Arts-Based Education in Pre-School Children – An Exploratory Study

Prof. Dr. Christiane Kiese-Himmel, Psychologist
Clinical Communication Sciences (Head)
University Medical Center, Georg-August-University Göttingen
Waldweg 37, D-37073 Göttingen, Germany.

Dr. Claudia Witte, Biologist
Department of Medical Psychology and Medical Sociology
University Medical Center, Georg-August-University Göttingen
Waldweg 37, D-37073 Göttingen, Germany.

Dr. Shariful Islam, Mathematician
Department of Medical Psychology and Medical Sociology
University Medical Center, Georg-August-University Göttingen
Waldweg 37, D-37073 Göttingen, Germany.

Prof. Dr. Nicole von Steinbüchel, Psychologist
Department of Medical Psychology and Medical Sociology (Head)
University Medical Center, Georg-August-University Göttingen
Waldweg 37, D-37073 Göttingen, Germany.

Abstract

This comparative exploratory study aimed to assess the effectiveness of an arts-based educational approach on spatial measures (visual, tactile) and graphomotor performance in pre-school children. We used a quasi-experimental control group pre-/ post-test-design to investigate 27 children receiving arts-based education for 1.5 hours weekly over a period of 10 months. Controls were 37 children without arts-based education. All children significantly improved their performance in the outcome test measures, on average, but no significant group differences were found. Therefore, the improvements found should be considered as an overall developmental impact instead of a training effect.

Key Words: Arts-based education, visual arts, drawing, developmental pedagogy, pre-school children, prevention

1. Introduction

An unimpaired progress of cognitive abilities and graphomotor skills (a set of cognitive, perceptual and motor capacities which enables to draw or to write with a pen) is a prerequisite for young children's development, preventing failure to learn and attaining success in school. These abilities are not solely biologically based and dependent upon the maturation, but are also formed by different perceptual and fine-motor experiences derived from environmental stimulation (e.g. playing, singing, drawing). In this context, the ability of visual-motor integration has to be mentioned, i.e. the ability to accurately integrate fine-motor skills and (visual-) spatial perception (Case-Smith et al., 1998). Studies using the 'Developmental Test of Visual Perception-2' (DTVP-2; Hammill, Pearson, & Voress, 1993) to assess visual perceptual skills (like eye-hand coordination, figure-ground perception, perception of form constancy; perception of position in space, and spatial relationships), or using the 'visual-spatial perception subtest' of the 'Developmental Test of Visual-Motor Integration ' (VMI; Beery, 1989) to assess underlying abilities of handwriting, an essential visual-motor skill, found significant correlations between these test performances and school adjustment (Bart, Hajami, & Bar-Haim, 2007).

The same applies to subsequent improvement in academic achievement, such as reading, maths and spelling (Kulp, 1999; Pieters, Desoete, Roeyers, Vanderswalmen, & van Waelvelde, 2012), the ability to copy letter forms, and handwriting (Tseng & Cermak, 1993; Weil & Cunningham Amundson, 1994; Cornhill & Case-Smith, 1996; Tseng & Chow, 2000; Daly, Kelley, & Krauss, 2003).

Children considered to be at risk for learning disabilities and school failure as well as children in need of additional support due to specific problems related either to the visual sense and/or to fine-motor skills provide further proof of an association between perceptual-motor skills and learning outcomes (Jongmans, Smits-Engelsman, & Schoemaker, 2003; Iversen, Berg, Ellertsen, & Tønnessen, 2005; Westendorp, Hartman, Houwen, Smith, & Visscher, 2011). There is some empirical evidence that perceptual-motor approaches offer ways to help to remediate these problems and support learning in general. Thus, school children receiving paediatric occupational therapy services, such as sensorimotor based interventions like sensory integrative therapy or cognitive-perceptive training, improve their visual perceptual skills, eye-hand coordination, in-hand manipulation, their ability to copy geometric forms (Case-Smith, 1994; Weil & Cunningham Amundson, 1994), and their tactile-kinaesthetic perception (Cornhill & Case-Smith, 1996; Tseng & Chow, 2000). Hence, the question arises whether an alternative intervention approach, i.e. an arts-based education, may also be effective to enhance perceptual and graphomotor skills. It is known that arts play a fundamental role in human development and in young children’s experiences (Sousa, 2006; Pramling Samuelsson, Asplund Carlsson, Olsson, Pramling, & Wallerstedt, 2009). Arts-based education is a broad area with several domains (e.g. music, dance, poetry). In the current study we will focus on visual arts in connection with fine-motor skills.

