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AUTHOR Cardona, Cristina; Artiles, Alfredo J.
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ABSTRACT

This paper reports the findings of a study that assessed the effect of two classwide instructional grouping adaptation strategies on the math performance of English-language Latino learners in an urban public school in the Southwestern United States. An ABAB within-case design was implemented over a 12-week period to contrast the effectiveness of these adaptation strategies on the math performance of 19 low-, average-, and high-achieving first grade Latino students (ages 6-8). All instruction was conducted in Spanish, with the exception of 35 minutes in which students received English-as-a-Second-Language instruction. In Phase A, students worked independently in small heterogeneous groups of 4-5 high-, average-, and low-achieving students. In Phase B, peer tutoring was used following a teacher-led instruction. Dyads included students with different performance levels; students in each dyad alternated roles as tutors and tutees. Student math achievement was assessed for the whole group as well as for distinct performance level subgroups. The results indicated the students' math performance was significantly higher during the peer tutoring phases than when in heterogeneous small groups. (CR)

ADAPTING CLASSWIDE INSTRUCTION FOR STUDENT DIVERSITY IN MATH

Cristina Cardona

University of Alicante, Spain

Alfredo J. Artiles

University of California, Los Angeles

Paper presented at the 1998 Annual Convention of The Council for Exceptional Children Minneapolis, MN

ABSTRACT

This study assessed the impact of two classwide instructional grouping adaptation strategies (heterogeneous small groups v. peer tutoring) on the math performance of English-language Latino learners. An ABAB within-case design was implemented over a 12-week period to contrast the effectiveness of these adaptation strategies on the math performance of 19 low-, average-, and high-achieving first-grade Latino students. Student math achievement was assessed for the whole group as well as for distinct performance level subgroups. The results suggest students' math performance was significantly higher during the peer tutoring phases.

INTRODUCTION

The changing demographics of the student population require that teachers make instructional adaptations to address the diverse needs of their students. Unfortunately, research suggests that although most teachers perceive instructional adaptations as desirable and effective, teachers only perceive as reasonable and feasible those adaptations that require minimal preparation and benefit the whole class (e.g., grouping strategies) (Scott et al., 1998). However, there is little evidence about the effectiveness of such strategies.

We know little about the differential impact of distinct instructional adaptations. Typically, studies include a range of adaptations but little attention has been given to their relative effect on student performance, and specifically, on groups of students with different performance levels. Moreover, few studies have been conducted with linguistic minority students in bilingual programs. This is indeed a critical area of inquiry given the increasingly large population of linguistic minority students who are entering the general education system and who are at risk for school failure. This study was designed to address these limitations.

RESEARCH QUESTIONS

1) What is the effect of two classwide adaptive instructional grouping strategies (heterogeneous small-group v. peer tutoring) on the math performance of first-grade linguistic minority students?

2) Does the impact of these adaptation strategies vary according to the performance levels of first-grade linguistic minority students?

METHOD

Participants and Context

This study was conducted in a transitional bilingual education classroom located in an urban public school in the Southwestern United States. The language classification of participating students was NE (non English speakers). All instruction was conducted in Spanish, with the exception of 35 minutes in which students received English-as-a-Second-Language instruction.

The sample was comprised of 19 Latino first-grade students (6 males and 13 females). Ages ranged from 6 to 8 years old (average = 6.11). All participating students received free lunch. The students in this classroom had the lowest achievement level of the school's six first-grade sections. Five students (26%) were repeating the first grade but no one received special education services.

The school followed a year-round calendar and served a predominantly ethnic minority population (about 50% black and 50% Latino). The classroom was staffed by a certified Spanish bilingual teacher and her assistant. The teacher held a Ph.D. in education and had 22 years of teaching experience in regular, special education, and college programs. She had also worked as a school psychologist. The teacher assistant possessed a high school degree and had 2 years of classroom experience.

Procedures and Design

Student Performance Level. We used the numerical aptitude subtest of the BADYG-B (*Batería de Aptitudes Diferenciales y Generales*) (Yuste, 1984) to group students according to their performance in low, average, and high achieving status. The BADYG-B is a math achievement standardized test developed in Spain. Reportedly, this test is correlated with the WISC's Arithmetic Subtest (r = .48) and with student math grades (r = .54) (KR-21 coefficient = .77; Spearman-Brown = .86) (Yuste, 1984). The numerical aptitude subtest covers the following content: basic quantitative concepts (6 items), addition problems (9 items), subtraction problems (11 items), repeated addition (5 items), grouping (1 item), and object classification (3 items).

