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Bridging the Gap: Towards an Understanding of Young Children's Thinking in Multiage Groups

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Abstract. Multiage settings are alternative educational groupings that promote complexity in young children's thinking. Grouping children across ages and grades encourages interconnectedness in social and intellectual development. This study compared the academic achievement of one group of multiage students to national norms on standardized achievement tests. The Stanford Achievement Test, 9th edition, was used as the standardized instrument. Analysis of the data revealed no significant difference in scores in reading and mathematics. However, a difference did exist in language scores. In addition, mixed group processing of linguistic and nonlinguistic problems from Odyssey of the Mind were analyzed, using independent samples t test for creativity, group cooperation, and problem solving. Significant levels of interaction were found.

> The fundamental factor [assigned to mental development] is social interaction and transmission. . . . Socialization is a structuration to which the individual contributes as much as he receives from it. . . . [I]t is widely accepted that cognitive and affective or social development are inseparable and parallel . . . in the last analysis it is the need to grow to assert oneself, to love, and to be admired that constitutes the motive force of intelligence. (Piaget & Inhelder, 1969, pp. 156-158)

Children have always lived with, learned from, and played alongside other children of different ages. Mixed-age groupings of children with disparate abilities and developmental levels hold a long history in education. Multiage groups of children date back well before the rural one-room schoolhouse or the Dame schools of the 1800s. The Montessori schools, as well as the British Primary Schools, have maintained classes without age and grade level classifications into this century. Only recently, in the 20th century, have the majority of public and private schools in the United States operated in a lockstep, single-age group, linear curriculum model.

Progress through the graded system on the basis of age became a regular feature of the efficiency-oriented, factory model in education at the turn of the century (Callahan, 1962). However, renewed interest in nontraditional groupings emerged as a promising strategy for school reform and education restructuring in the 1980s and early 1990s. The re-emergence of nongraded, or multiage, classrooms finds its origins in the notion of continuous pupil progress. Mixed-age and -ability interactions provide students with opportunities to learn from others and, in turn, to teach classroom peers. Learning opportunities are structured to allow progress at an individual pace in an environment that is best suited to the child's specific needs. To teach children of widely varying levels requires interactive curriculum experiences, fluid grouping strategies, and individualized planning. Nongrading assumes heterogeneity of chronological age, academic experience, maturity, and sociocultural experience, as well as interests and abilities. Multiage classrooms are multidimensional environments "in which children have some real choices about what they do and when or how to do it; they are more likely to make ego-enhancing choices that lead to positive self-evaluations" (Greenberg, as cited in Katz, Evangelou, & Hartman, 1990, p. 7).

Social thought, social understanding, and emotional intelligence intimately connect with intellectual development. Affective learning is indissociable from cognitive learning (Gardner, 1983; Goleman, 1995). Existing research supports the strong social, emotional, and moral development of children in multiage groupings. Children are universally sensitive to the differences and attributes associated with age, and differentiate their own behavior and expectations based on the age of the participants (French, 1984). Graziano, French, Brownell, and Hartup (1976) found that specific prosocial behaviors are extended to the youngest children, including helping, sharing, and turn-taking. Older children have the opportunity to test leadership skills and provide younger children with more complex language and play than they would initiate by themselves (Howes & Farver, 1987; Wertsch, 1985). Lougee and Graziano (undated) found that older children in multiage settings often act as the rule enforcers and facilitate the development of self-regulation. Social participation is increased for younger children in mixed-age groups, requiring less redirection of social interactions (Goldman, 1981). Research by Diehl, Lemerise, Caverly, Ramsay, and Roberts (1998) affirms that the availability of long-term friends and a stable environment in multiage settings enhance achievement, attitudes towards schooling, and the ability to work cooperatively in groups.

