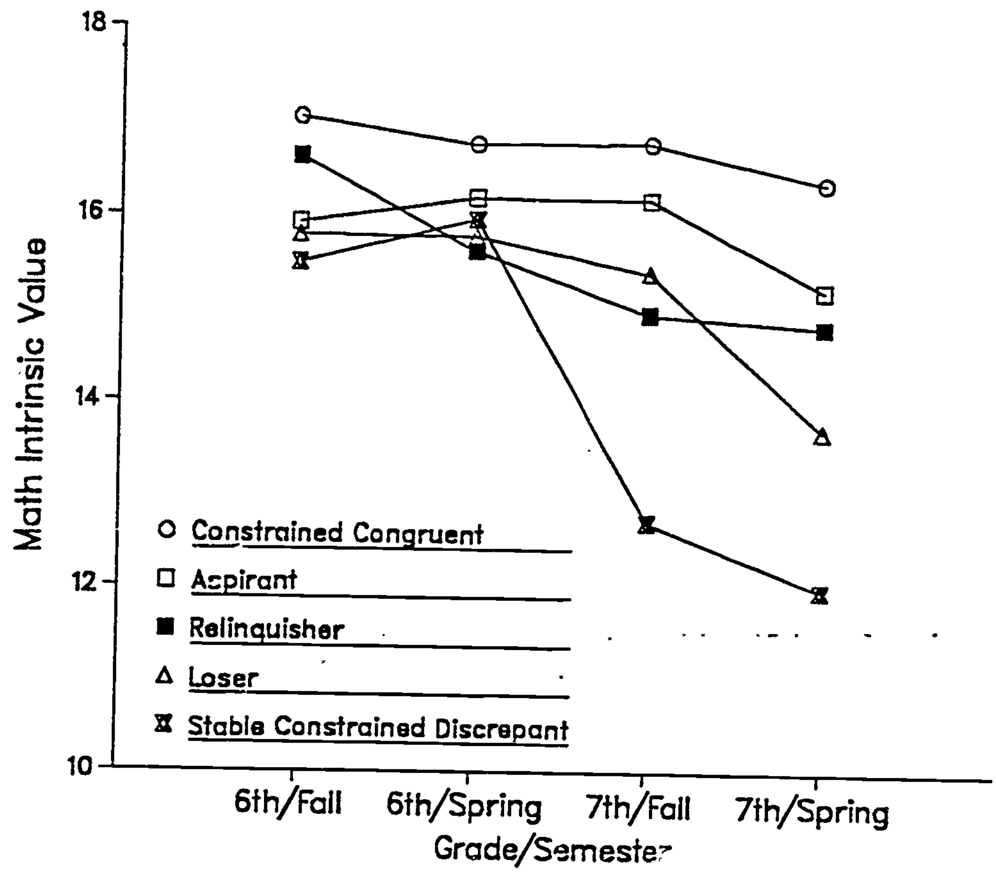


Figure 4. Effects of Seventh-Grade Cluster on Perceptions of the Intrinsic Value of Math for Students who were Balanced Congruent in Sixth Grade.

Summary of Bonferroni Comparisons

6th/Fall and 6th/Spring: No significant differences among means.

7th/Fall: Constrained Congruent > Relinquisher, Stable Constrained Discrepant

Aspirant, Relinquisher, Loser > Stable Constrained Discrepant

7th/Spring: Constrained Congruent > Relinquisher~, Loser, Stable Constrained Discrepant

Aspirant, Relinquisher > Stable Constrained Discrepant

Note. A "~" indicates that the relevant comparison is only marginally significant ($p < .10$). For all other comparisons listed, $p < .05$.

opportunities they feel are justified. For example, in the fall, Constrained Congruent and Aspirant students report higher valuing of math than do students who are Stable Constrained Discrepant. Again, the expectation that Relinquishers and Losers would value math less in the fall than Constrained Congruents and Aspirants but more than Stable Constrained Discrepants was confirmed, but only some of the relevant comparisons were statistically significant.

In the spring, students who have remained or become highly discrepant (Stable Constrained Discrepants or Losers) value math less than students who have remained highly congruent (Constrained Congruent). Students with midrange levels of discrepance (Relinquishers and Aspirants) value math less than students with high congruence and more than students with low congruence, although not all of the relevant comparisons are significant.

Effects on students who were Losers, Aspirants, or Stable Constrained Discrepants in sixth-grade Figures 5, 6, and 7 depict the effects of seventh-grade cluster on students who were sixth-grade Losers, Aspirants, and Stable Constrained Congruents, respectively. Although each figure is slightly different, the main finding is robust: In both semesters of seventh grade, students in clusters characterized by high levels of decision-making discrepance value math less than do students in clusters characterized by decision-making congruence.

