

A Look at the Academic
Benefits of Multi-age Science
Instruction in Kindergarten

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by

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ABSTRACT

Multiage classroom instruction is currently receiving more attention in the public schools in the United States. The opportunity to teach in a multiage setting is becoming more readily available to educators. The primary objective of this research is to study the effects of multiage grouping on the levels of knowledge and comprehension of kindergarten students. The researcher instructed using single grade and multiage groupings to see if in effect there was a difference in the performance of the kindergarten students.

Students were assessed and the results were then compared. The results obtained by this research were not statistically significant, but the research suggests many positive reasons for multiage groupings and the researcher feels that longer and more in depth studies are needed in the area of Science instruction in the multiage classroom.

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Chapter I

Statement of the Problem

Educators today believe there are many social benefits of multi-age instruction (Kasten and Clarke 1993) thus, in many districts and countries students have a choice to be in a multi-age classroom or to interact with other grade levels in a variety of ways. Research comparing the effectiveness of multi-age instruction and single grade instruction has been conducted for many years. The research conducted has focused primarily on language arts, mathematics and social skills.

Research on instruction in multi-age classrooms indicates that academic results are equal or better than single grade instruction. “Although mixed-age grouping is a straight forward concept, the practical details of implication are not well researched” (Katz, Evangelou & Hartman, 1990). The research that has been done shows very little occurrences of a decrease in ability in a multi-age classroom setting.

Many educators feel that the current single grade classroom situation was originally developed by the Quincy School in Massachusetts in 1848. They believe it was adopted for financial and

administrative reasons. (Kasten & Clarke, 1993) Teachers today are looking at the developmental process of education, not the economic and political aspects of education. (Lodish, 1992)

This researcher has focused attention on multi-age science instruction. Throughout my intern experience, I have had the unique opportunity to work with a traditional single grade kindergarten as well as a kindergarten that mainstreams with a first grade class for multi-age instruction. This multi-age interaction appears to have many social benefits for the students, but does it benefit them academically?

Purpose

Is there a difference between the academic achievement of students in a multi-age and single grade science instruction? Is the impact on knowledge and comprehension significant?

This researcher believes that students in the multi-age group will perform better on knowledge and comprehension skills than those in the single grade group.

Null Hypothesis

There will not be a statistically significant difference between the scores received on the single grade science unit test and the multi-age science unit test. Students scoring higher on the observation scale will also have increased success on the unit test.

Need for Study

It is important to determine whether multi-age grouping methods correlate with higher test scores. Much of the current research focuses on language arts, mathematics and social effects of multi-age instruction. The focus of the present research is to find out if grouping children according to age or grade has an impact on knowledge and comprehension of a science topic. Parents and educators need to be aware of which types of groupings are most effective for learning.

Definitions

In this study, the following terms will be defined as follows:

Single Grade- A traditional, self contained classroom that contains students in a grade level associated with their age, not ability.

Multi-age- A deliberate grouping of children that includes more than one traditional grade level in a single classroom community. Students usually remain with the same teacher for more than one year to create a closer classroom community.

Knowledge- Knowledge is one of two major areas of the cognitive domain. This area is also referred to as low level thinking because it does not call for the processing or manipulation of information. Knowledge is often referred to as recalling or memorization of material.

Comprehension- Comprehension is positioned as the least complex of the high levels. Students are not asked to merely memorize information, but to put new information into their own words. Translation is another term used to describe this level of thinking.

Chapter II

Review of the Literature

Purpose

Is there a difference between the academic achievement of kindergarten students in multi-age and single grade science instruction? Is the impact on knowledge and comprehension significant?

Overview

Educators are constantly looking for ways to improve student learning and the delivery of instruction. One area of educational debate is student grouping and class structure. Multi-age grouping began in the one-room school. In the early years of formal education, it was done out of necessity, due to the lack of teachers and small numbers of students attending school (Lodish, 1992). In recent years, many districts have tried to recapture the multi-age classrooms to provide a variety of developmental benefits (Katz, Evangelou & Hartman, 1990). Although the single grade structure is the most widely used in the United States today, research shows that there is a sound rationale for multi-age grouping in certain grade levels. Current trends in economics, the need for more developmentally appropriate material and decreasing class size are just a few of the reasons for returning to the mixed age grouping.