Less compelling is the research evidence indicating that children do as well cognitively and academically as peers in same-age, single-grade level classrooms. Parents, administrators, and teachers voice concern that children in multiage classrooms suffer academically, particularly the oldest children. It is proposed that the greater heterogeneity in academic and social skills within a multiage classroom offers unique challenges, particularly to the youngest children. The opposing ideas and notions held by older children, and the desire to verify these ideas, stimulates a causal relationship of logical development in the younger child. The older children solidify their own understandings through tutoring the younger children (DeVries, 1997). The reteaching dimension of multiage classrooms is a valuable metacognitive component of learning in mixed-age groups and supports the perspective of cognitive conflict as learning impetus in multiage settings.

Existing research evidence regarding cognitive development is mixed in comparing the academic performance of children in multiage settings to traditional classrooms. Veenman (1995) reports no significant difference in test scores, while Mason and Burns (1996) report a slightly negative effect for multiage classrooms. Kelley and Fitterer (1999) report that multiage students perform as well, if not better than, national norms. They perform as well as surrounding schools with a similar sociocultural and economic profile that are organized into traditional graded classrooms. Gorrell (1998) reports that analysis of SAT 9 scores for multiage classrooms were compared to scores of traditional classrooms in reading and math. No statistically significant difference in reading or math achievement between student groups was found in this comparison. If, indeed, complex social settings are essential for children's thinking to develop, as Piaget and Inhelder maintain, the multiage setting should promote greater complexity in cognitive development (DeVries, 1997).

Purpose of the Study

The purpose of this study is to complement the growing body of literature that supports equally strong cognitive development and academic achievement in multiage settings. The participants in the study are a multiage group of 29 nine-, ten-, and eleven-year-olds in a suburban area of a large metropolitan area in the western United States. Sixteen students are boys; 13 students are girls. Support teachers deliver all special services in a fully inclusive model. The group of students includes children with special needs and learning disabilities, English language learners, Title 1 designated students, and

one child with a physical disability. The school receives Title 1 monies, and 29 percent of the school population is on free and reduced lunches. The elementary campus houses evening adult literacy classes and parenting outreach programs, integrated preschool classrooms, and dual language multiage classrooms.

The multiage classrooms at this school span two- and three-year age groupings. Alongside very traditional classrooms, some teachers on this campus also loop grades for two and three years. Primary multiage classrooms feed directly into intermediate multiage classrooms. The multiage teachers work as a single team, not unlike a grade level, and plan together for thematic units, field trips, buddy classes, and professional development. The curriculum design and pedagogy of these classrooms emphasize inquiry/discovery approaches to content learning, a comprehensive literacy program within rich, literate environments, and democratic communities of learning.

Method

Do groupings of multiage children across ages and grades encourage social and intellectual complexity? Three indicators of "intellectual complexity" are compared to examine cognitive development in one group of multiage students. First, academic achievement is represented by comparing the scores of this group of multiage students to national norms on standardized achievement tests. The Stanford Achievement Test, 9th edition, is used as the standardized instrument to make this comparison. In cooperative problem-solving situations, children are required to discuss their ideas about a problem, reach agreement through negotiation about ideas, agree on a solution strategy, and take turns (Katz, McClellan, Fuller, & Walz, 1995). All of these skills are taken to be indicators of intellectual development. In order to assess group cooperation and problem-solving skills, a rubric rates the groups of multiage students on group levels of seven different attributes, with a maximum score of 28. Team problem solving from Odyssey of the Mind (Micklus & Micklus, 1977) academic competitions were selected as the problems to be used with the students. Both linguistic and nonlinguistic types of problems were selected for the study. The Odyssey of the Mind scoring rubrics were used to assess group performance as well. The scoring criteria for the linguistic Odyssey of the Mind problems ranged from "1" for common, low creativity performances to "5" for uncommon, highly creative performances.