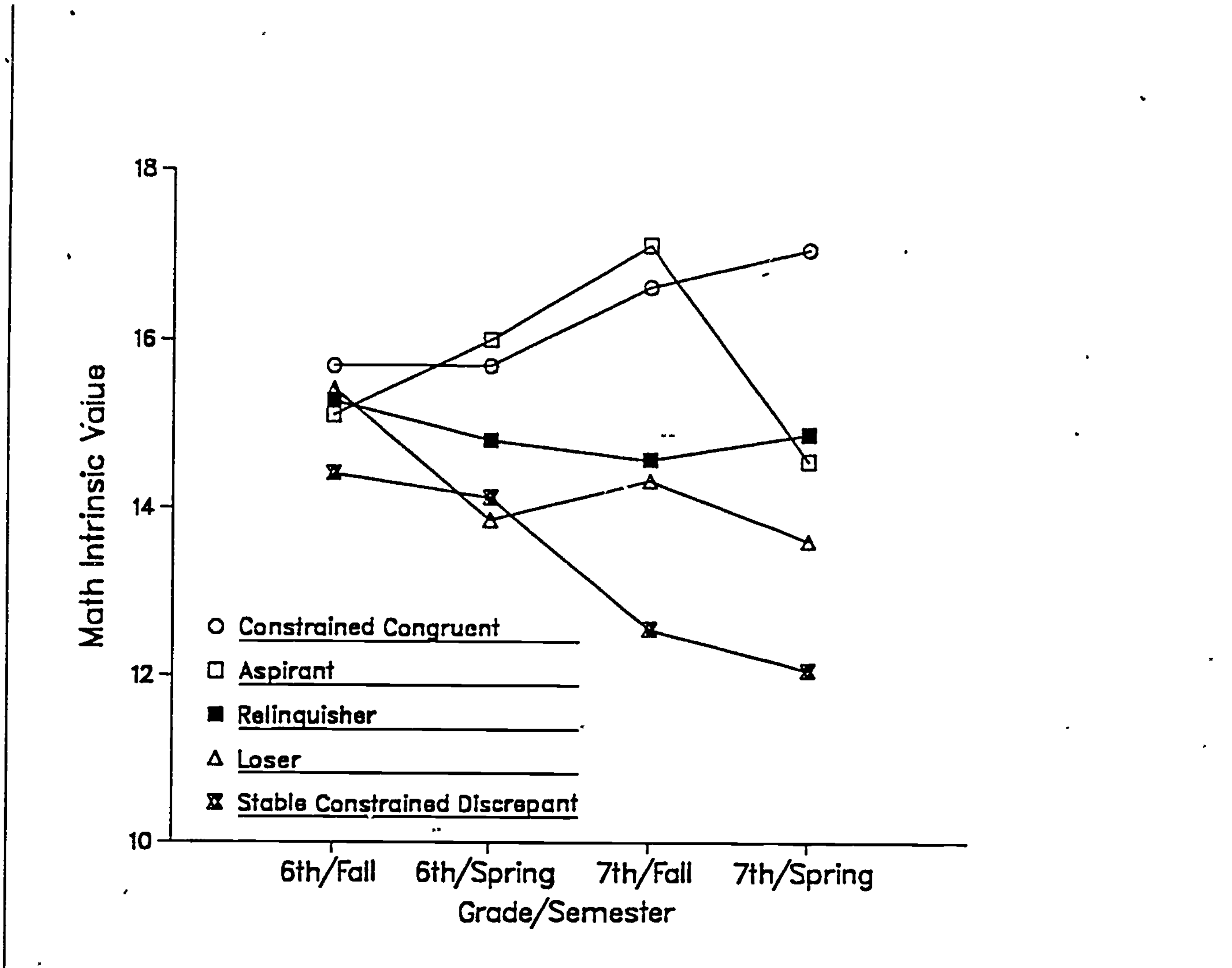


Figure 5. Effects of Seventh-Grade Cluster on Perceptions of the Intrinsic Value of Math for Students who were Losers in Sixth-Grade.

Summary of Bonferroni Comparisons

6th/Fall and 6th/Spring: No significant differences among means.

7th/Fall: Constrained Congruent > Stable Constrained Discrepant~

Aspirant > Stable Constrained Discrepant

7th/Spring: Constrained Congruent > Loser~, Stable Constrained Discrepant

Relinquisher > Stable Constrained Discrepant

Note. A "~" indicates that the relevant comparison is only marginally significant ($p < .10$). For all other comparisons listed, $p < .05$.