Content of Instruction. Student needs were assessed with a curriculum-based test. The test covered several topics from the first grade curriculum. Content validity was assessed by comparing the test with the district's core math curriculum for first grade and the basic math series adopted in the school for this grade level (Burton et al., 1991). The assessment results suggested students had the most significant needs in the areas of numeration and operations. Hence, the instruction implemented during the study focused on these two content areas (see contents in Appendix 1). The selected content was broken down in small sequences to facilitate student learning.

Design. We used an ABAB within-case design. The study was conducted over a period of 12 weeks during math instruction; each phase lasted three weeks. Two grouping strategies were used throughout the study:

Phase A. We implemented heterogeneous small-group instruction during this condition. A lesson typically consisted of a 15-minute lecture in which the instructor explained a concept, demonstrated the sequence of steps needed to solve a problem, and provided examples. For the next 30 minutes, students worked independently in small heterogeneous groups. The groups were comprised of 4-5 high-, average- and low-achieving students. Students used manipulatives and worksheets. Lastly, students took a curriculum-based test which was typically completed in 10-15 minutes and included 12-15 items.

Phase B. The grouping strategy used in this condition was peer tutoring. A typical lesson included a teacher-led segment similar to what was described in phase A. Peer tutoring was used during the subsequent practice segment. Dyads included students with different performance levels. Students in each dyad alternated roles as tutors and tutees and followed a 2/3-step sequence that was printed on cards to complete the math exercises. Similar to phase A, students took a test at the end of the period.

RESULTS

1) What is the effect of two classwide adaptive instructional grouping strategies (heterogeneous small-group v. peer tutoring) on the math performance of first-grade linguistic minority students?

The overall results indicated that student math performance in numeration and operations was higher during the peer tutoring phases (see Figures 1 and 2). The performance in numeration tests was significantly different between phases A1 and B1 ($Z = -3.54$; N = 19; $p < .000$) and between A2 and B2 ($Z = -3.62$; N = 19; $p < .000$). A similar pattern was observed in operations tests between A1 and B1 ($Z = -3.70$; N = 19; $p < .000$) and A2 v. B2 ($Z = -3.82$; N = 19; $p < .000$).

2) Does the impact of these adaptation strategies vary according to the performance levels of first-grade linguistic minority students?

All subgroups obtained significantly higher scores in the math tests during the peer tutoring phases of the study (see Tables 1 and 2). The only exception was the low-achieving group's performance in numeration tests between the phases A2 and B2.

CONCLUSIONS

- It was reasonable and feasible to implement classwide grouping strategies in a bilingual education classroom.

- Heterogeneous small-group instruction and peer tutoring had a positive effect on linguistic minority students' math performance.

- Peer tutoring had a greater impact on students' math performance. This effect was observed on both the whole group and the low-, average-, and high-achieving subgroups.

- Future studies should assess the impact of interventions that combine classwide and individualized adaptation strategies. Such approach can assist educators to address simultaneously the multiple and unique educational needs of diverse students.

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Appendix 1
Instructional Content Selected for the Study

Numeration

- Number identification.
- Representation of given numbers.
- Building numbers to 100.
- Comparing numbers to 100.
- Ordering numbers to 100.
- Finding different combinations for a given number or amount.
- Counting forward and/or backward.
- One-more, two-more, five-more, ten-more.
- One-less, two-less, five-less, ten-less.
- Completing and extending patterns in sequences of numbers.
- More and less.

Operations

- Addition sentences (language, symbols and stories).
- Subtraction sentences (language, symbols and stories).
- Turnaround sentences.
- Finding the addition (one digit, two digits).
- Finding the subtraction (one digit, two digits).
- Same sum, different numbers.
- Same difference, different numbers.