A central aim of visual arts is to promote sensory perception, learning and to enhance the cognitive resources in young children (Epstein & Trimis, 2002). Wood (1977) investigated school children receiving directed arts activities and found an increased performance using the above mentioned outcome measure Frostig’s DTVP after 8 weeks of arts education. A positive relationship between arts participation and academic achievement in reading and writing was found in many studies (e.g. Willett, 1992; Alejandro, 1994; Gardiner, Fox, Knowles, & Jeffrey, 1996; Catterall, 1998). Although these effects are thought to be rather limited (Eisner, 1998), arts education is highly valued by the elementary school community for its intrinsic and instrumental contributions to academic achievements (Gibson & Larson, 2007). Meanwhile several visual arts education programmes exist (e.g. Stationery Office of the Government of Ireland, 1999; Braun & Wardelmann, 2009; The Government of Manitoba, 2011). Empirical data on the effect of arts education on specific abilities such as space visualization or visual-motor integration skills in pre-school children are rather scarce.

Since Germany is one of the primary European countries for migrants (Bundesamt für Migration und Flüchtlinge, 2014) the number of children with migrant backgrounds attending German pre-schools and schools is increasing continuously. ‘Migrant background’ in Germany is a proxy for children and their families coming to Germany from another country with the intention of living here - not only with another language but also with another culture and different social characteristics. Children with migrant background predominantly grow up with a language other than German. Often these children are disadvantaged with respect to school enrolment and academic achievements, especially due to poor language performance (Diefenbach, 2004; Stanat, 2006; Dubowy, Ebert, von Maurice, & Weinert, 2008; Kiese-Himmel, Auberlen, & von Steinbüchel, 2012; Kiese-Himmel, Witte, & von Steinbüchel, 2013). But as previously said, other factors like perception and perceptual-motor integration skills might also hinder success in school.

Focus of the Present Study

To our knowledge, this is the first study including children from both migrant and non-migrant backgrounds to investigate whether an early, mostly entirely language-independent arts-based education enhances their ability in spatial tasks (visual and tactile) and graphomotor performance. We suppose an advantage in these skills for children receiving arts-based education in comparison with children who do not receive such specific education while attending pre-school.

2. Method

2.1. Study background

The present study is part of an ongoing prospective longitudinal research project. The project was approved by the local ethics committee of the University Medical Center, Göttingen (Germany).

The aim is to provide evidence of the potential effectiveness of music or arts-based education, including activities children generally enjoy, especially to promote their cognitive, linguistic, perceptual, motor, behavioural, communicative, and social development.

Eight pre-schools catering for a demographically diverse population of the urban areas of Frankfurt/Main and Darmstadt (Germany) were willing to participate after a publicity campaign and an information event (presentation of our research study in the presence of the head of the pre-school, the teachers and parents).The pre-schools did not participate in further research projects or any special music or art training programs beyond the normal daily activities. Each pre-school was assigned pseudo randomly to one of the three groups (arts, music and controls). In order to match the sample sizes for each group we had to include two pre-schools with music education, three pre-schools with arts education and three pre-schools as control group.

Whereas the curriculum-based music education ('music group') included vocal singing, singing songs, listening to music, music making, tasks in tone duration, rhythm, pitch, melody, and instrumental exercises, the curriculum-based arts education ('arts group') was related to visual- and tactile-spatial skills (for more details, see the section on arts-based education). Professionally trained music teachers and arts teachers were specifically hired for this project and assigned to the music group and to the arts group, respectively. Children in the control group participated only in the usual daily activities in pre-school. An average pre-school day consists of a morning circle with singing, playing with rhymes, and learning about the days of the week, seasons etc. When the weather was fine, the children were allowed to play freely outside. When the weather was bad, special activities, such as painting with water colours, seasonal handcrafts, cooking or baking, gymnastics, reading, and projects about nature were offered inside, or the children played freely either in the group room or in a special play area with costumes etc.

The measurement instruments include inter alia seven standardized tests at each test point (pre-test at T1, representing the baseline before music or arts-based education started; T2 = post-test). Individual testing by psychological assistants (trained in the administering of the tests) as well as the music or arts-based education in groups took place in a separate quiet room in the pre-school. The entire testing took several sessions distributed over several days. Breaks between tests were provided if required.

We hypothesized that if music or arts-based education affects post-test outcomes on any test, then the differences between children with specific education (music or art) on that test should be greater than for the controls without such additional specific education. Possible retest effects are minimized due to the large number of measurement instruments and the lengthy test interval of 8 to 12 month between pre- and post-tests.

2.2. Procedure

The data we present were drawn from the arts-based education group and from the controls-with two points of testing (T1, T2) for a defined subset of outcome measures (for more details, see the section on measurement tools). T1 (pre-test), before the initiation of the arts-based education, was followed by T2 on an average of 10 months later (arts group: mean 10.3 [SD=1.2], controls: mean 9.95 [SD=1.1] months). There was no significant difference between both groups with regard to the elapsed time between T1 and T2 ($p=.22$; $T=-1.24$).

