UNIVERSITY of ST. THOMAS

RIME RESEARCH & ISSUES IN MUSIC EDUCATION
SEPTEMBER 2012 : VOLUME 10 : NO. 1

Composition Instruction and Cogn Performance: Results of a Pilot Stu

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Abstract

The purpose of this study was to evaluate the effects of a composition progra in Public Schools (CiPS), on cognitive skills essential for academic success. Th hypothesis is that composition instruction will promote creative expression an performance on music-specific skills such as music reading, as well as foster analytical/aural skill development associated with vocabulary, arithmetic, and speed abilities. Two sixth-grade classes assigned to the experimental (n = 15 (n = 13) groups completed a series of standardized neuropsychological and c assessments pre and post-instruction. Results of a Repeated Measures ANOV Time) indicate significant (p < .05) enhancements in arithmetic performance group compared to controls. These results suggest that creative experiences notational symbols, sequence creation, and analytical compositional concepts impact student performance in subject areas depending upon analysis and sy manipulation such as arithmetic.

Introduction

Music education programs prepare the mind for learning in many cognitive do Previous research suggests that musical training enhances general cognitive a as spatial temporal reasoning (Hetland, 2000; Rauscher, Levine, Shaw, Wrigh Newcomb, 1997; Rauscher & Zupan, 2000), verbal memory performance (Ho Chan, 2003; Rickard, Vasquez, Murphy, Gill, & Toukhsati, 2010) and executiv (Bugos, Perlstein, McCrae, Brophy, & Bedenbaugh, 2007). In addition, cogniti enhanced through music education programs impact learning and achievemer academic subject areas. Musicians score higher on standardized math and rea achievement assessments compared to non-musicians (Fitzpatrick, 2006; Joh Memmott, 2006). Research supports a relationship between musical training understanding of numerical concepts (Gardiner, 2008). Evidence from neuroi show cortical links between areas of activation associated with musical trainin mathematical computation, suggesting potential overlap between learning an systems (Schmithorst & Holland, 2004). The purpose of the present study wa the effects of music training in composition instruction on music reading, proc vocabulary performance, verbal fluency, and arithmetic computation.

While this body of research suggests connections both anatomically and beha between musical training and cognitive abilities, results of other studies revea contradictory findings. Bahar and Christiansen (2000) found enhanced mathe performance by music students in conditions where mathematical tasks conta structure as those in music. If the task was not structured similarly, no signifi difference in performance was found. Results of a longitudinal study examinin of piano instruction on arithmetic performance in fourth-grade students found enhancements (Costa-Giomi, 2004). It is also unclear as to whether those e music programs innately demonstrate higher academic achievement or if mus capacity to enhance other learning domains. For instance, a comparison of ac achievement and mathematical achievement among high school students witl credits compared to students without music credits reveal no significant differ academic achievement (Cox & Stephens, 2006).

Despite this research, little is known as to what specific musical activities hav potential to prepare the mind for learning. It is widely acknowledged that inst training produces many general benefits. Instrumental music instruction is co treated as a foreign language in the school curriculum of some countries such where all elementary students are provided two years of instruction on an ens instrument (McPherson, 2005). While instrumental training is valuable, musi such as composition may also foster general cognitive development. Composi instruction requires complex integration of a spiral curriculum of musical knov skills, and instrumental skills. Few articles detail transfer effects of compositio to other cognitive domains; however, research in clinical populations suggests composition instruction has the capacity to enhance self-concept (Colwell, Da Schroeder, 2005). The present study investigated the effects of a compositior areas associated with academic performance in middle school students. The rationale is that any project-based composition program that incorporates cre collaborative composition and compositional teaching practices with technolo comprehensive musicianship has the capacity to engage multiple learning dor hypothesize that a novel composition program that incorporates critical thinki theory and musical performance could enhance areas associated with general such as vocabulary, arithmetic performance, and processing speed.