Multi-age Grouping

In the 19th century, when education moved out of the private home and into the public schools, children were placed in a multi-age, one room, school house educational setting. One teacher would teach a wide range of students and abilities. Students would progress through material on a mastery basis, not according to their age. Groups would be small and individual attention would be prevalent. Students in a mixed setting worked and learned from each other.

These multi-age settings “provide a natural environment in which children can acquire knowledge” (Chase & Doan, 1994, p. 40). Many educators see life as a multi-age experience and feel that the diversity and social interaction increases the want to learn and the ways of learning. “A balanced classroom profile - children differing academically, socially, and ethnically - is the most logical and sensible approach” (Kasten & Clarke, 1993, p. 43).

According to Chase and Doan (1994), the multi-age concept is undergoing a resurgence in popularity in the 1990's. Many districts in the United States are restructuring to include multi-age programs. Some states, like Kentucky and Oregon, have mandated multi-age programs for their primary classrooms.

The multi-age concept is receiving renewed attention because it can often lower class size, increase the number of resources available to each student, and allow educators to move toward a developmentally appropriate educational program (Katz, Evangelou, & Hartman, 1990).

In a study conducted by Dr. G. Rule, it was found that “in general multi-age students scored higher on standardized achievement tests in reading than did single-grade students. Multi-age classes did score significantly higher on vocabulary sections of the reading test administered” (Rule, 1983 p.70). These results suggested to Rule that the comprehension and oral skills of multi-age students were greater than the single-grade students.

Other researchers have also concluded this from their studies. For example, students in multi-age classrooms achieve at a higher level through shared learning and reteaching to classmates. Students take on the role of the learner, as well as the role of the teacher (Katz, Evangelou & Hartman, 1990).

According to a study by the Virginia Education Association and Appalachia Educational Laboratory, multi-age grouping can be both academically and socially beneficial. This was based upon “results from several studies that generally favor the multi-age classroom when

measures of student attitude toward self, school or peers are compared across a range of schools and geographic areas” (Miller, 1990, p.68).

Many researchers argue that multi-age grouping is a natural progression that stimulates elaborate play, promotes interaction with peers, gives children the ability to make choices, develops a sense of responsibility, mirrors life and gives students the ability to model their behaviors after others, (Kasten & Clarke, 1993).

Theilheimer has argued that, even though children experience cognitive conflict when they interact with children of other ages who approach problems differently than they do, this conflict allows the children to model their behavior. This has a positive effect of assisting in the development of appropriate problem solving skills. This approach is child-centered. Students work on skills and activities at their individual rate and receive the needed assistance from peers and teachers (Theilheimer, 1993).

“Piaget and others who describe mixed-aged classroom interactions, state that they stimulate disequilibrium, equilibrium and cognitive growth, especially in the less mature individuals participating in the interactions. In other words, younger children may persist for less time in erroneous thinking,

mis-generalizations, or other developing, but inaccurate hypotheses about the world because of the presence of older or more experienced children. The social support of the group stimulates an environment where disagreement, argument and resistance are all conducive to thinking. These dynamic processes support and encourage children's growth" (Kasten & Clarke, 1993, p. 17).

Kasten and Clarke's findings suggest that young children may spend less time learning unimportant and often incorrect material when they have the social support, group stimulus, and peer interaction provided in a multi-age class setting. The mixed-age grouping provides the support and encouragement needed to make learning occur naturally. "Students develop the confidence that allows them to take risks as learners" (Chase & Doan, 1993, p. 7).

According to Chase and Doan, learning is an individual developmental process. Because all students learn at their own rates and have dissimilar strengths, this intensifies teachers' desire to work with children in a multi-age setting. "The difference is that in a multi-age classroom it is easier to put the emphasis on the children's needs rather than the curricular needs. In a multi-age setting children naturally learn from each other" (Chase & Doan, 1994, p. 8).

Many other countries have adapted the multi-age classroom model to make the learning process more natural. In New Zealand and Australia multi-age models are commonplace, groupings of either two grades, three grades, or the entire age 5-11 spectrum can be found in any one classroom setting (Kasten & Clarke, 1993).