Table 1

Subgroups' Performance in Numeration Tests and Significance of Grouping Strategies

Performance Subgroups	Phases A1 M	Phases B1 M	A1 - B1 *Z*	A1 - B1 *p*	Phases A2 M	Phases B2 M	A2 - B2 *Z*	A2 - B2 *p*
Low (n = 6)	27.87	47.84	- 2.20	.028*	31.85	50.31	- 1.78	.075
Average (n = 7)	61.03	78.94	- 2.02	.043*	66.61	78.48	- 2.20	.028*
High (n = 6)	76.76	90.31	- 2.20	.028*	81.19	94.95	- 2.20	.028*

Wilcoxson Matched-Pairs Signed-Ranks Significance Tests

* .05

** .0001

Table 2

Subgroups' Performance in Operations Tests and Significance of Grouping Strategies

Performance Subgroups	Phases A1 M	Phases B1 M	A1 - B1 *Z*	A1 - B1 *p*	Phases A2 M	Phases B2 M	A2 - B2 *Z*	A2 - B2 *p*
Low (n = 6)	33.00	50.03	- 1.99	.046*	40.63	70.87	- 2.20	.028*
Average (n = 7)	62.46	83.51	- 2.20	.028*	65.14	86.34	- 2.37	.018*
High (n = 6)	74.82	89.75	- 2.20	.028*	71.47	91.85	- 2.20	.028*