Composition instruction is an important part of the music education curriculur opportunities to foster creativity and nurture musicianship skills. Even though is a natural part of music education and included in the National Standards fo Education in the United States, many music educators in the U.S. report usin infrequently in the classroom (Strand, 2006). One reason for reported infrequ composition by music educators stems from a lack of familiarity and knowled compositional teaching practices. Many additional challenges such as competi goals, teaching loads, class size, and technology limitations are cited as limiti opportunities for composition activities. Research in other countries reports si For instance, results of another study conducted in Slovenian elementary sch that educators may not be aware of strategies to teach composition and impr (Rozman, 2009). Due to the 2002 counter-reform in Spain, music education i was restricted to instruction that included declarative knowledge and lacked i authentic music skills such as performing or composing (Rusinek, 2007). Ma educators in Spain are reluctant to include student-centered pedagogies such composition (Rusinek, 2007). A key challenge is to develop new composition include learning opportunities related to compositional teaching practices, mi

technology requirements, and comprehensive musicianship skills. The purpos
present study was to examine the effects of a novel composition program, Co
Public Schools, on skills necessary for academic success.

Frequently, the focus of activities in a music classroom is on replication of exp
performance rather than generation (Csikszentmihalyi & Custodero, 2002). W
performance is essential in developing and refining musicianship skills, compo
not take away from this goal. Rather, composition instruction further contribu
aural and intellectual development of a musician. Research suggests that part
generative musical activities fosters creativity, critical thinking, and aesthetic
(Barrett, 2006). While much is known about the intrinsic benefits (i.e. overal
creative thinking, and problem solving) of engaging in compositional activities
known about the cognitive benefits related to engagement in compositional a
the best approaches for teaching composition in classroom.

Composition Pedagogy

Many music educators understand that composition instruction during the ele
middle school years encompasses social and cultural contexts (Barrett, 2006)
of "creative collaboration" is especially important in a learning environment. C
composition instruction incorporates revision and spontaneous sharing of idea
the creative process (Webster, 2003). According to Webster three main varia
necessary to facilitate group composition, those variables include: work envir
project experience, and peer scaffolding (2003). These variables can also be
Csikszentmihalyi's concept of flow and optimal experience (1975). According
research examining the impact of flow on creativity, a learning environment w
sense of worry of failure, clear project goals, and instant feedback combined
and skill provide a sense of flow (Bryne, 2006). A sense of flow involves atter
concentration important for teaching and learning. Focused concentration on
specific subject matter in which instruction offers some challenges and inform
to gain skills necessary to complete challenging tasks may have the capacity
other learning domains (Bugos et al., 2007).

In addition to the context for creative musical activities, research provides
recommendations for structuring compositional activities. Prior research in co
shows that children illustrate unique characteristics in their approach to comp
tasks based upon choices such as range (Kratus, 1989; Kratus, 1994; Kratus,
other pedagogical recommendations from the literature suggest providing stru
meaningful prompts such as phrases or motives, access to materials such as
pitches or rhythmic values, and opportunities that involve action-based projec
2006; Webster, 2003).

The Composers in Public Schools (CiPS) program, a novel composition progra
encourages a collaborative creative environment through a focused progressiv
curriculum with project-based goals that emphasize skill development and pro
comprehensive musicianship. The CiPS program incorporates all of these peda
practices in a curriculum that has the capacity to be implemented in a variety
educational settings and grade levels. The goal of the present study was to ex
effects of Composers in Public Schools on cognitive and academic performanc
grade students. We hypothesized that participation in the Composers in Publi

(CiPS) program enhances performance in music reading, processing speed, v
performance, verbal fluency, and arithmetic computation for the experimenta
compared to controls who do not receive CiPS instruction.

Methodology

Participants

Participants consisted of one sixth-grade general music class and one sixth-gı
education class assigned to experimental (*n* = 15; mean age 11.20 years) an
groups (*n* = 13; mean age 11.23 years) respectively. All participants were as
enrolled in music and physical education coursework for one semester in a ro
system or "wheel" system. Students not enrolled in music or physical educati
first semester were assigned music or physical education courses the second
testing for this project occurred during the first semester. Classes were taugh
school with 38% free and reduced lunch status in the Southeastern United St
for research participation in either group consisted of no prior history of forma
instruction (private or studio instruction), not currently enrolled in band or or
not currently engaged in music reading. Informed written consent from paren
from participants was obtained in compliance with the guidelines established
University Institutional Review Board (IRB) and the County School Board.