2.3. Participants

All parents gave their informed consent for their children's participation. Participants were typically-developing pre-school children (with and without migrant background) aged between three and five yrs with an average intelligence (assessed with the Kaufman Assessment Battery for Children, K-ABC; Melchers & Preuß, 2009), and had attended at least six months in pre-school before the individual testing. Twenty-seven children (mean age: 53.89 [SD=9.76] months; 3 yrs: n=10, 4 yrs: n=9, 5 yrs: n=8) received arts-based education (mean number of sessions: 36.41 [SD=3.29]), while 37 control children (mean age: 55.97 [SD=8.72] months; 3 yrs: n=7, 4 yrs: n=17, 5 yrs: n=13) received no specific education (Table 1). Comparability of both groups was controlled with respect to mean chronological age at T1 ($p=.373$; $t=.898$), duration of pre-school attendance till T1 ($p=.265$; $t=1.124$), country of birth ($p=.397$, $t=.852$), mother's education level ($p=.762$; $z= -.303$) and child's fine-motor skills ($p=.664$; $t=.463$) (assessed with the subtest *Lernbär* [Learning Bear] of the Vienna Developmental Test, WET; Kastner-Koller & Deimann, 2002). The WET–Subtest *Lernbär* comprises four items (the child is asked to do up a button and a belt, and to make a knot and tie a bow).

Table 1. Descriptive data of the study groups.

	Arts group n	Arts group (%)	Control group n	Control group (%)
Migration background				
yes	19	(70.4)	28	(75.7)
no	8	(29.6)	9	(24.3)
Gender				
males	10	(37.0)	15	(40.5)
females	17	(63.0)	22	(59.5)
Language families				
Indo-European	16	(59.3)	22	(59.5)
Altaic	4	(14.8)	5	(13.5)
Afro-Asiatic	2	(7.4)	5	(13.5)
Austro-Asiatic	2	(7.4)	0	(0.0)
Sino-Tibetan	0	(0.0)	3	(8.1)
Dravidian	0	(0.0)	1	(2.7)
Tai-Kadai	0	(0.0)	1	(2.7)
Niger-Congo	3	(11.1)	0	(0.0)
Mother's education level[1]				
First skill level (primary education)	1	(3.8)	2	(5.6)
Second skill level (secondary education)	8	(30.8)	12	(33.3)
Third skill level (tertiary education, no university)	11	(42.3)	14	(38.9)
Fourth skill level (tertiary education, university or equivalent)	6	(23.1)	8	(22.2)
Chronological age at T1 (M [SD]) in months	53.89 (9.76) min 38 max 71		55.97 (8.72) min 38 max 70	
Pre-school attendance till T1 (M [SD]) in months	20.19 (9.29) min 6 max 36		22.68 (8.34) min 6 max 37	
Education sessions[2] (M [SD])	36.41 (3.29) min 31 max 41		-	

Note: T1 – test time point before arts-based education; n=group size; M=Mean; SD=Standard Deviation; min=minimum; max=maximum
[1]Four skill levels according to ISCO-08 (source: ILO - International Labour Organization).
[2]Sessions of arts-based education between the first (T1) and the second test time point (T2).

2.4. Arts-based Education

This specialist education emphasized the development of visual- and tactile-spatial performance as well as fine-motor skills, especially graphomotor ones, on several components such as lines, points, angles, geometric forms, letters forms, patterns, and contours. Children were encouraged to explore and to experiment with colours, shapes, sizes and textures following an education curriculum (developed by the Institute of Art Education at the Goethe University in Frankfurt/Main, Germany) using main elements of the well-developed child training program for pre-schools 'Von Piccolo bis Picasso' (Braun & Wardelmann, 2009). In a step by step approach, children practised visual discrimination of forms and shapes, shape recognition, visual-motor reproduction, proportionality, tactile perception, pictorial symbol function, and pictorial representation.

A variety of materials were used, such as [coloured] pencils, crayons, markers, watercolours, plasticine, clays, textiles, dough, [shredded] paper, wallpaper, and paperboard. Multiple techniques for creating visual arts were introduced, such as finger painting, body tracing and painting, mixing colours, drawing spontaneously, copying drawings, contour drawing, constructing, making collages, prints, sculpting and modelling amongst others emphasizing the development of perceptual-spatial skills. Training included skills demonstration and skills teaching. The curriculum comprises interrelated activities.

The group-based arts education was provided twice a week by two arts teachers at each pre-school for 1.5 hours in total (2 sessions of 45 min each). Group size ranged between 7 and 12 children. Arts teachers had completed a ten-semester study program of arts education graduating with a university state examination and were very experienced in working with young children (more than 10 years of professional experience).