Results

SAT 9 Score Comparisons

Standardized test scores from the Stanford Achievement Test in language, reading, and math were examined for this group of students. Score means compared to national norms. Table 1 shows differences in test performance for the multiage students and students in national norming groups in reading and mathematics. Reading scores for all three grade levels fall three to four points above the mean national score. Multiage students in this group scored higher in the comprehension subtest than national norming groups. Mathematics scores fall closer to national means, with a range of .8 below the national score to 1.1 above the national score. Language results do indicate significantly lower test performance for multiage students at each test grade level. Prewriting subtests and total

Table 1
SAT 9 Scores for Three Grade Levels

	Mean Raw Score			Mean National Score		
Subject	Third	Fourth	Fifth	Third	Fourth	Fifth
Reading	55.2	56.4	56.0	50.8	52.9	52.0
Mathematics	50.2	52.1	48.3	49.1	52.9	47.2
Language	35.2	33.5	32.0	54.8	46.0	44.8

language scores are the lowest for this group of multiage students.

Creative Team Problem Solving Results

Odyssey of the Mind is a national academic competition emphasizing creative, team problem-solving tasks. The spontaneous thinking tasks from Odyssey of the Mind fall under two general headings: 1) linguistic problem solving that includes "fast on your feet" thinking problems, and 2) nonlinguistic problem solving that entails creation and construction of solutions. Problems of both types were selected for this study. The two tasks chosen were selected for their learning potential, as well as their level of engagement. The development of problems, timing of team work, as well as the rubrics for scoring solutions, are clear, quantifiable, and standardized for use by Odyssey of the Mind competition judges nationwide.

The linguistic problems chosen for this study required the teams of multiage students to think in terms of categories and to look for alternatives within a given category that are unusual or creative. One example of the linguistic problems required the student teams to discuss all the possible things that they would not like to hear the pilot say to them while on a plane trip. Another linguistic problem required the student teams to think of all the possibilities for objects that are inside of other objects. Scoring of linguistic problems is "1" or "5," with "1" awarded for common answers and "5" awarded to creative answers.

The nonlinguistic problem chosen for the study requires the multiage students to build a structure using 50 toothpicks, four plastic straws, and one piece of plasticine clay. No example is shown to the student. Verbal directions are given only. The structure must support the weight of 20 one penny nails; points are awarded based on the number of nails supported, combined with the height of the structure. Teams of three children were given 6 minutes to create their structure.

Videotapes of the problem-solving activities were made. Anecdotal observation

Figure 1
SAT 9 Reading Subscores

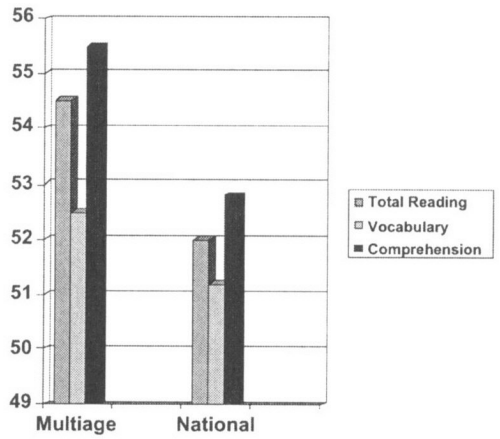


Figure 2
SAT 9 Mathematics Subscores

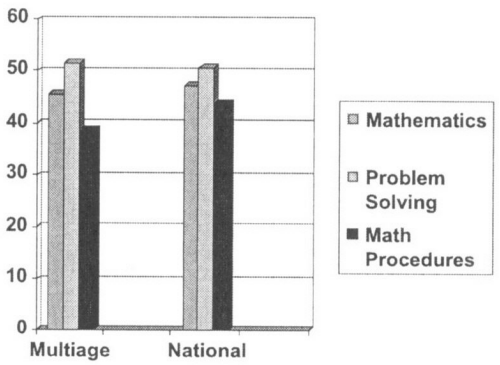
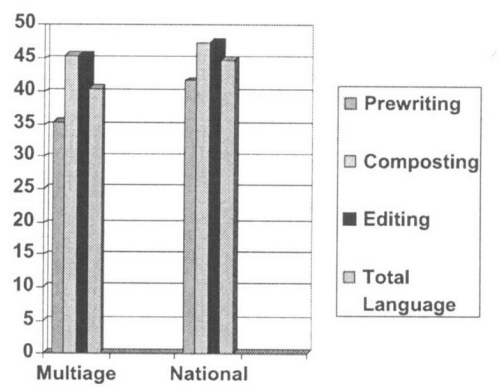