Procedure

Participants completed a short questionnaire regarding demographic informat
previous musical experience. All students participated in two group-administe
testing and post-testing sessions. Cognitive assessments were administered d
school day in two class periods (40 minutes each). Only members of the expe
group received the CiPS program. Members of the control group did not partic
music courses. All post-testing was administered upon the completion of the f
CiPS program. Only students who returned completed parent consent and cor
assent forms participated in testing in accordance with Institutional Review Bo
All testing was held in a quiet classroom, testing environment.

Description of Assessments

Intermediate Measures of Music Audiation (IMMA; Gordon, 1986): measures
by responses to determine if melodic phrases are the same or different. This
music aptitude provides tonal and rhythmic composite scores based upon aur
consist of 30 paired melodic phrases. The IMMA was chosen for its reliability (
content validity.

Music Reading Assessment (MRA; Bugos & Groner, 2009): measures music re
treble and bass clef as well as knowledge of basic musical symbols. The MRA
information regarding domain-specific learning in music reading.

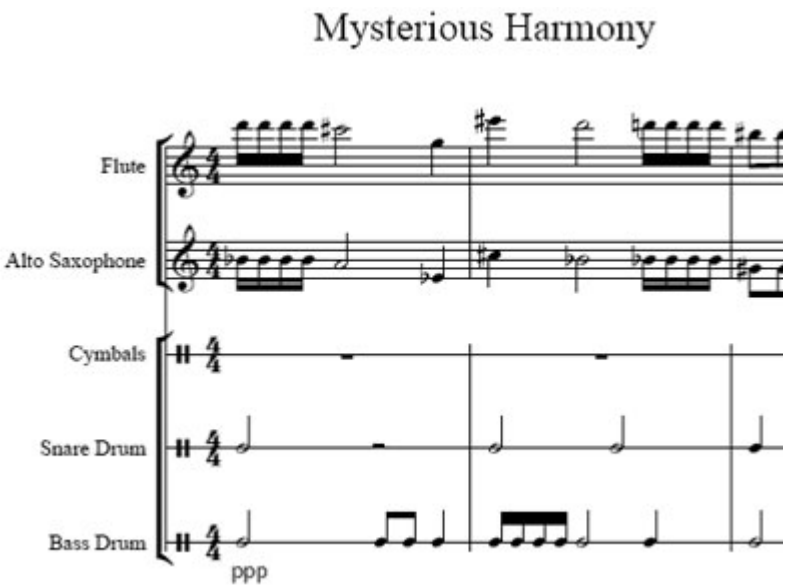
Delis-Kaplan Executive Function System (D-KEFS; Delis, Kaplan, & Kramer, 2
Modified Verbal Fluency subtest: Each 60-second trial consists of including as
that begin with specific letters of the alphabet. Words selected could not be n
people, places, or numbers. Form 1 was used for pre-testing, and Form 2 was
-testing to remove potential practice effects.