2.5. Measurement Tools

We selected four measures from three standardized tests to assess the effects of arts-based education. The skills that they examine are contained in arts-based education:

2.5.1. The WET–Subtest *Nachzeichnen* [Copying] of the Vienna Developmental Test (Wiener Entwicklungstest – WET, Kastner-Koller & Deimann, 2002)

This subtest refers to the individual ability of visual perception, spatial visualization, and visual-motor coordination. The child is asked to copy geometric forms with increasing difficulty. Raw scores range between 0 and 10 with higher scores indicating better performance. Psychometric properties of the subtest, e.g. reliability (.78) and factorial validity (.77 for factor visual-motor/visual perception) met the requirements as it is mentioned in the WET-manual.

2.5.2. The WET–Subtest *Bilderlotto* [Picture Bingo]

This subtest measures the perception of spatial relations between different details on a picture. The child gets a picture and is asked to match it to the identical picture in a row of similar ones. The level of difficulty, i.e. the number of details, increases systematically. Raw scores between 0 (no matches found) and 24 (all matches found) can be achieved. Psychometric properties for this task are empirically supported and reported in the WET-manual (reliability: .89; factorial validity: .4 for factor visual-motor/visual perception and .54 for factor cognitive development).

2.5.3. The subtest *Räumliche Beziehungen* [Spatial Relations] of the German version of the Developmental Test of Visual Perception, 2nd ed. (Frostigs Entwicklungstest der visuellen Wahrnehmung-2 – FEW-2; Büttner et al., 2008)

The–subtest ‘Spatial Relations’ measures the child’s visual-motor integration ability. The child is asked to reproduce a given template by connecting dots accurately to form given shapes or patterns. The complexity of the templates increases systematically. Raw scores range between 0 and 34 with higher scores indicating better performances. Psychometric properties for the subtest are described in the manual as meeting the requirements (retest reliability: .87; factorial validity of the subtest: .61 for factor motor-reduced visual perception).

2.5.4. The subtest *Graphästhesie* [Graphesthesia] of the Göttinger Entwicklungstest der Taktil-Kinästhetischen Wahrnehmung (TAKIWA; Developmental Test of Tactile-Kinaesthetic Perception, Kiese-Himmel, 2003)

TAKIWA–subtest ‘Graphesthesia’ measures tactile-spatial perception and integration of sensory input from the body (with eyes closed). The child is asked to point to the same geometric figure on a multiple-choice picture map (four different figures), which the examiner had previously drawn on his or her hand using a cotton bud. Raw scores ranged between 0 and 10 with higher scores indicating better performances. Psychometric properties are provided in the manual (split-half reliability of the whole test: .84; mean factorial validity of the subtest: .52 for factor tactile-visual integration).

2.6. Data Analysis

Frequencies, measures of central tendency and standard deviations were calculated for the children’s test scores. Each test variable was screened for normal distribution before adopting statistical methods. According to the Shapiro-Wilk Test for normality, the paired t-tests were used for normally distributed and the Wilcoxon Signed Rank Test for nonparametric data. Differences between T1 and T2 in each group were analysed with the unpaired t-test if the data were normally distributed; otherwise the nonparametric Mann-Whitney-U-Test was used.

The significance level was chosen to be 0.05. Bonferroni correction was used to reduce the chances of obtaining false-positive results (adjusted α: .0125). A further analysis was conducted using Cohen's effect size d (incl. 95 % confidence interval = CI) to measure the sizes of differences. A d-value > 0.2 is considered as a small effect, > 0.5 represents a moderate and > 0.8 a large effect. Moreover, T1-T2 differences for all four test measures were analysed by using a multivariate analysis of covariance (MANCOVA) with group (control/art), gender (male/female) and migration background (migrant/non-migrant) as independent variables and mean age (T1-T2) as covariate.

3. Results

Differences at T1 between arts and control group are not statistically significant in the test measures with alpha-adjusting (WET–Copying: p=.111, t=1.628; WET–Picture Bingo: p=.154, Z=-1.424; FEW-2–Spatial Relations: p=.034, Z=-2.119), except for one (TAKIWA-Graphesthesia: p=.003, Z=-2.943). Overall there was a trend for lower baseline performances in children attending arts-based education to a later point of time which was not intended, but resulted by chance.

Means and standard deviations at pre- and post-test and tests of significance are presented in Table 2. Mean rates of improvement between T1 and T2 were found for both the arts group and the control group, in all pre- to post-test raw scores. Cohen's d indicated moderate to large effects for most post-tests in the arts group, especially in TAKIWA-Graphesthesia (d=0.87). In FEW-2-Spatial Relations d was 0.39; the 95 %-CI spanned zero, which indicates that it is uncertain whether there was an effect. The standard deviation from pre- to post-test results had obviously increased with the outcome of a reduced d. The results were similar for the control group although the developmental gain in test performance was greater in two subtests (WET-Picture Bingo; FEW-2-Spatial Relations) compared to the arts group.