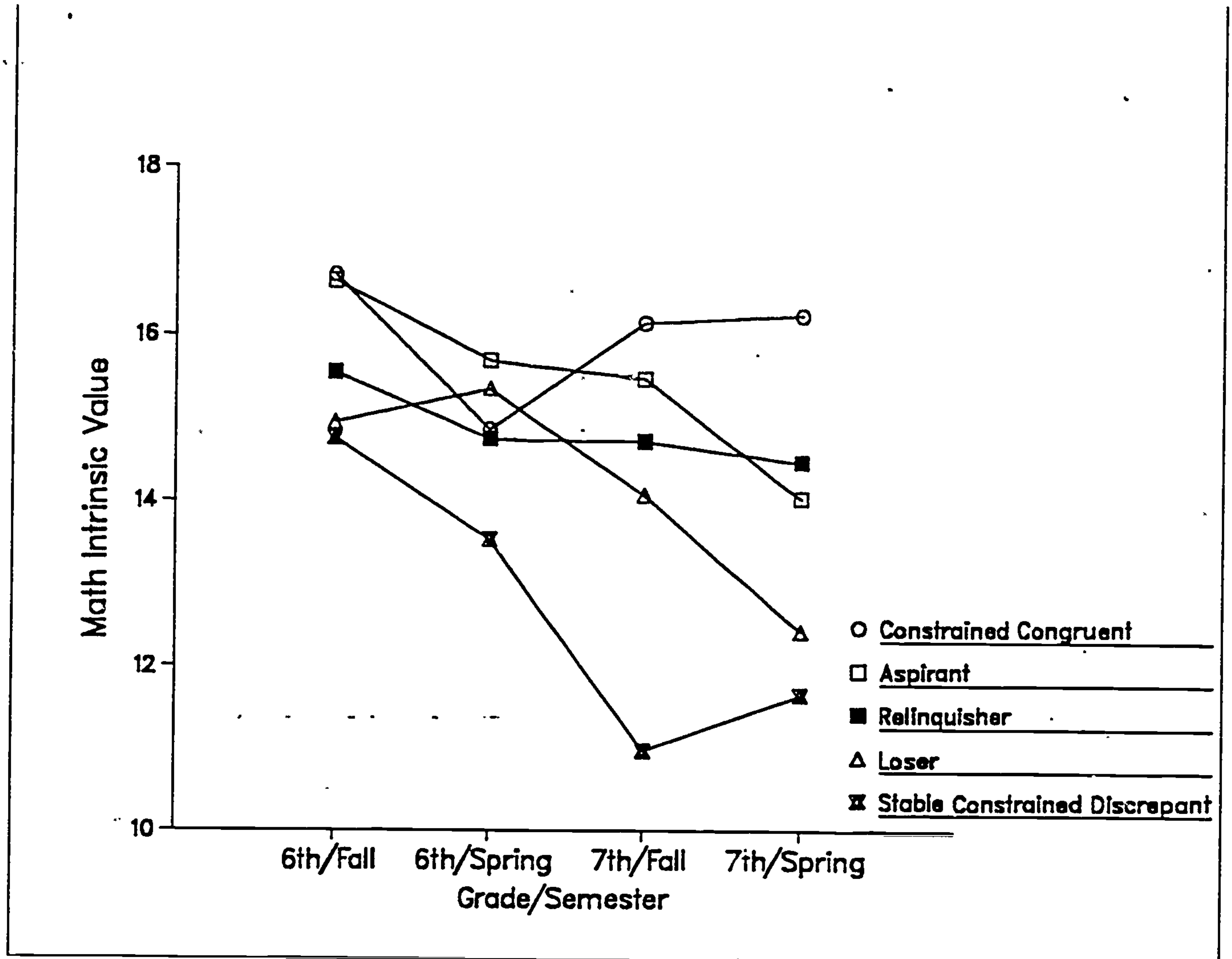


Figure 6. Effects of Seventh-Grade Cluster on Perceptions of the Intrinsic Value of Math for Students who were Aspirants in Sixth Grade.

Summary of Bonferroni Comparisons

6th/Fall and 6th/Spring: No significant differences among means.

7th/Fall: Constrained Congruent, Aspirant, Relinquisher, Loser > Stable Constrained Discrepant

7th/Spring: Constrained Congruent > Loser, Stable Constrained Discrepant

Relinquisher > Stable Constrained Discrepant

Note. A "~" indicates that the relevant comparison is only marginally significant ($p < .10$). For all other comparisons listed, $p < .05$.

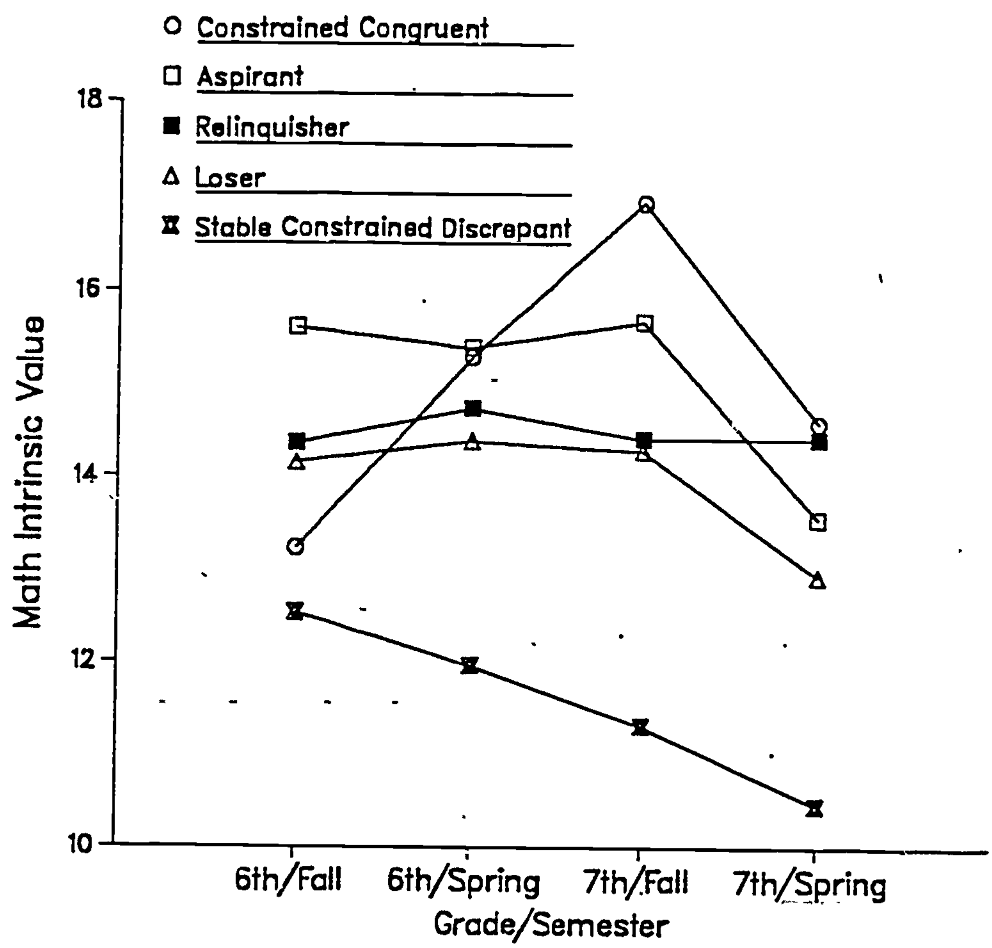


Figure 7. Effects of Seventh-Grade Cluster on Perceptions of the Intrinsic Value of Math for Students Who Were Stable Constrained Discrepant in 6th Grade

Summary of Bonferroni Comparisons

6th/Fall: Aspirant, Relinquisher > Stable Constrained Discrepant~

6th/Spring: Constrained Congruent, Aspirant, Relinquisher, Loser > Stable Constrained Discrepant

7th/Fall: Constrained Congruent, Aspirant, Relinquisher, Loser > Stable Constrained Discrepant

Constrained Congruent > Relinquisher, Loser

7th/Spring: Constrained Congruent, Relinquisher, Loser > Stable Constrained Discrepant

Aspirant > Stable Constrained Discrepant~

Note. A "~" indicates that the relevant comparison is only marginally significant ($p < .10$). For all other comparisons listed, $p < .05$.