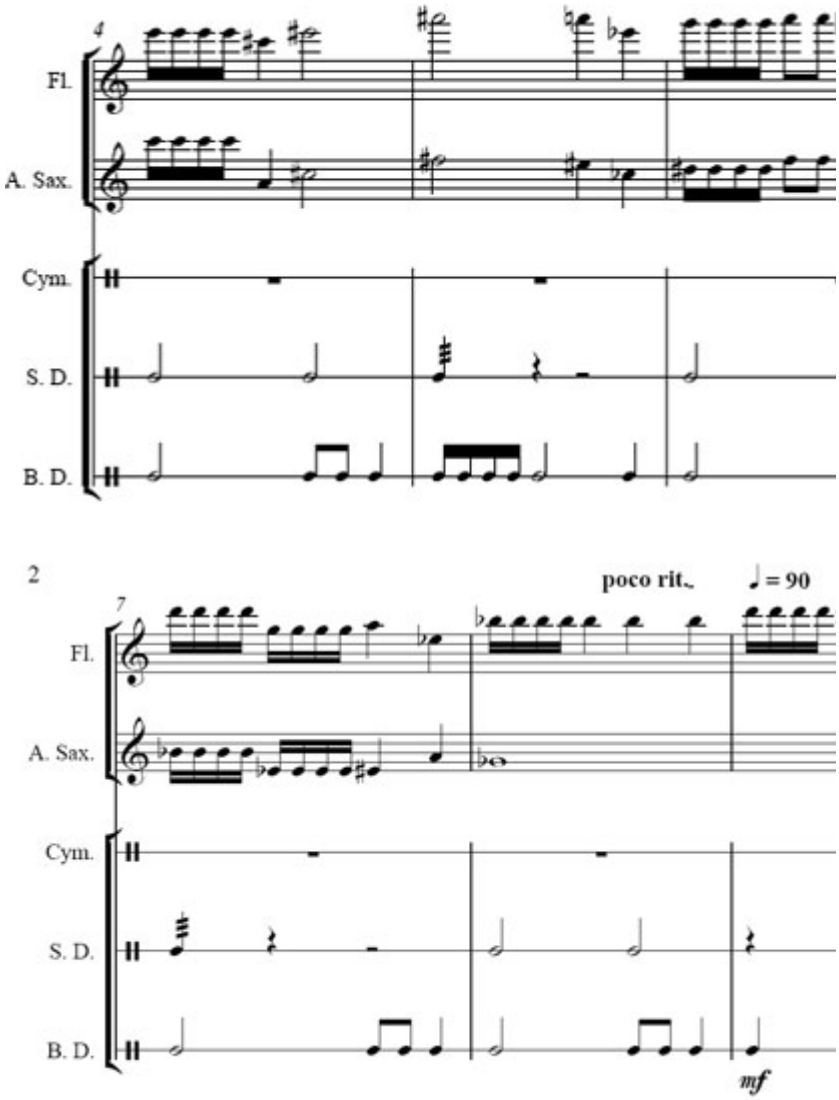
Group Modified Wechsler Intelligence Scale for Children IV (WISC-IV; Wechsl
modified version for group assessment included the *Vocabulary, Arithmetic, S
Search*, and *Coding* subtests. Group modification of each subtest consisted of
administration and aural script of vocabulary words. The *Vocabulary* subtest i
providing a definition of specific words. The *Arithmetic* subtest required formu
calculations including basic addition, subtraction and multiplication. The *Symb*
subtest comprised of a visual scanning task for symbols matched to a target i
time limit of two minutes. The *Digit Coding* subtest evaluated planning, visual
processing speed in a paper pencil completion task. Symbols given in a code
numeric stimuli were to be placed in the box below corresponding numbers. S
Dumont (2004) examined the reliability of the WISC-IV and report reliability
of .94 (Verbal Comprehension), .92 (Perceptual Reasoning), .92 (Working Me
(Processing Speed) and .97 (Full Scale Intelligence Quotient). Internal consist
WISC-IV ranges from .79 – .90, and internal consistency is lowest for 6 year
highest for 12-, 15-, and 16-year-olds (Sattler & Dumont, 2004).