We did not find any statistically significant difference between the two groups for all four tests. Both groups made more or less the same progress from T1 to T2. For example, while the arts group improved in WET-Copying from 4.67 to 6.11 (mean difference: 1.44), the control group improved accordingly from 5.62 to 6.47 (mean difference: 0.85). In WET-Picture Bingo progress was from 13.15 to 16.93 (mean difference: 3.78) in the arts group and from 16.08 to 19.42 (mean difference: 3.34) in the control group. In brief, there were neither group nor time differences empirically verifiable.

Table 2. Descriptive and statistical data of children's performances at pre- (T1) and post-test (T2) in raw scores*; T1-T2 differences and mean effect sizes with 95% confidence interval (CI).

		WET–Copying	WET–Picture Bingo	FEW-2–Spatial Relations	TAKIWA–Graphesthesia
Control group	**T1: M (SD)**	5.62* (1.77) median 6	16.08* (4.54) median 17	11.31 (9.23) median 11	5.84 (2.48) median 6
	T2: M (SD)	6.47 (1.78) median 7	19.42 (4.73) median 21	15.89* (8.34) median 16	7.20 (1.88) median 7
	p Test-statistic	.00 Z=-2.59 n=36	.00 Z=-4.13 n=36	.00 Z=3.29 n=35	.01 Z=-2.52 n=35
	d (95 %-CI)	0.49 (0.02-0.96)	0.73 (0.25-1.21)	0.53 (0.05-1.01)	0.63 (0.15-1.11)
Arts group	**T1: M (SD)**	4.67* (2.65) median 5	13.15 (7.70) median 12	7.15 (9.28) median 3	4.19* (2.04) median 4
	T2: M (SD)	6.11* (1.67) median 6	16.93 (5.15) median 17	11.00 (10.56) median 8	6.19* (2.63) median 7
	p Test-statistic	.00 t=-3.48 n=27	.00 Z=-3.45 n=27	.00 Z=-2.73 n=27	.00 t=-5.41 n=27
	d (95 %-CI)	0.66 (0.11-1.21)	0.59 (0.05-1.13)	0.39 (-0.15-0.93)	0.87 (0.31-1.43)
Control vs. Arts group (T1-T2 differences)	**p Test-statistic**	0.375 Z=-.89 n=63	0.673 t=-.42 n=63	0.483 t=.71 n=62	0.203 t=-1.29 n=62
	d	0.33	0.11	-0.18	0.34

Note: M=Mean; SD=Standard Deviation; d=Cohen's d
*****Normally distributed outcome variables.
Adjusted significance level: .0125
Raw score range: WET–Copying: 0-10; WET–Picture Bingo: 0-24; FEW-2–Spatial Relations: 0-34; TAKIWA–Graphesthesia: 0-10

Although the mean differences between the groups were not significant, we studied more closely the factors that may have influenced the differences between control and arts group (Figure 1). A multivariate analysis of covariance revealed no main effect of group (control/art). No interaction effect occurred between group, gender and migrant background and the four test performances (Table 3). By introducing mean age (T1-T2) as covariate we controlled for age-dependent effects. Mean age indeed affected the performance in WET-Copying ($F(8.54)=11.96$, $p < .00$).