Figure 3
SAT 9 Language Subscores



notes of the two one-hour Odyssey of the Mind problem-solving sessions also were made. These notes were reviewed with the videotape. The tape was coded by the researcher using the Group Cooperation and Problem Solving Rubric and Score Checklist, with the maximum score being 28 points. Review of the tape by another rater was conducted to ensure reliability of ratings with 93 percent agreement.

An independent samples t-test analysis of the group cooperation scores and the Odyssey of the Mind scores was completed. The interaction between these two independent measures within the group was significant, $t(4)=8.17$ and $p=.001$. Results suggest that the high levels of cooperation between the multiage students positively and significantly interact with the creativity and problem-solving scores for both linguistic and nonlinguistic problems.

Discussion

Examination of the SAT 9 scores indicates no significant difference between achievement in the multiage class and national norm groups, except in language. Scores are higher in reading and comparable in mathematics to national norms for this group of students. The lower language scores may be accounted for in the testing format for language skills. The children in this multiage class routinely write in a writer's workshop setting. This setting entails extended, daily periods of time on writing, self-chosen genres and topics, peer editing conferences, teacher coaching and editing, and publication for a real audience. The SAT 9 attempts to measure achievement in the writing process, including the prewriting, composing, and editing stages. Students are tested on these fluid stages of writing in a multiple choice format, rather than in real language in a contextualized manner. Students who write in an authentic manner may have difficulty transferring holistic understanding to the fragmented knowledge in a standardized test format.

The scores assigned to the teams in linguistic problem solving suggest that students in this multiage class interact with high levels of group interdependence, strategic planning, and positive interpersonal interactions. These were stable throughout the problem-solving tasks. The teams with lower overall scores had lower levels of group interdependence, strategic planning, and positive interpersonal interactions. Group cohesion in the teams was affected by strong personalities dominating the group. Some students failed to actively participate as a result. Group functioning did not deteriorate, although not all members participated as fully. The Odyssey of the Mind scores were lower for these teams as well.

Rich, unanticipated outcomes emerged later in the debriefing sessions with the children. Nearly all students enjoyed the linguistic problems and participated enthusiastically. Some of the children expressed disapproval with the Odyssey of the Mind scoring technique of assigning a "1" to common answers and a "5" to creative answers. In the debriefing, the students asked for a range of scores from 1 to 5 and requested that they be able to participate as a group in the assignment of scores. Their protests were clearly and concisely stated—judging some ideas as creative while the "thinker"

Table 2
Aggregated Scores for All Groups

Linguistic Problem Type	Group Cooperation Score	Odyssey of the Mind Score
Airline Pilot	28	5
Almost	28	5
Bears	25	1
Broken Things	28	5
Brushes	26	1

may see unusual or uncommon thinking in their own answer was not fair. The children articulated an acceptance of all ideas, no matter who contributes the ideas; all ideas have merit. They expressed an equally strong sense of democratic procedure and asked to be included in the evaluation process to ensure fairness to all. This unanticipated outcome speaks to the voice and efficacy this group of students has developed within a multiage setting.

In the nonlinguistic problem solving, more opportunity for group breakdown emerged and some students separated themselves from participating in the activity. These groups had strong personalities that dominated the exchange of ideas and controlled the materials. These stronger personalities were not, however, all older students. One team with lower scores was composed of same-age students working together. In the remaining teams, one older male student and one older female dominated the group interactions. Problem-solving breakdown did not prevent the completion of the structure and did not affect the score received by the group.