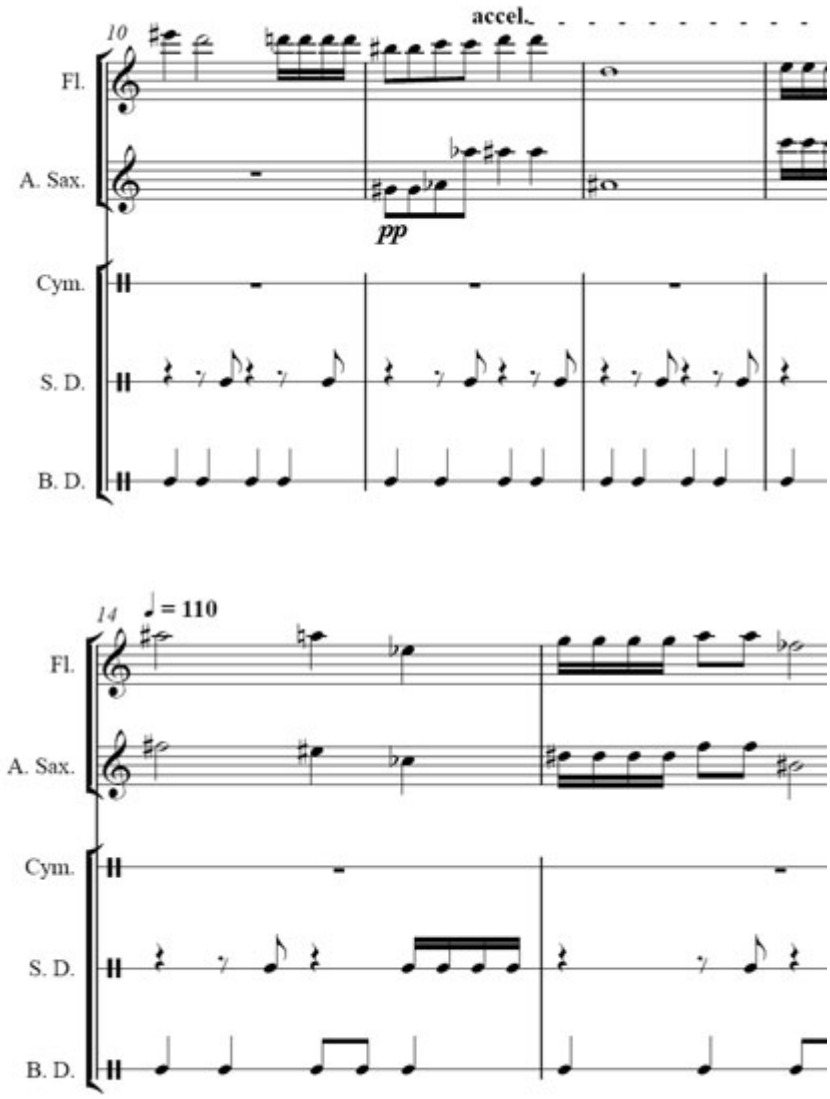
Composers in Public Schools (CiPS) Program

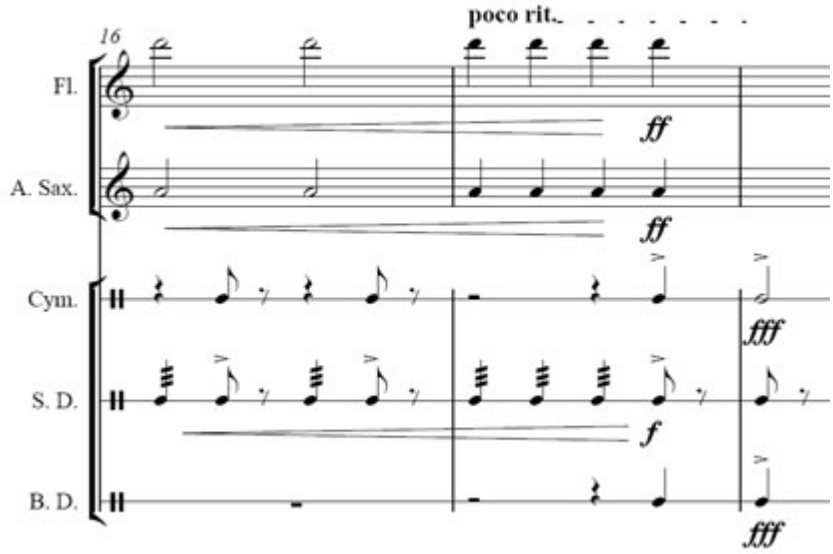
The Composers in Public Schools program provides opportunities for students
music while learning specific compositional and stylistic concepts. Each unit o
consists of various compositional experiences integrated with technology. Ind
lessons focus upon clear project goals. Lessons include composing for a "virtu
percussion pieces, vocal and instrumental blues pieces, recorder and ensembl
well as vocal compositions. Students participate in discussions regarding com
techniques such as sequence and retrograde, followed by group creation of m
such tools and techniques (Figure 1). Demonstrations of concepts and active
in learning compositional concepts serve to promote a sense of ownership. Op
for performances and discussion about performances are fostered through ins

Figure 1. An example of a completed piece titled, "Mysterious Harmony," for
percussion




4
Fl.
A. Sax.
Cym.
S. D.
B. D.
2
poco rit.
♩ = 90
7
Fl.
A. Sax.
Cym.
S. D.
B. D.
mf


10
accel.
Fl.
A. Sax.
pp
Cym.
S. D.
B. D.
14
♩ = 110
Fl.
A. Sax.
Cym.
S. D.
B. D.