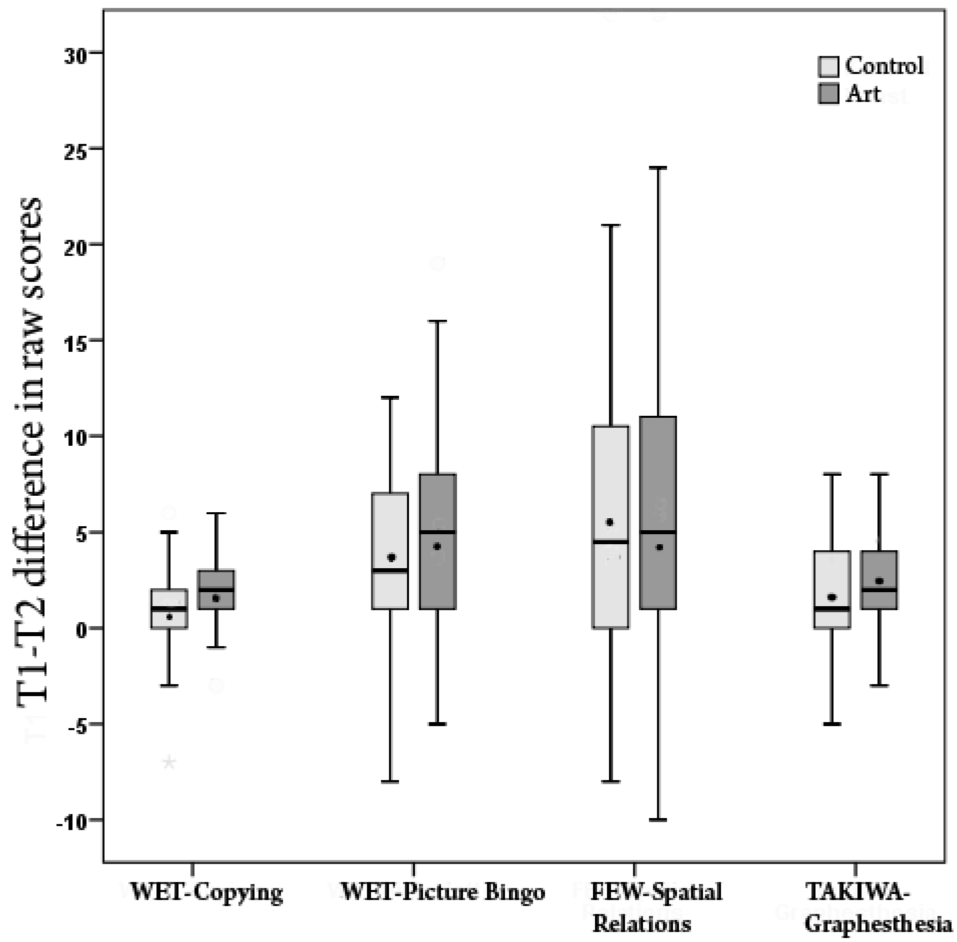

Figure Caption:

Figure 1. Difference between the two test points T1 and T2 (raw scores) for perceptual-spatial and graphic-motor test performances. Differences are displayed as box plots with median (solid line), mean (points), the 25^{th} and 75^{th} percentile (lower and upper end of the box, respectively) and the 5^{th} and 95^{th} percentile (lower and upper whiskers, respectively) for both groups (control group in light grey and arts group in dark grey).

Note that, although T1-T2 differences (mean and median) appear to be greater in the arts group compared with the control group in three of the four tests, no difference reaches significance.

Table 3. MANCOVA results among T1-T2 differences in - and tactile-spatial and graphomotor test performances with respect to group (control group/arts group), gender (male/female), migration background (migrant/non-migrant) and mean age (T1-T2 in months).

T1-T2 Differences	Factor	Test statistic F	p
WET–Copying	Group	.72	.40
	Gender	.00	.99
	Migration background	.01	.91
	Group x Gender	.17	.68
	Group x Migration background	.11	.74
	Mean age	11.96	.00
WET–Picture Bingo	Group	.00	.99
	Gender	.00	.96
	Migration background	.55	.46
	Group x Gender	.28	.60
	Group x Migration background	.42	.52
	Mean age	3.34	.07
FEW-2–Spatial Relations	Group	.17	.68
	Gender	.69	.41
	Migration background	.00	.95
	Group x Gender	.35	.56
	Group x Migration background	.33	.57
	Mean age	.36	.55
TAKIWA–Graphesthesia	Group	.80	.38
	Gender	.17	.68
	Migration background	.07	.79
	Group x Gender	1.55	.22
	Group x Migration background	.02	.89
	Mean age	.64	.43

Degrees of freedom: WET-Copying & WET-Picture Bingo: F(8.54), FEW-2-Spatial Relations & TAKIWA-Graphesthesia: F(8.53)

4. Discussion

Arts-based education is a field of developmental learning for a child in pre-school. It is based on visual, visual-spatial and tangible components which are realized in building, drawing, painting, modelling, sculpting and similar activities requiring perceptual and fine-motor skills. Such abilities are associated with the acquisition of academic skills like reading, spelling, writing or mathematics (Kulp, 1999; Pieters et al., 2012). There is some evidence that arts-based education may have an effect on perceptual-motor learning as described in the introduction (Kulp, 1999; Pieters et al., 2012), which is beyond the intrinsic values of the arts themselves.

We evaluated the effectiveness of an arts-based education in group sessions on defined visual- and tactile-spatial as well as graphomotor performance in pre-school children aged from 3 to 6 years. To demonstrate a link between arts-based education and perceptual-motor development, the children receiving the intervention should score higher in the post-test measures. That is exactly what has occurred; all valid and reliable test measures showed a statistically significant improvement. Especially an increase in the TAKIWA-subtest ‘Graphesthesia’ was observed. The performance of the control group showed a similar significant improvement compared with the arts group. More importantly, when looking at differences between the groups, contrary to our initial hypotheses, the progress in the test measures was not significantly different. Although there was a basic difference on the comparison measures among the groups (the raw score differences between T1 and T2 were slightly larger in the arts group except for the FEW-2-subtest ‘Spatial Relations’) the findings offer little support for the use of arts-based education to improve the selected perceptual-motor abilities. Therefore, the improvements found should be considered as an overall developmental impact instead of a training effect till a replication of the present study will be conducted.