Effects of Sixth-Grade Cluster

Figure 8 depicts the effects of sixth-grade cluster on perceptions of the intrinsic value of math for students who are Stable Constrained Discrepants after the transition to junior high school. In the fall, the most discrepant students (Stable Constrained Discrepants) have a lower mean valuing of math than do those students who have the least amount of constrained discrepance (Constrained Congruents, Aspirants, and Balanced Congruents). Between the fall and the spring, however, Aspirants become dissatisfied with the high constraints they are experiencing. Their rating of the intrinsic value of math drops below that of Constrained Congruent and Balanced Congruent students. Of course, all the students in Figure 8 experience stable constrained discrepance upon entry to junior high. Regardless of their sixth-grade cluster, their valuing of math drops sharply. (There is no significant relationship between sixth-grade cluster and valuing of math in seventh grade for these students.)

Inspection of the simple effects of sixth-grade cluster within each of the remaining seventh grade clusters reveals that the effects on valuing of math during the sixth-grade year are similar regardless of students' seventh-grade cluster. For example, if one plots a separate figure like Figure 8 for students within each seventh grade cluster, the sixth-grade portions of

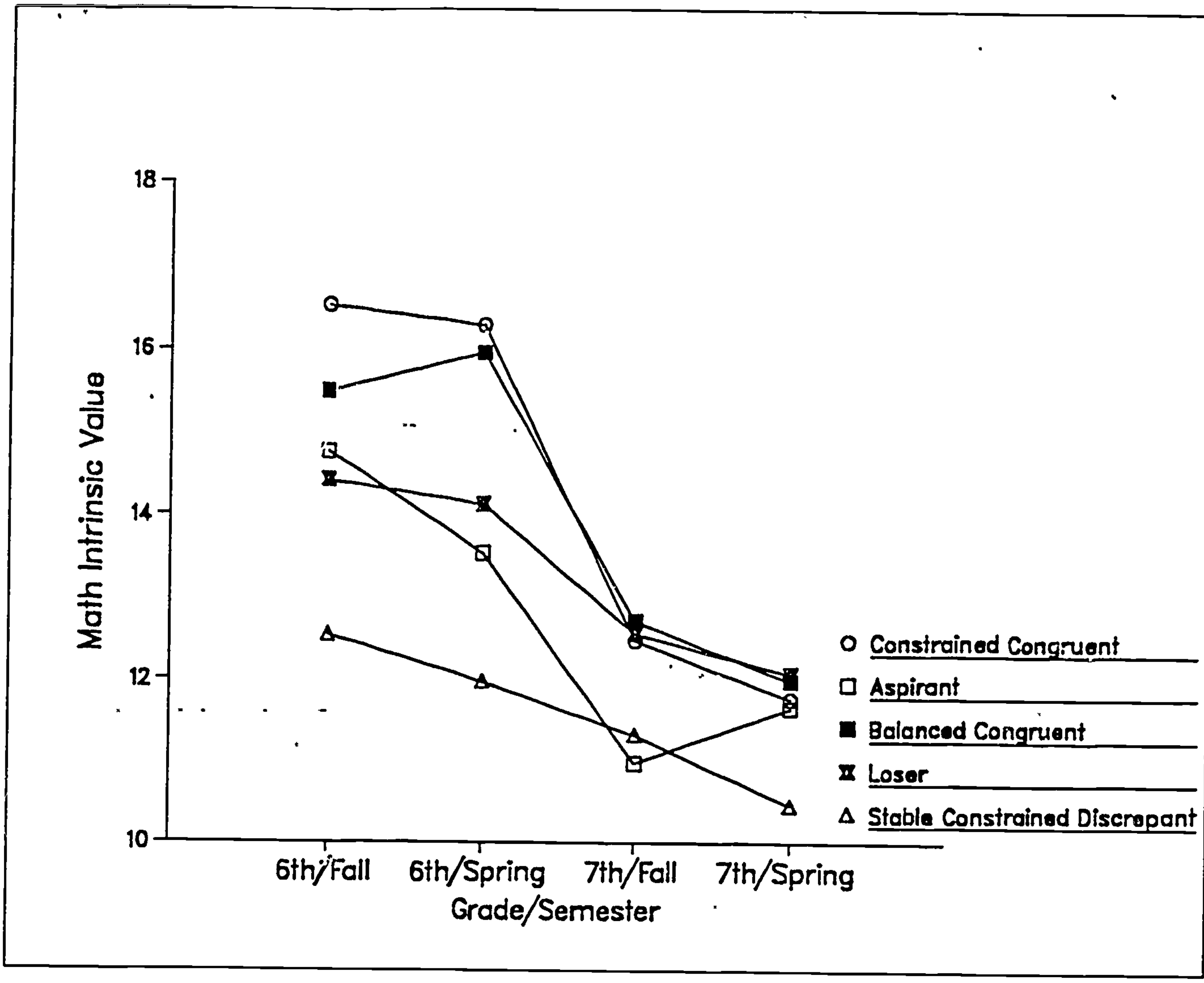


Figure 8. Effects of Sixth-Grade Cluster on Perceptions of the Intrinsic Value of Math for Students who Become Stable Constrained Discrepant in Seventh Grade.

Summary of Bonferroni Comparisons

6th/Fall: Constrained Congruent, Balanced Congruent > Stable Constrained Discrepant

Aspirant > Stable Constrained Discrepant~

6th/Spring: Constrained Congruent, Balanced Congruent > Stable Constrained Discrepant

Loser > Stable Constrained Discrepant~

Constrained Congruent > Aspirant~

7th/Fall and 7th/Spring: No significant differences among means.