According to Moyer (1992), the multi-age organizational plan does have drawbacks although they can be overcome. Moyer argues that the areas of concern using the multi-age grouping are; getting parents to understand and accept a change in the traditional approach of age segregation, completing and combining curriculum for all students, having adequate time to plan effectively and having a greater range of abilities in one classroom. Because teachers are given a more diverse group for which to plan. This may cause difficulty if additional time for preparation is not permitted.

Of additional concern is the reactions and attitudes of teachers to this approach. In a 1989 study, by the Virginia Educational Association and Appalachia Educational Laboratory (VEA-AEL), teachers were surveyed on their feelings about multi-age instruction. The results showed that; 83% felt it was too demanding to plan for multi-age

activities, 48% felt that they did not have time to master more than one curriculum, 24% said that there was not sufficient time to offer remediation to needy students, 38% believed it was too difficult to schedule for a multi-age day, and 11% felt that it was too difficult to accommodate parents and parent concerns with the multi-age approach (AEL, 1990). The alternative to multi-age grouping is continuing with single age classroom settings.

Single Grade Grouping

Single grade classrooms have become the predominant way educators and parents view education. The single grade grouping, often referred to as the traditional approach, promotes the separation of students by chronological age (Kasten & Clarke, 1993).

According to Goodlan and Anderson (1987), the practice of unit-level grouping did not evolve from any research base. They traced this type of grouping to the Quincy School in Massachusetts, which opened in 1848 with a new plan for school organization. The school predicted their new organization would set trends for fifty years to come.

Looking at education in the United States today, this approach is practiced almost universally. It is economically sound, educates more children for less money and makes monitoring by administrators easier (Katz, Evangelou & Hartman, 1990).

According to a study conducted in 1989, by VEA-AEL, many educators favor the single grade approach. In an age segregated classroom student tracking, teacher planning and lesson preparation is less demanding. Teachers also felt that a decrease in diversity makes it easier to instruct. Competition is lower in a single grade classroom (AEL, 1990).

Students in a single grade classroom who are grouped for instructional purposes tend to spend greater periods of time on academic tasks and have greater improvements in reading scores. Providing students an environment with less diversity and creating groups, either intra (within the class) or inter (between classes) of similar abilities makes learning less threatening and easier for students and teachers (Burns, Roe & Ross, 1988).

According to Raymond (1990), educators find it easier to organize and manage students placed in a graded or age divided school system. The teachers believed this was as a result that most, if not all, their training was provided in the single-grade classroom. Because of this,

educators have the skills that are appropriate for a single-grade classroom approach.

According to Slavin (1987), classroom organization done by age is appropriate and acceptable, but grouping by ability is not. Slavin believes that students need some level of difference and that a single-grade situation offers enough diversity, but does not provide a spectrum that is unmanageable.

The single graded classroom does not take into account how developmental the education process is. "Unit level grading assumes that children grouped within approximately one chronological year of each other will have similar learning needs and abilities, and thus will benefit similarly from instruction" (Kasten & Clark, p. 7). In schooling we deal with human beings and not objects. Learning and development are not mechanized processes, but are ongoing (Kasten & Clark).

Some educators believe that the graded classroom also effects the text book and literature used in the classroom. Alfred Ellison (1972), argues against the reinforcement of the use of graded series of

textbooks, which has become an ingrained educational practice promoted by a single graded classroom. He feels that graded classrooms and graded text books have little justification in research or in philosophy and, in fact, often become stumbling blocks to progress. Curriculum and text book outcomes are used as vehicles for education in a single grade classroom.

In a single grade classroom the range of ability can vary, but the number of students that can provide support is limited. In the single grade situation, the school year is not looked at as a process, but teachers are given outcome standards that stress the importance of the product, not the steps or progress being made.

Single grade grouping does not offer a vast amount of difference. Some researchers feel that single grade grouping in effect “minimizes diversity as diversity in this paradigm is viewed as problematic or less efficient” (Kasten and Clarke, 1993, p.7).

Summary

Many teachers, administrators and parents continue to speculate on the benefits and drawbacks of the single grade and multi-age classroom arrangements. In terms of academic success, the current data clearly support the multi-age classroom as a viable and equally effective organizational alternative to single grade instruction. Areas relating to student attitude toward school, higher achievement, self-concept, social relationships and a sense of belonging and anxiety toward school also significantly favor the multi-age learning environment (Miller, 1990).