Wilcoxson Matched-Pairs Signed-Ranks Significance Tests

* .05

** .0001

Fig. 1. Performance on Numeration Tests for the Whole Group

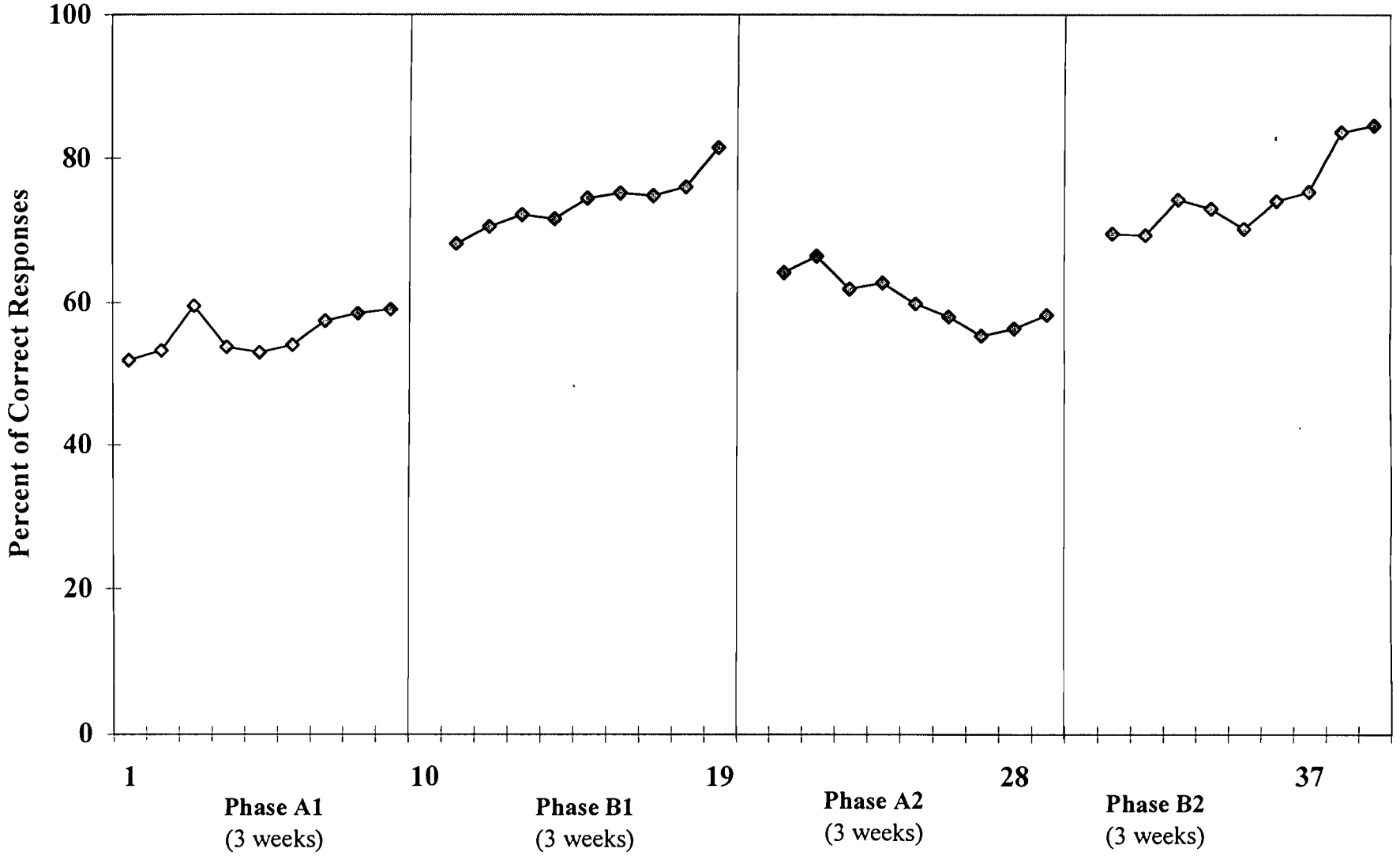


Fig. 2. Performance on Operations Tests for the Whole Group

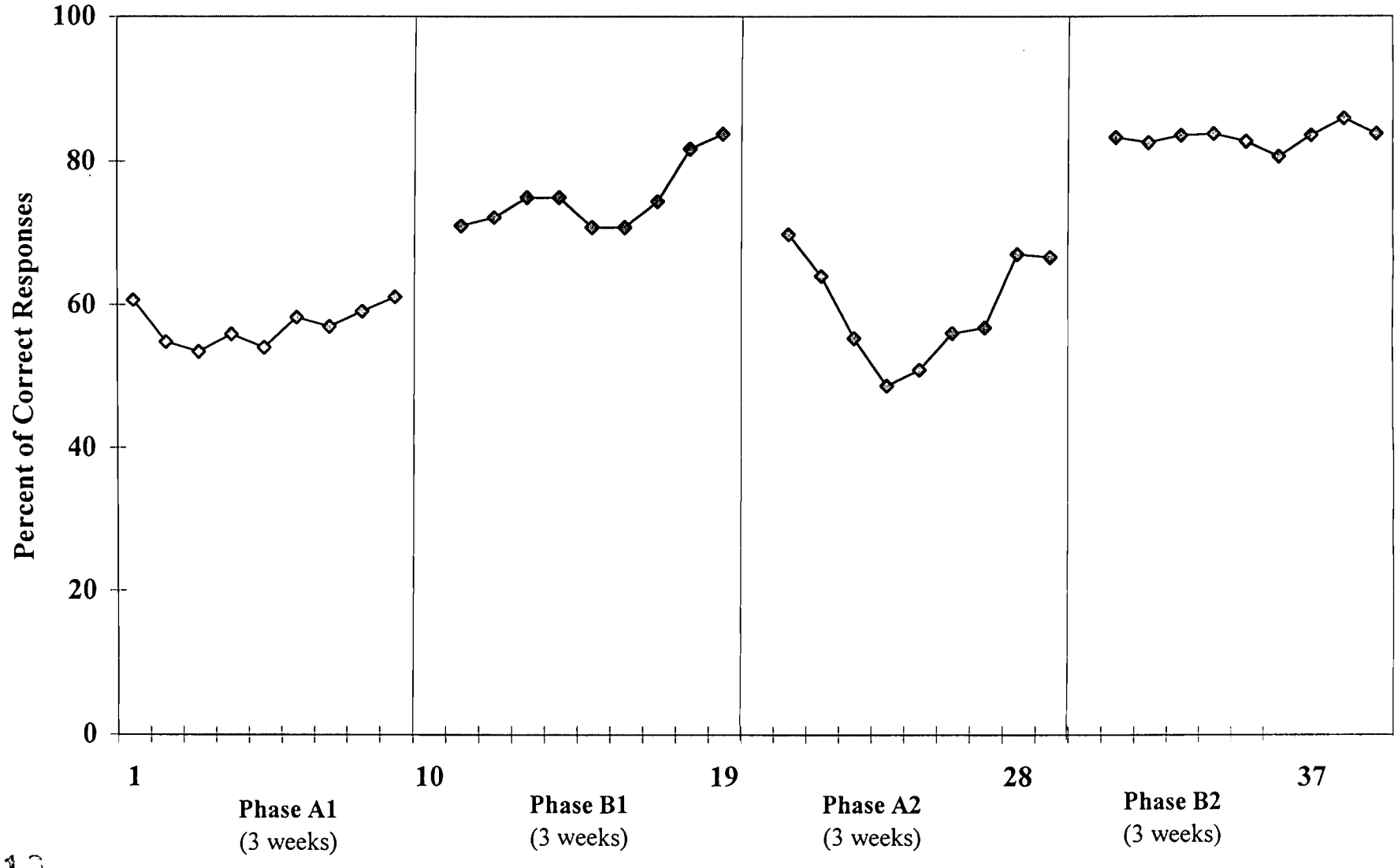