Note. A "~" indicates that the relevant comparison is only marginally significant ($p < .10$). For all other comparisons listed, $p < .05$.

these figures are similar to each other and to the sixth-grade portion of Figure 8. For the sake of brevity, therefore, none of these figures are plotted here. Instead, Figure 9 displays the average effects of sixth-grade cluster after lumping together students who end up in different seventh-grade clusters and reports comparisons among the sixth-grade cluster means. (Because of the larger cell sizes obtained after collapsing across seventh grade clusters, Scheffe contrasts are reported rather than [less rigorous] Bonferroni contrasts.)

Figure 9 can be summarized as follows. In the fall of sixth-grade, Stable Constrained Discrepant students have significantly lower perceptions of the intrinsic value of math than any of the other students. The only unexpected finding is that, on the average, Aspirants have lower intrinsic valuing of math than do students in the Constrained Congruent cluster even though Aspirant and Constrained Congruent students have equally high levels of constrained congruence in the fall. Between the fall and the spring of sixth grade, students who experience an escalation of constrained discrepance (Losers and Aspirants) lower their perceptions of the intrinsic value of math. Thus, by the spring, they no longer value math significantly more than students in the Stable Constrained Discrepant Cluster.

As can be seen in Figure 9, the effects of one's sixth grade cluster tend to persist into seventh grade. However, as noted

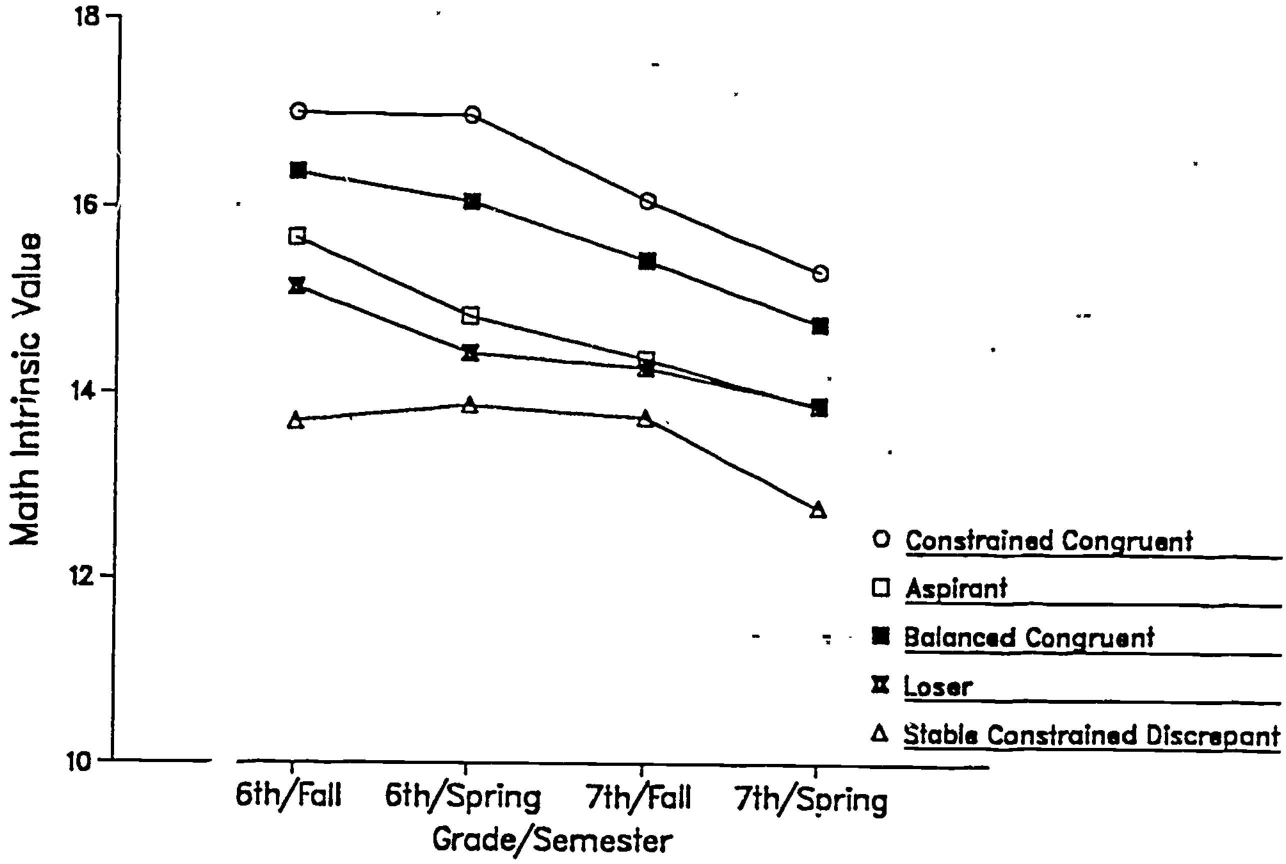


Figure 9. Effects of Sixth-Grade Cluster on Students' Perceptions of the Intrinsic Value of Math.

Summary of Scheffé Comparisons

6th/Fall: Constrained Congruent, Balanced Congruent, Loser, Aspirant > Stable Constrained Discrepant

Constrained Congruent > Loser, Aspirant

6th/Spring: Constrained Congruent, Balanced Congruent > Loser, Aspirant, Stable Constrained Discrepant

7th/Fall: Constrained Congruent, Balanced Congruent > Stable Constrained Discrepant

Constrained Congruent > Loser, Aspirant

7th/Spring: Constrained Congruent, Balanced Congruent > Stable Constrained Discrepant

Constrained Congruent > Loser, Aspirant

Note. All of the listed comparisons are significant, $p < .05$.

earlier, the degree of persistence depends on one's seventh-grade cluster (See Figure 8 for an example of nonpersistence.)