The quantitative studies that have been done in the area of multi-age and single grade classrooms primarily focus on the affective dimension of multi-age instruction. Research shows benefits and increased social skills and interaction in a multi-age environment. The social environment for children during their formative years is an important issue.

However, before there is a wholesale switch to multi-age classrooms, more research is needed to explore the best ages or developmental stages in which this approach should be used. Because

we live and work in a non-age segregated society, it only seems reasonable that students should have the opportunity to learn in a more diverse setting. However, in order to ensure that organizational settings are appropriate and child-centered more research is needed. Studies must provide a larger picture of the multi-age classroom and the academic effects on the students, teachers and parents.

Chapter III

Research Design

Purpose

Is there a difference between the academic achievement of kindergarten students in a multi-age and single grade science instruction? Is the impact on knowledge and comprehension significant?

This researcher believes that students in the multi-age group will perform better on knowledge and comprehension skills than the single grade group.

Methodology

The researcher in this study worked collaboratively with a kindergarten and first grade classroom. Students in the morning kindergarten worked in a single grade classroom (Group A). Students in the afternoon classroom worked in a classroom that blended with a neighboring first grade class for multi-age activities (Group B).

Before the study was conducted, the afternoon kindergartners would combine weekly for non-threatening social visits with the first graders to create a level of comfort. After several social meetings, the instructional activities began. The student feedback was very positive.

The researcher could observe that work quality was higher and that there were apparent social benefits to the multi-age grouping, but wanted to see how academically beneficial this multi-age interaction was.

Subjects

In this study, researchers created two groups. Both groups came from Pine Brook Elementary School (Greece, New York). Group A consisted of a single grade heterogeneously grouped kindergarten (N=44, n=20). Students in this group were rank ordered according to ability and then cross matched with some one of the opposite ability (i.e. the top student was partners with the lowest student). Due to illness of more than two days, Group A lost four students (n=16).

Group B consisted of students in an afternoon kindergarten that blended with a neighboring first grade class for multi-age interactions. This sample of students was also heterogeneously grouped (N=44, n=24).

The multi-age classroom was grouped similarly as Group A. The first grade students were ranked from highest to lowest as well as the kindergartners (i.e. The highest first grader was paired with the lowest kindergartner, the highest kindergartner was with the lowest first grader). Group B did not lose any subjects in the study.

Procedure

The researcher created a four day Plant Unit in collaboration with the cooperating kindergarten and first grade teachers. This science topic is in the curriculum for both grade levels.

The researcher taught the Plant Unit to the morning kindergarten as a single grade class and then repeated the same lesson for the multi-age group. The lessons were presented in the same manner and with the same time restraints. During instruction and actual work time students were observed at random by other educators in the classroom. Both groupings were able to ask for assistance and were given the same treatment.

The Plant Unit contained a variety of hands on , oral, and listening activities. It also included one home work assignment. Work was assessed on accuracy, quality and completion. When the Plant Unit was complete, the kindergarten students were individually assessed to see how much of the information could be recalled at the knowledge or comprehension level. First grade students were not assessed for the study. The researcher was focusing on the achievement levels of the kindergarten students only.

The assessment contained three parts. Part one required students to match the word labels to the four major plant parts (stem, leaf, flower and root). The second part asked the students to explain the functions of the four part plants, and the final section required the students to recall the four ways that seeds travel. Each student was assessed individually under the same conditions with no time constraints by the researcher. The researcher then graded the final test and was able to compare the scores.

After the unit was completed, the researcher read the observation sheets that were filled out by other teachers during the course of the weeks lessons. Areas that were of importance on the observation sheet were the amount of active involvement, the amount of conversation, the information offered, the information that was questioned, and the level of difficulty. The researcher also compared the quality of work of the two different groups.

Chapter IV

Analysis of Data

Test Scores Received By Group A and Group B

<u>Group A</u>	<u>Group B</u>
6	2
8	9
12	10
13	11
13	11
13	12
13	13
14	15
14	15
15	16
15	16
15	16
18	18
18	18
19	19
19	19
	19
	19
	19
	20
	20
	20

<u>Group A</u>		<u>Group B</u>
16.00	# of Subjects	22.00
14.06	Mean	15.32
14.00	Median	16.00
13.00	Mode	19.00
3.59	Sx	4.62

Calculated t-score = 0.91

Critical t-score = 2.028

The calculated t-score is less than the critical t-score, therefore we must fail to reject the null hypothesis.