In this connection it should be mentioned that meta-analytic studies, e.g. by Haanstra (1996), detected no overall significant effect of arts education on visual-spatial abilities, but demonstrated training effects in children between the ages of 4 to 6 years suggesting an important role of the actual developmental state. Such young children are in the first half of the pre-operational phase in Piagetian terms and generally they cannot read or write.

Several reasons why this approach did not achieve better effects for the arts group compared to the controls are worth mentioning. *First*, arts-based education contains a broad, more general concept, eclectic in origin and not very specific. This could have prevented a measurable effect. *Second*, an arts-based education may be more successful in younger children, e.g. below 3 years old**.** The children of our sample were three to five years old. *Third*, perhaps it makes sense to teach children only according to their weaknesses. In future, the children’s skills should be precisely analysed in detail before starting an individual arts educational approach. *Fourth*, it may also be that children with good innate abilities in the visual arts who prefer arts will become motivated and would do better with an arts-based program, but we did not check it before assignment to the intervention. *Fifth*, the trained abilities tend to reach a developmental plateau before entering school and will further improve in the course of schooling. Consequently, it may be worth investigating the effects at school-age and adding a further test point (T3). *Sixth*, perhaps the arts-based education sessions (twice a week, overall 1.5 hours) were inadequate and insufficiently intensive, and therefore not strongly distinguishable from the general play situations or free play time in pre-school.

Till now, the study question was not investigated in a sample comprising children with migrant background although there are no reasons why such children should gain more by participating in arts-based education for developing spatial and motor skills than monolingual growing up children. In future research we should work with several control groups adding more or even other developmental measures (e.g. criterion measures), or nonverbal intelligence measures, because visual-spatial tests often load strongly on the general fluid intelligence factor and spatial ability reasoning may be understand as a kind of fluid intelligence. Until more research is conducted to prove the arts-based education approach in pre-school children, we have to conclude that this approach did not substantially enhance visual-motor and spatial abilities. Consequently, at present we think a good all-round pre-school experience is the best way for children with migrant background to develop the skills needed for a successful schooling.

Acknowledgments

This work was supported by the Niedersächsisches Institut für Frühkindliche Bildung und Entwicklung under Grant (nifbe FP17-09; Hannover, Germany), Albert and Barbara von Metzler Stiftung under Grant (1348840; Frankfurt/Main, Germany), Gemeinnützigen Hertie Stiftung under Grant (1.00.1/07/006 H; Frankfurt/Main, Germany), and Adolf Messer Stiftung under Grant (1351110; Bad Soden, Germany).

We are grateful to the children and parents who participated in the study as well as to the psychological assistants for helping to test the children.

References

Alejandro, A. (1994). Like happy dreams--Integrating visual arts, writing, and reading. *Language Arts*, 71(1), 12-21.

Barnes, R. (2002). *Teaching art to young children 4-9* (2nd ed.). London: RoutledgeFalmer.

Bart, O., Hajami, D., & Bar-Haim, Y. (2007). Predicting school adjustment from motor abilities in kindergarten. *Infant and Child Development*, *16*(6), 597-615.

Beery, K.E. (1989). *The Developmental Test of Visual-Motor Integration* (3rd ed.). Cleveland: Modern Curriculum Press.

Braun, D., & Wardelmann, B. (eds.). (2009). *Von Piccolo bis Picasso.* Offensive Bildung. Berlin: Cornelsen.

Bundesamt für Migration und Flüchtlinge (2014). *Migrationsbericht 2012.* Zentrale Ergebnisse. http://www.bamf.de/SharedDocs/Anlagen/DE/Publikationen/Migrationsberichte/migrationsbericht-2012.pdf?__blob=publicationFile. Last Accessed: 24.01.2014

Büttner, G., Dacheneder, W., Schneider, W., & Weyer, K. (2008). *FEW-2: Frostigs Entwicklungstest der visuellen Wahrnehmung-2; deutsche Fassung des Developmental test of Visual Perception, (DTVP-2) von D.D. Hammill, N.A. Pearson & J.K. Voress; Manual*. Göttingen: Hogrefe.

Case-Smith, J. (1994). Fine motor outcomes in preschool children who receive occupational therapy services. *The American Journal of Occupational Therapy,* 50(1), 52-61.

Case-Smith, J., Heaphy, T., Marr, D., Galvin, B., Koch, V., Ellis, M.G., & Perez, I. (1998). Fine motor and functional performance outcomes in preschool children. *American Journal of Occupational Therapy*, *52*(10), 788-796.

Catterall, J.S. (1998). Involvement in the arts and success in secondary school. *Americans for the Arts Monographs*, *1*(9), 1-10.