Utility Value

The MANOVA summary table can be found in Table 4. Each of the factors has a significant effect on students' perceptions of the utility value of math and these perceptions decline, on average, both between and within each schoolyear. In contrast to the intrinsic value analysis, the four-way interaction is not significant. Two of the three-way interactions are significant; the sixth grade cluster x year x semester and the seventh grade cluster x year x semester interactions. This indicates that the nature and magnitude of the cluster effects depend upon the schoolyear and semester under consideration.

Effects of Seventh-Grade Cluster

The mean perceptions of the utility value of math for students in each of the seventh-grade clusters is summarized in Table 5. (The means listed in Table 5 are adjusted means: to permit more meaningful comparisons, the effect of sixth-grade cluster on math utility value has been covaried out. Experiencing person-environment mismatch during sixth-grade predisposes one to value math less in seventh-grade regardless of how well the decision-making prerogatives in seventh-grade match those one thinks one should have.) With one exception, there is no significant relation between one's valuing of math in sixth-grade

Table 5

Summary of Scheffe Comparisons among Math Utility Value Means for each Seventh-Grade Cluster ("*" denotes pairs of clusters significantly different at the .05 level.)

Mean in Fall/Sixth	Seventh-Grade Cluster	C	A	R	L	S
30.94	Constrained Congruent (C)					
29.98	Aspirants (A)					
30.32	Relinquishers (R)					
30.07	Losers (L)					
29.66	Stable Constrained Discrepant (S)	*				

Mean in Spring/Sixth	Seventh-Grade Cluster	C	A	R	L	S
30.48	Constrained Congruent (C)					
30.17	Aspirants (A)					
30.07	Relinquishers (R)					
29.68	Losers (L)					
29.06	Stable Constrained Discrepant (S)	*				

Mean in Fall/Seventh	Seventh-Grade Cluster	C	A	R	L	S
30.69	Constrained Congruent (C)					
29.73	Aspirants (A)					
28.97	Relinquishers (R)	*				
28.34	Losers (L)	*				
26.25	Stable Constrained Discrepant (S)	*	*	*	*	

Mean in Spring/Seventh	Seventh-Grade Cluster	C	A	R	L	S
29.98	Constrained Congruent (C)					
28.30	Aspirants (A)					
28.75	Relinquishers (R)					
26.88	Losers (L)	*		*		
25.93	Stable Constained Discrepant (S)	*	*	*		

and one's (future) seventh-grade cluster. The one exception is that, even before their entry into seventh-grade, students' who become Stable Constrained Discrepant in seventh-grade perceive math to have less utility value than do students who become Constrained Congruent in seventh-grade. This relation between one's seventh-grade cluster and one's previous valuing of math suggests that students who don't think math is very useful or important may be more likely than students who value math to be dissatisfied with the low level of decision-making prerogatives encountered upon entry to junior high school.

How is ones' seventh-grade cluster related to perceptions of math utility value in seventh-grade? The findings can be summarized simply: with one notable exception, the effects of a student's seventh-grade cluster on his or her perceptions of the usefulness and importance of math during seventh grade, match those effects that would be predicted based on person-environment fit theory. At each semester, students who experience a wide discrepancy between actual and ideal decision-making opportunities report lower math utility value than do students who experience a close fit beween actual opportunities and the opportunities they feel are justified. For example, in the fall, the stable constrained discrepant cluster is experiencing much more person-environment mismatch than any other group (See Figure 2). One would therefore predict that it should also value math less than any other group. It does.

In the fall, the relinquishers and the losers have moderate levels of constrained discrepance (See Figure 2). One would predict that they should value math less then the constrained congruent cluster and the aspirants. The relinquishers and losers do value math less than the constrained congruent group BUT not significantly less than the aspirants. (The aspirants are the exception mentioned earlier. They value math less than would be predicted based on their person-environment fit in the fall.)

By the spring, the losers have become almost as discrepant as the stable constrained discrepant group. One would therefore expect the losers' valuing of math to drop to a level near that of the stable constrained discrepant students. It does; the stable constrained discrepant group continues to e bit the lowest math utility value, but their valuing of math is no longer significantly lower than that of the losers.

The relinquishers, were named relinquishers because they achieved a moderate increase in constrained congruence between the fall and the spring by relinquishing some of their ideals concerning their role in classroom decision-making. Consistent with expectations, by the spring they value math almost as much as the constrained congruent cluster, and value math significantly less than the two clusters where person-environment mismatch is at its highest, the losers and the stable constrained discrepant students.

In the spring, aspirants are right in the middle of the other groups when it comes to person-environment mismatch. And as person-environment theory would predict, they are right in the middle as far as valuing math is concerned.

In summary, except for students in the Aspirant cluster in the fall, it is possible to predict a students' valuing of math in seventh-grade based on the closeness of the person-environment fit found in the seventh-grade cluster of which the student is a member.

Effects of Sixth-Grade Cluster

One's cluster in sixth-grade is related to one's math utility value in sixth- and seventh-grade (See Table 6). For example, in the fall of sixth-grade, the constrained congruent cluster and the balanced congruent cluster value math more than does the stable constrained discrepant cluster. Since the stable constrained discrepant cluster is experiencing much higher levels of person-environment discrepancy than these two clusters, this finding is consistent with person-environment fit theory.

Students in the Aspirants cluster, however, display lower perceptions of math utility value in the fall of sixth-grade than would be predicted based on person-environment fit theory. At that time, students in the Aspirant cluster are experiencing as

Table 6

Summary of Scheffe Comparisons Among Math Utility Value Means for each Sixth-Grade Cluster ("*" denotes pairs of clusters significantly different at the .05 level.)