Observational Data

Scoring 0-2, 2 being the highest

<u>Group A</u>	<u>Mean Scores</u>
Are children actively involved?	1.57
Amount of conversation	1.06
Is the K student offering information?	0.85
Is the K student asking questions?	0.94

Comments made by observers:

Need support of teacher, need clarification, slow to start, trouble sharing and delegating jobs, selfish, one child seems to be controlling the activity, too difficult, need to be redirected and confusion.

<u>Group B</u>	<u>Mean Scores</u>
Are children actively involved?	1.72
Amount of conversation	1.46
Is the K student offering information?	1.28
Is the K student asking questions?	1.18

Comments made by observers:

Both actively involved, working cooperatively, sharing roles, on task discussion, splitting jobs, taking turns, supporting each other, and feeling confident.

Chapter V

Conclusion and Implications

Purpose

Is there a difference between the academic achievement of students in a multi-age and single grade science instruction? Is the impact on knowledge and comprehension significant?

Conclusions

The data clearly shows that there is no statistically significant difference in the test scores received. The calculated t -score is less than the critical t -score, therefore we must fail to reject the null hypothesis (calculated $t = 0.91$ and critical $t = 2.028$).

When comparing the test results of Group A and Group B it is apparent that Group B had three students score 100%, and five students who only had one wrong response. Group A had no students score 100%, and only two students that had one wrong response. From this data the researcher can see some positive difference in the scores. Group B had the score distribution farther from the mean. Group A's scores were closer to the mean.

The lowest score obtained in Group A was a 30%. Group B had the lowest scoring student. This student scored a 10%. After completion of this study, this child has been classified learning disabled and is being placed in a special education classroom. Even without counting this anomaly, the change in scores would still not be statistically significant.

When the researcher tallied the observational data sheets, Group B's results showed more partner interaction, a higher level of on task conversation, questions were task related, less teacher support and direction was needed, students worked more independently and cooperatively and there was less confusion for the kindergarten students.

Students in Group B scored higher in all four areas on the observational data sheet. Student involvement was .15 points higher, amount of conversation was .40 points higher, the amount of information offered by kindergarten students was .43 points higher and the number of kindergartners asking questions was .24 points higher. This information provides evidence that the multi-age grouping increases student involvement and lessens the need for extra teacher support. The researcher also felt that the quality of work for the multi-age group was higher than the single grade group. .

Implications

The researcher of this study feels that several factors effected the results obtained. One factor that the researcher feels was an impact was the duration of the study. The four day unit seems to have been too short for appropriate measures to be obtained. The study could have been conducted for a longer time period. The researcher recommends a study that is conducted over at least a month's time.

Student attendance could have also been a factor. The single grade group had four students that missed two or more days, so they could not be counted in the results. Many educators feel that there is a correlation between absences and low achievement. If these students were assessed, their score could have possibly lowered the results of Group A causing a significant difference. The multi-age group had no students left out due to absences.

Regardless of the test results obtained, the researcher believes that multi-age instruction is beneficial. The researcher also feels that if the study duration was increased and more measures were added, the multi-age students would outperform the single grade students. This is supported by numerous studies and conclusions of other researchers in the field. Notably; Chase & Doan, Kasten & Clarke, Moyer, and Rule

discussed in Chapter 2. The multiage setting provides a natural learning environment which mirrors the diversity of society in a logical and sensible way. “In a multiage setting children naturally learn from each other” (Chase & Doan, 1994. p. 8).

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Vita

Margaret Mary Johnson was born in [REDACTED] on [REDACTED], the youngest child of Eugene James Johnson and Julia McGrath Johnson. In January 1993, she received a Bachelors of Art in Psychology and Elementary Education from St. John Fisher College, Rochester, New York. She was selected to participate in the Collaborative Intern Masters Program (CIMP), in cooperation with the SUNY College of Brockport and the Greece Central School District.

Margaret will receive her Masters of Science in Education in August of 1995. She is currently teaching Kindergarten in the Rush-Henrietta School District. Her other interest include the outdoors and being a life long learner and educational risk taker.