Implementation of the CiPS program included four-months of weekly composi instruction administered by a university professor of composition and highly t graduate composition students. Graduate composition students were trained i curricular content of the program, required to observe instruction, and meet r the professor to discuss program performance. The middle school music educ school provided basic rhythmic notational instruction to students and backgro information about composers prior to the integration of the CiPS program and music classes on compositional skills addressed by the composer. Each compo correlated to previous learning established by the music educator. The music systematically incorporated compositional skills taught by composers in conju prior-developed lessons to ensure compliance with state and national standar

Data Analysis

Independent samples *t*-tests were used to examine potential group difference demographic variables. All other data were analyzed using separate 2-Group (Experimental, Control) X Time (Pre-test, Post-test) analyses of variance (AN group as a between-subjects factor and time as within subjects factor over ea independent cognitive domain of verbal fluency, vocabulary, arithmetic, and p speed. A group by time interaction indicates a differential response to training effect size coefficients (*d*) are reported upon for significant group X time inter (1992). Interpretation of effect size of .2 to .3 is considered a small effect, .5 medium effect, and .8+ is considered a large effect (Cohen, 1992).

Results

Results of a *t*-test on age and music aptitude show no significant differences b groups (Table 1). Results of a Group (Experiment, Control) X Time (Pre-test, ANOVA on the Music Reading Assessment (MRA) indicate no significant ($p < .$ differences between groups, $F(1,26) = .002$, $p = .96$. No main effects were fo

Table 1.

Demographic Table with Means (SD)

	Experimental Group (*n* = 15)	Control Group (*n* = 13)	*t*	*p*
Male/Female	7/8	7/6		
Age	11.20 (.41)	11.23 (.73)	-0.14	0.89
MRA Pre-Test	18.13 (24.54)	19.85 (19.55)	-0.20	0.84
MRA Post-Test	19.33 (21.42)	21.23 (19.76)	-0.24	0.81
IMMA Tonal All	34.4 (2.0)	33.2 (2.1)	1.50	0.14
IMMA Rhythmic All	33.5 (2.3)	34.0 (2.8)	-0.56	0.58

*Note: MRA, Music Reading Test; IMMA, Intermediate Measures of Music Aud

Results of a Group (Experimental, Control) X Time (Pre-test, Post-test) ANOV *Arithmetic* subtest scores revealed significantly enhanced performance for the group compared to controls, $F(1, 26) = 6.64$, $p = .02$ (Table 2).

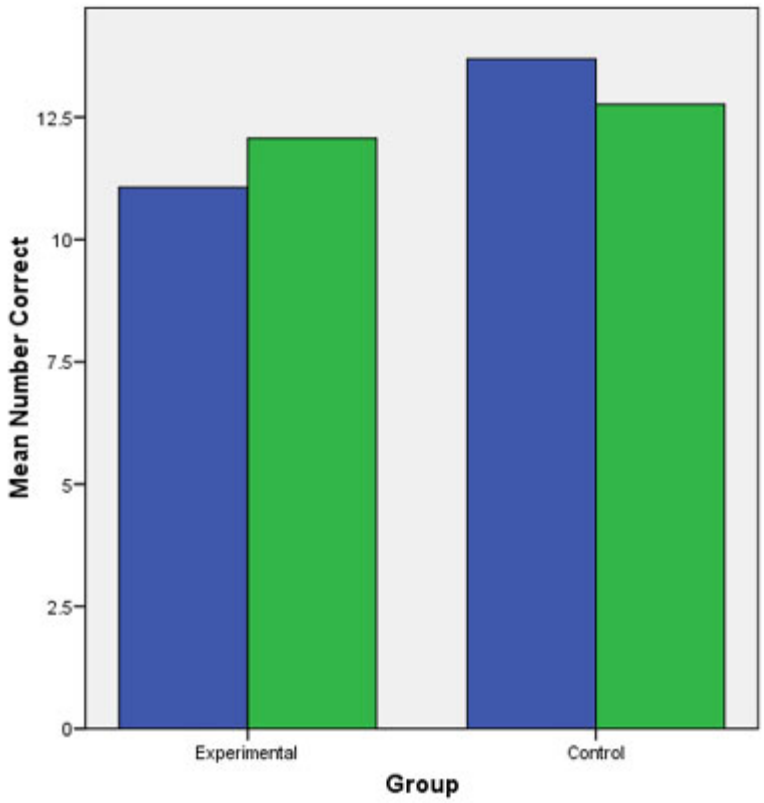
Table 2.