Mean in Fall/Sixth	Sixth-Grade Cluster	C	B	L	A	S
30.79	Constrained Congruent (C)					
30.77	Balanced Congruen‹ ·B)					
30.12	Losers (L)					
29.81	Aspirants (A)					
29.20	Stable Constrained Discrepant (S)	*	*			

Mean in Spring/Sixth	Sixth-Grade Cluster	C	B	L	A	S
30.93	Constrained Congruent (C)					
30.64	Balanced Congruent (B)					
28.64	Losers (L)	*	*			
29.17	Aspirants (A)	*	*			
28.61	Stable Constrained Discrepant (S)	*	*			

Mean in Fall/Seventh	Sixth-Grade Cluster	C	B	L	A	S
29.99	Constrained Congruent (C)					
29.46	Balanced Congruent (B)					
28.49	Losers (L)					
27.68	Aspirants (A)	*	*			
27.69	Stable Constrained Discrepant (S)	*	*			

Mean in Spring/Seventh	Sixth-Grade Cluster	C	B	L	A	S
29.07	Constrained Congruent (C)					
29.00	Balanced Congruent (B)					
27.30	Losers (L)	*	*			
27.89	Aspirants (A)					
26.30	Stable Constrained Discrepant (S)	*	*			

much person-environment fit as the constrained congruent and balanced congruent clusters. One would therefore expect the Aspirants to value math significantly more than the students in the Stable Constrained Congruent Cluster, but this is not the case.

Finally, the Losers -- who are right in the middle of the groups when it comes to how much person-environment mismatch they are experiencing in the fall of sixth-grade-- are also right in the middle of the groups in their valuing of math.

The data in the spring of sixth-grade are consistent with expectations. By the spring, the Constrained Congruent and Balanced Congruent groups are the only two groups who are not experiencing a high level of person-environment mismatch. As would be predicted, these two groups display a higher perceptions of math utility value than do the others.

Regardless of one's sixth-grade cluster, mean perceptions of math utility value drop upon entry to junior high school. (This drop is responsible for the large main effect of Year in Table 4). However, students who experience either constrained or balanced congruence throughout sixth-grade are more likely than others to maintain a high valuing of math in seventh-grade (see Table 6). Supplemental analyses confirm that students who experience decision-making congruence throughout sixth-grade have higher math utility value in seventh-grade than do others even after covarying out the effects of students' seventh-grade clusters.

Discussion

Several researchers have noted with concern that, during early adolescence, there is a deterioration in the fit between the needs or goals of students and the opportunities afforded them in the classroom (e.g., Eccles & Midgley, in press; Lispsitz, 1977; Sprinthall, 1985). Many feel that this decreasing congruency between students and their classroom environments may be partly responsible for increases in students' devaluation of school subjects and alienation from school during early adolescence (e.g., Feldlaufer, et al., 1987; Lee 1979).

One area of mismatch between early adolescents and their classroom environments is in the area of classroom decision-making. For example, students want more decision-making power in their mathematics classroom after the transition to junior high school and receive less (Midgley & Feldlaufer, 1986). Teachers confirm this decline in decision-making opportunities.

In the present study, we found a steady decrease in decision-making opportunities and decision-making fit across sixth- and seventh-grades. Furthermore, consistent with the predictions of person-environment fit theory and pawn theory, we found that students who experienced a lack of decision-making fit in their math classrooms perceived math to have less intrinsic and utility value than did students who experienced a close fit between the decision-making prerogatives provided to them and those prerogatives that they think they should have. Of course, causality cannot be inferred from this quasi-experimental dataset. The analyses were designed to test only whether the relations observed in the data were consistent or inconsistent with the hypothesis that decision-making congruence influences ones' valuing of math. As in other studies that have examined this issue (Reuman et al., 1984; Mac Iver, et al., 1986), a relation consistent with the hypothesis was found. Futhermore, the relation is large enough to be educationally significant (e.g., cluster membership "explains" about 13% of the variation in students' perceptions of math intrinsic value in each semester of seventh-grade.) These findings suggest that researchers and educators might be able to help prevent declines in students' valuing of mathematics, if they modified classroom decision-making practices in such a way as to increase the match between the prerogatives students feel they should have and the prerogatives they are given.

In examining the relation between decision-making congruence and students mathematics-related beliefs, attitutes, and values, earlier studies have not distinguished the two different types of congruence: unconstrained congruence (teacher gives and student wants a voice in decision-making) and constrained conguence (teacher does not give and student does not want a voice in decision-making). One contribution of this study is that it compares two types of congruent students: those whose congruence consists entirely of the constrained variety and those whose congruence is a balanced mixture of both unconstrained and constrained congruence. The results indicate that the effects of constrained congruence and balanced congruence on students' valuing of math are highly similar. Both types of congruence are associated with a high valuing of math (See Table 6 and Figure 9). Furthermore, the effects of seventh-grade cluster on math intrinsic value are similar for students who were congruent in sixth-grade, regardless of whether they were constrained congruent or balanced congruent (compare Figures 3 and 4). The functional equivalence of the two types of congruence is consistent with the finding in earlier studies (Reuman et al., 1984; Mac Iver et al., 1986) that overall decision-making congruence (summing constrained and unconstrained congruence) predicts student outcomes much better than does the level of actual decision-making opportunities. Taken together, these findings suggest that past research has perhaps placed too much emphasis on the sheer number of decision-making opportunities given to students without devoting enough explicit attention to whether the opportunities provided match student preferences and ideals.