Unanticipated outcomes for the nonlinguistic problem solving included the extent to which competition between teams became a motivating force. Multiage classrooms are characterized as learning environments where competition is minimized and group cooperation is emphasized. However, intergroup rivalry became fierce. The entire class gathered around the teacher during the structure testing and counted out loud as nails challenged the strength of each structure. Cheers went up from the children as their structure outperformed a previous structure in supporting nails. The children began to make careful observations of the structures holding the most nails. From these observations, the teams reorganized themselves. Then, during free exploration opportunities, the students re-created their structures and tested them independently. It was the problem solving and competition against other teams that spurred on the creativity of the children within groups.

In reviewing the videotapes for interrating, the reviewer could not distinguish the children with special needs or the second language learners in the group. The children with "labels" interacted as completely and energetically as all other class members. The fully included students were not members of the three teams with interaction breakdown. This indicates a high degree of acceptance of students with widely differing cognitive levels. In fact, some of the most creative responses in one team came from a student with special needs. When asked to think of possible "bills," he responded with "dollar bill" and "my Uncle Bill." Both responses were scored as uncommon and creative according to the Odyssey of the Mind scoring criteria. Imitation and demonstration to each other in the process of doing and learning together is a strong feature in this multiage classroom.

The results of the problem-solving sessions in this mixed-age group indicate that

Table 3
Scores for Nonlinguistic "Skyscraper" Problem

Group	Group Cooperation Score	Odyssey of the Mind Score
1	28	10
2	25	41
3	20	39
4	25	70
5	28	76
6	20	69
7	28	18
8	28	68
9	28	49
10	28	41

children in this multiage setting are accustomed to actively contributing to strategic planning. They contribute ideas and solutions, listen to each other, and acknowledge the thinking of others. Seven of the 10 teams demonstrated group cohesiveness and shared materials for task completion. Humor and positive regard toward each other was demonstrated in these seven groups. Compromise was achieved without arguments in seven of the 10 groups and without a "winner" or "loser." Little impulsivity was observed and the children encouraged self-control in each other throughout the activity. In the class debriefing session, the students were able to clearly identify the purpose and the "real life" value of working cooperatively and solving problems together.

These results seem to indicate that fears about academic performance in multiage classes are unfounded. None of the score comparisons indicate statistically significant differences on standardized academic achievement scores. Continued typical growth and development is indicated for these students. Some students showed more than one year of gains, even three years of gain, in specific SAT 9 subtests. Consistent with the results found by Kelley and Fitterer (1999) and Gorrel (1998), there appears to be no difference in academic performance on standardized tests for the students in this multiage class. Multiage students are as bright as their counterparts of the same age.

Future Research Directions

Continued longitudinal examination of social, emotional, and cognitive development in a variety of multiage settings is in order. This study is merely a snapshot of just one multiage classroom and of the depth and richness of thinking, language, and problem solving that occurs there. An examination of gains made across time and study of achievement into the secondary years for these students is also needed. At this juncture, anecdotal evidence points to sustained achievement and intellectual development. However, the current national educational climate that stresses accountability and high-stakes testing mitigates against unusual, nontraditional ways of children learning together. A narrowing of curriculum to meet standards and the convergent pedagogy of national curricula has worked against multiage teachers and their classrooms. Fewer and fewer are found across the nation.

Conclusion

The reality of child development is uneven "fits and starts." This fact challenges the rigid ordering of children's abilities and attainments often characterizing graded classrooms. Students in mixed-age classrooms have a longer history with one teacher and with a cadre of peers. The greatest fears of elementary schooling are addressed when the child knows the teacher from year to year, knows what the expectations of the classroom organizational structure will be, and knows who his classmates will be. The SAT 9 test results are only one small piece of the portrayal of a child's developing intellect. Intelligence—cognitive development—is complex and multidimensional. Complemented with qualitative images of multiage intellectual growth, a more inclusive understanding emerges. The construction of knowledge is a social endeavor. For children, learning and academic achievement is done "together" (Gergen, 1985). This study affirms the indissociablity of social and cognitive growth in multiage groupings.

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