Means (SD) of Repeated Measures

Measures	Experimental Group (*n* = 15)	Control Group (*n* = 13)
Total Correct Verbal Fluency Pre-Test	23.47 (6.26)	26.08 (7.81)
Total Correct Verbal Fluency Post-Test	27.53 (8.18)	27.69 (8.31)
Digit Coding Pre-Test	42.60 (12.41)	54.46 (17.19)
Digit Coding Post-Test	53.40 (11.33)	55.08 (9.09)
Symbol Search Pre-Test	28.93 (8.49)	28.77 (6.61)
Symbol Search Post-Test	32.73 (7.38)	31.08 (11.01)
Vocabulary Pre-Test	19.07 (8.89)	22.54 (6.58)
Vocabulary Post-Test	20.33 (8.99)	24.85 (7.01)
Arithmetic Pre-Test	11.07 (1.53)	13.69 (3.09)
Arithmetic Post-Test	12.07 (2.12)	12.77 (2.71)

No main effect for time was found, $F(1, 26) = .01$; $p = .92$. We further exami size associated with the performance on the *Arithmetic* subtest. Cohen's (*d*) e calculated based upon means and standard deviations between the performar experimental and control group (1992). According to Cohen's coefficient, our small effect ($d = .33$) for group differences on the *Arithmetic* subtest (Figure

Figure 2. Arithmetic Subtest Results for Experimental and Control Groups



A series of Group (Experimental, Control) X Time (Pre-test, Post-test) ANOVA conducted for the *Verbal Fluency, Vocabulary, Digit Coding,* and *Symbol Sear* (Table 2). No significant group interactions were found for *Verbal Fluency*, *F*(1 *p* = .32; *Vocabulary*, *F*(1,26) = .37, *p* = .55; *Digit Coding*, *F*(1,26) = 2.80, *p* *Symbol Search*, *F*(1, 26) = .29, *p* = .59 subtests. Main effects for time were f *Verbal Fluency*, *F*(1,26) = 5.42, *p* = .03; *Vocabulary*, *F*(1,26) = 4.34, *p* = .05 *Search*, *F*(1,26) = 4.89, *p* = .04 subtests only.

Discussion

Our original hypothesis was that participation in the Composers in Public Scho program would enhance performance in music reading, processing speed, voc performance, verbal fluency, and arithmetic computation. Results show impro arithmetic scores, but not in other cognitive measures. While scores on meas place demands on processing speed such as the *Digit Coding* and *Symbol Sea* reveal enhancements, due to a relatively large variance in scores, these enha were not significant.

Our data indicate enhancements in arithmetic performance resulting from par the Composers in Public Schools (CiPS) program. As shown in Figure 2, the e group demonstrated a 23.7% increase in arithmetic performance on a 34-iter subtest, while the control group did not show such a pattern as a function of t the *Arithmetic* subtest contains high reliability of .94 (Ryan, Glass, & Bartels, repeat administration and the time between pre/post-testing was just over fo

the increase in scores by the experimental group can not adequately be expla practice effects. These data are consistent with previous findings investigating of music instruction on standardized English and math assessments (Johnson 2006). We hypothesize that some concepts/skills reinforced in the CiPS progr music reading (decoding), sequencing and pattern recognition may have cont experimental group's success on the *Arithmetic* subtest.