What then is our message to educators? It is our hope that educators will work toward increasing the fit between actual decision-making opportunities and the opportunities that students feel are justified. This is a particularly important message for junior high school teachers to hear because early adolescents express a desire for more control over their lives (Lee 1979; Lee, Statuto, & Kedar-Voivodas, 1983). Yet, when these early adolescents move from elementary to junior high school, they are given fewer opportunities to make suggestions regarding what they will learn and how they will learn it (Feldlaufer, et al., 1987). The junior high school teachers in our sample, by refusing to provide their students with decision-making opportunities, eliminated the possibility of balanced congruence and thus increased the proportion of students who were experiencing moderate or high levels of discrepance between the prerogatives available and the prerogatives students felt were justified. We have shown that such discrepance is associated with a lowered valuing of math. Furthermore, others have demonstrated that valuing of math is a major determinant of decisions to enroll in math when it becomes an optional subject in school (Chipman, Brush, & Wilson, 1985; Eccles, et al., 1983). Similarly, one's valuing of a subject has an important influence on how much effort one expends trying to master the subject (e.g., Eccles & Wigfield, 1985). Thus, continued constrained discrepance may prompt some students to "slack off" in their mathematics classes and to stop taking mathematics before they acquire the level of skill required for admission to many college majors and for many professional and technical occupations.

We acknowledge that it may not always be easy to increase the fit between actual decision-making opportunities in the classroom and the opportunities that students feel are justified. Although students within a classroom tend to agree among themselves concerning the actual opportunities present in their classroom, they display considerable disagreement concerning which opportunities they feel are justified (Mac Iver et al., 1986). Because students differ in what decision-making opportunities they believe they should have, a uniform decision-making policy within a classroom may result in some students' congruence and others' discrepancy. For example, allowing students to help decide how much math homework they will get may have a positive effect on students who believe they should have a say in this, but may have a negative effect on those who believe that the teacher should make this decision. (On the other hand, the rarity of unconstrained discrepance in this study and previous studies may indicate that, when given a prerogative such as this, early adolescents who originally believe they should not have the prerogative quickly come to accept the prerogative as justifiable.)

When students disagree over the desirablility of a particular decision-making opportunity, it may sometimes be possible to individualize the role given to students to bring them all into congruence. For some types of decisions, however, establishing a classroom-wide decision-making policy may be the only practical or equitable course of action. When a classroom-wide decision-making policy is necessary, teachers could learn through class discussions what decisions a majority of their students believe they should have a say in. Prerogatives could then be established in specific domains of classroom activity. Teachers and students could monitor the success with which students handle these prerogatives, establish sanctions for misuse, and decide when a prerogative should be revoked. Even though some students' preferences will not be met, being involved in the process of establishing, monitoring, and evaluating opportunities for classrooms decision-making should heighten students' feelings of congruence with their classroom environment. Had more teachers in our sample requested input from students about their ideal prerogatives, they might have been able to avert the condition where so many of their students felt they did not have decision-making opportunities they ought to have.

One effect of involving students in the process of classroom decision-making may be to redefine their ideal prerogatives. Students who were part of a minority that voted to institute a prerogative would become aware of the reasoning of the majority. This might facilitate the re-examination of their position. That is, hearing their classmates' or their teacher's arguments against a particular prerogative may help these students understand the reasons for the prerogatives absence. If this helps them feel less strongly that they should have the prerogative, these students may suffer fewer of the negative consequences of lack of fit with the classroom environment.

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APPENDIX

STUDENT QUESTIONNAIRE ITEMS MEASURING OUTCOMES RELATED TO MATHEMATICS

Math utility value: Girls' alpha = .815; Boys' alpha = .771

In general, how useful is what you learn in math?

not at all useful						very useful
1	2	3	4	5	6	7

How useful do you think the math you are learning will be for what you want to do after you graduate and go to work?

not at all useful						very useful
1	2	3	4	5	6	7

Is the amount of effort it will take to do well in math this year worthwhile to you?

not very worthwhile						very worthwhile
1	2	3	4	5	6	7

For me, being good at math is

not at all important						very important
1	2	3	4	5	6	7

How useful do you think high school math will be for what you want to do after you graduate and go to work?

not at all useful						very useful
1	2	3	4	5	6	7

Math intrinsic value: Girls' alpha = .759; Boys' alpha = .745

Do you spend as much time as you do in math
(Check one answer.)

____ 1) because you have to in order to finish the work.
____ 2) because you just like doing math.

In general, I find working on math assignments

very boring						very interesting
1	2	3	4	5	6	7

How much do you like doing math?

a little						a lot
1	2	3	4	5	6	7

Would you take more math <u>if you didn't have to</u>? *(Reversed for analyses)*

____ 1) I very definitely would take more math.
____ 2) I probably would take more math.
____ 3) Maybe I would take more math.
____ 4) I'm not sure.
____ 5) Maybe, but not that likely.
____ 6) I probably would not take any more math.
____ 7) I very definitely would not take any more math.

Footnotes

[1]In 1977, Mojena developed an ad hoc rule for selecting stopping points that seemed to work well in his Monte Carlo study of hierarchical grouping methods. His rough rule of thumb involves computing the mean and standard deviation of the amalgamation coefficients from every step in the clustering process. He suggests stopping at a step in the clustering process where the amalgamation coefficient for that step is 3 to 3.5 standard deviations above the mean. The stopping points we have selected either satisfy this rule (in seventh grade) or almost satisfy the rule (the amalgamation coefficient for the five-cluster solution in sixth grade is 3.52 standard deviations above the mean). In sixth grade, the ratio of the smallest between-cluster distance to the largest within-cluster distance is 1.3. The corresponding ratio in seventh grade is 1.2. On average, 52% of the variance in the person-environment measures is between-clusters in sixth grade. The corresponding percentage in seventh grade is 51%.

[2]In preliminary MANOVAs, we also included student gender as a between-subject factor. There were no significant main effects or interactions involving gender.