Fig. 3. Performance on Numeration Tests by Achievement Groups

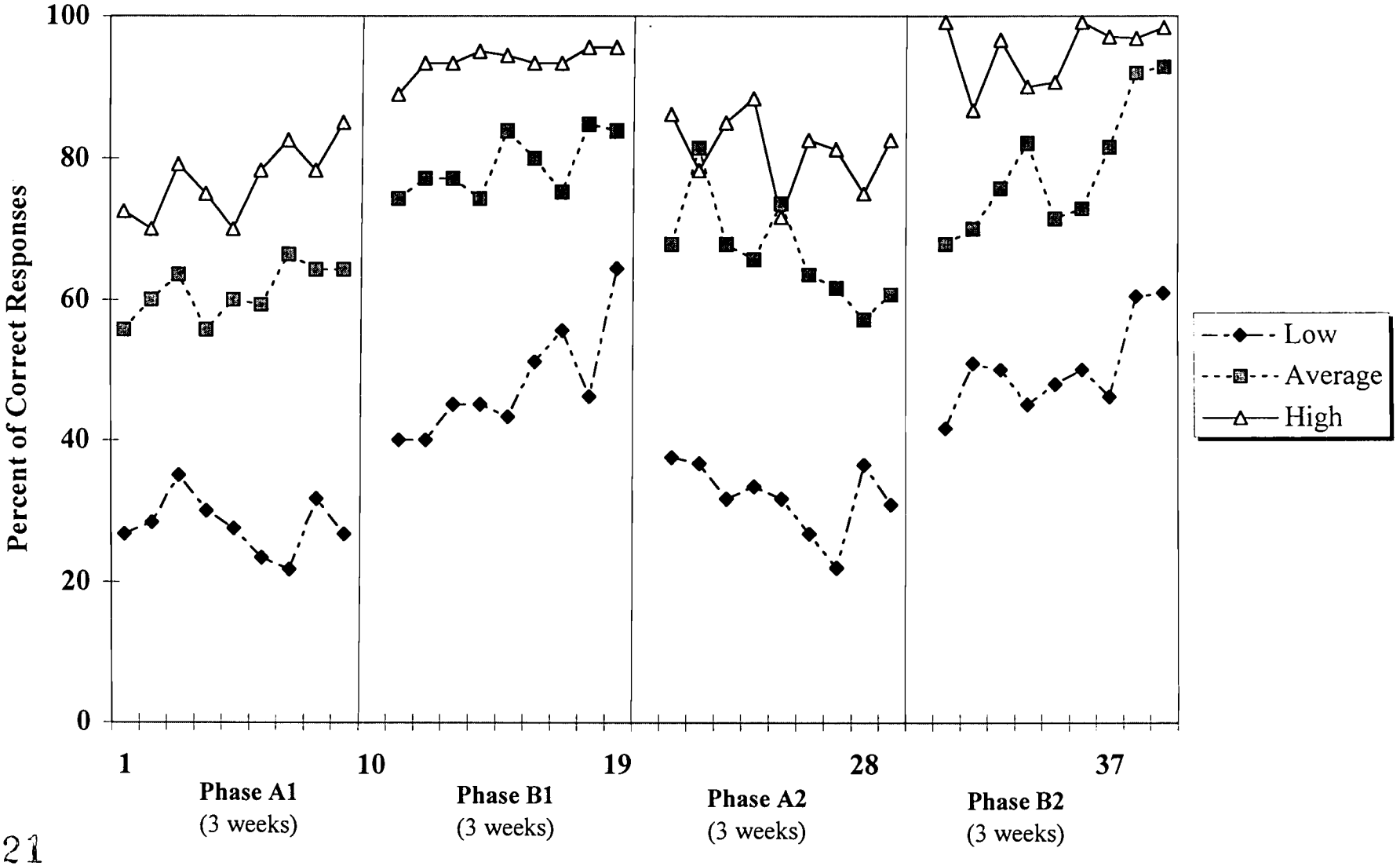
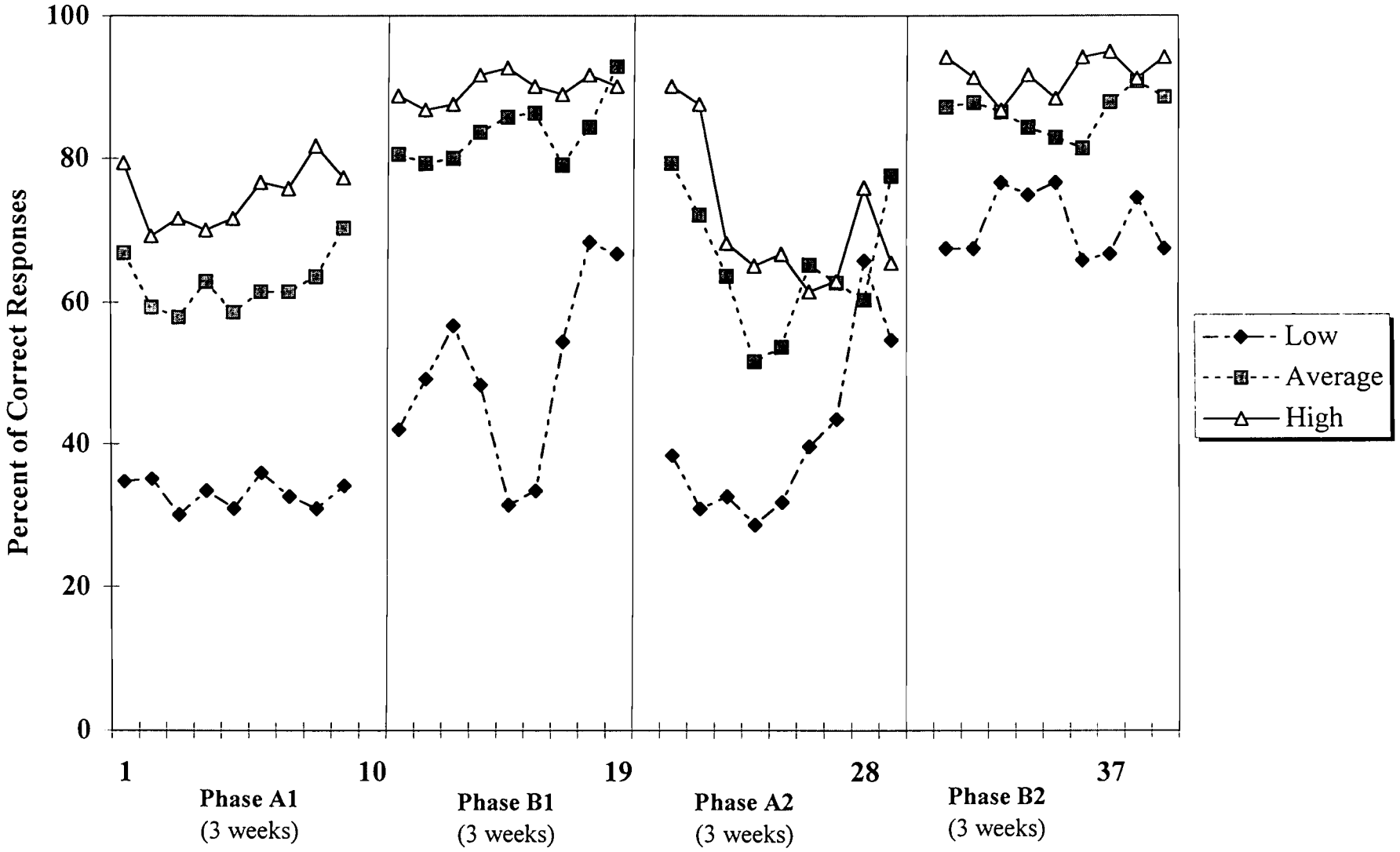


Fig. 4. Performance on Operations Tests by Achievement Groups



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Signature:	Printed Name/Position/Title: M. CRISTINA CARDONA/PROFESSOR/Dr.
Organization/Address: University of Alicante, School of Education P.O. Box, 99 Alicante 03080, Spain	Telephone: 011-34-6-5903960 FAX: 011-34-6-5903990
	E-Mail Address: cristina.cardona@ua.es Date: 09/01/98

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