Our overall results are consistent with previous data regarding the relationshi music and mathematics. Results of a metanalysis indicate modest support for relationship between music and mathematical abilities (Vaughn, 2000). Furth the relationship between music and mathematics is necessary. Since the field mathematics includes examining quantity, structure, space, and change, this investigated the effects of a novel composition program on arithmetic perform part of the field of mathematics. Further research is necessary to examine po relationships between skills learned in music instruction related to abstraction reasoning and those skills employed in algebra, geometry, or analysis.

We found no significant differences between groups with regard to music read performance. Students performed similarly on music reading skills as measur *Music Reading Assessment* (MRA; Bugos & Groner, 2009) at both time points was surprising, since the middle school general music instructor and the Com Public Schools program included instruction on music notation and reading sk program engaged students in a variety of musical experiences including perfo creating, notating, and evaluating music. While the program was comprehens and practice with notational skills was not required. It may be necessary to pr opportunities for practice with music notation (i.e. assignments and drills) in demonstrate enhancements in this area.

Our data reveal no significant differences with regard to verbal fluency and vo performance. We originally hypothesized that composition instruction would in vocabulary due to the introduction of new vocabulary describing patterns and however, vocabulary knowledge did not transfer to items on the standardized While we observed an increase in verbal fluency performance by the experime the variance among these scores was high. Further research is necessary to e effects of composition instruction on vocabulary and verbal fluency performar

Composition programs such as the CiPS focus on a large array of skills. This s some insight into areas most sensitive to compositional programs. We found s increases in arithmetic performance, an area similar to composition as it nece analytical skills and relies upon sequence. In addition to the intrinsic benefits education, knowledge of musical structure through composition may have the enhance cognitive abilities essential to academic success.

Limitations and Potential Explanations

One limitation of the current research design was the usage of relatively intac Students with formal musical training were the only group disqualified from re participation. Students with experience in band, orchestra, private lessons, ar currently reading music were disqualified. Due to exclusionary criteria, a relat sample size was employed in this research design. However, without exclusio we would not be able to isolate the independent variable in composition instru

In addition, while demographic variables were collected on students and all st attended the same community school, no specific data were collected on indiv students regarding socioeconomic status. In addition, composition lessons in program focused primarily on western musical styles. More research is necess examine outcomes of the CiPS method of composition using non-western mus This information would be helpful in the design of future composition-based p

Implications for Music Educators

The results of this research add to the preponderance of evidence suggesting training has the capacity to prepare the mind for learning in certain subject a education programs should not be justified or evaluated by potential external participation in music programs provides intrinsic benefits and fosters aesthet A comprehensive music education encourages creativity and critical thinking s most importantly, can broaden and enrich a child's life. Composition, an impo comprehensive music education, promotes creativity and communication in a environment.

Our findings show increases in arithmetic abilities as a result of a group-base composition program, Composers in Public Schools. Project-based compositio that incorporate creative collaborative composition and compositional teachin with technology and comprehensive musicianship have the capacity to engag learning domains and provide an optimal learning experience. Students gain a accomplishment by implementing concepts and skills recently acquired into th compositions. Student compositions serve as an assessment tool and an oppo experiment with new ideas. For instance, Figure 2 illustrates the students' kn complementary rhythmic patterns between wind and percussion parts. Experi new ideas can only occur in a learning community that values contributions b structure of the Composers in Public Schools program offered a supportive en which ideas are discussed. Decision-making and critical thinking opportunities students to reflect on concepts and serve to establish a learning community (2003; Collins, 2005). Research on child development stresses that intellectua is related to a child's learning environment (Crncec, Wilson, & Prior, 2006). M educators should strive to foster a community of learners through a cooperati experimental learning environment that embraces creativity.

Acknowledgements

We would like to thank Pitt County Public Schools, Robin Loy, Jenny Causey, I Elizabeth Smart, Amanda Avery, and Mike Arny for their assistance in this res thanks to John Dull, Josh Dearing, Christian Loebs, and Michiko Theurer for as CiPS instruction.

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