Cornhill, H., & Case-Smith, J. (1996). Factors that relate to good and poor handwriting. *American Journal of Occupational Therapy*, *50*(9), 732-739.

Daly, C.J., Kelley, G.T., & Krauss, A. (2003). Relationship between visual-motor integration and handwriting skills of children in kindergarten: A modified replication study. *American Journal of Occupational Therapy*, *57*(4), 459-462.

Diefenbach, H. (2004). Bildungschancen und Bildungsmisserfolg von ausländischen Schülern oder Schülern aus Migrantenfamilien im System schulischer Bildung. In R. Becker & W. Lauterbach (ed.). *Bildung als Privileg? Erklärungen und Befunde zu den Ursachen der Bildungsungleichheit* (S.225-250). Wiesbaden: VS Verlag für Sozialwissenschaften.

Dubowy, M., Ebert, S., von Maurice, J., & Weinert, S. (2008). Sprachlich-kognitive Kompetenzen beim Eintritt in den Kindergarten. *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie*, *40*(3), 124-134.

Eisner, E.W. (1998). Does experience in the arts boost academic achievement? *Journal of Art and Design Education*, *17*(1), 51-60.

Epstein, A.S., & Trimis, E. (2002). *Supporting young artists: The development of the visual arts in young children.* Ypsilanti, MI: High/Scope Press, High/Scope Educational Research Foundation.

Gardiner, M.F., Fox, A., Knowles, F., & Jeffrey, D. (1996). Learning improved by arts training. *Nature, 381*(6580), 284.

Gibson, M.A., & Larson, M.A. (2007). Visual arts and academic achievement. *Journal for Learning through the Arts*, *3*(1), Article 8.

Haanstra, F. (1996). Effects of art education on visual-spatial ability and aesthetic perception: a quantitative review. *Studies in Art Education*, *37*(4), 197-209.

Hammill, D.D., Pearson N.A., & Voress, J.K. (1993). *Developmental Test of Visual Perception* (2nd ed.). Austin , TX: PRO-ED.

Iversen, S., Berg, K., Ellertsen, B., & Tønnessen, F.E. (2005). Motor coordination difficulties in a municipality group and in a clinical sample of poor readers. *Dyslexia*, *11*(3), 217-231.

Jongmans, M.J., Smits-Engelsman, B.C., & Schoemaker, M.M. (2003). Consequences of comorbidity of developmental coordination disorders and learning disabilities for severity and pattern of perceptual-motor dysfunction. *Journal of Learning Disabilities*, *36*(6), 528-537.

Kastner-Koller, U., & Deimann, P. (2002). *WET. Wiener Entwicklungstest. Ein Verfahren zur Erfassung des allgemeinen Entwicklungsstandes bei Kindern von 3 bis 6 Jahren*. 2. überarb. u. neu normierte Aufl. Göttingen: Hogrefe.

Kiese-Himmel, C. (2003). *Göttinger Entwicklungstests der taktil-kinästhetischen Wahrnehmung (TAKIWA)*; Manual. Göttingen: Beltz.

Kiese-Himmel, C., Auberlen, S., & von Steinbüchel, N. (2012). Ausgewählte Sprachentwicklungsfacetten von Kindergartenkindern mit Migrationshintergrund in Deutschland. *Zeitschrift für Medizinische Psychologie, 21*(2), *80-88.*

Kiese-Himmel, C., Witte, C., & von Steinbüchel, N. (2013). Einschätzungen des Sprachverhaltens von Kindern mit Migrations- vs. ohne Migrationshintergrund durch Kita-ErzieherInnen. *Logos*, *21*(3), *180-189.*

Kulp, M.T. (1999). Relationship between visual motor integration skill and academic performance in kindergarten through third grade. *Optometry & Vision Science*, 76(3), 159-163.

Melchers, P., & Preuß, U. (2009). *Kaufmann Assessment Battery for Children, dt. Version (K-ABC).* Frankurt/M.: Pearson Assessment.

Pieters, S., Desoete, A., Roeyers, H., Vanderswalmen, R., & van Waelvelde, H. (2012). Behind mathematical learning disabilities: What about visual perception and motor skills? *Learning and Individual Differences*, *22*(4), *498-504*.

Pramling Samuelsson, I., Asplund Carlsson, M.A., Olsson, B., Pramling, N., & Wallerstedt, C. (2009). The art of teaching children the arts: music, dance and poetry with children aged 2-8 years old. *International Journal of Early Years Education*, 17(2), 119-135.

Sousa, D.A. (2006). How the arts develop the young brain: Neuroscience research is revealing the impressive impact of arts instruction on students' cognitive, social, and emotional development. *School Administrator, 63*(11), *26-32*.

Stanat, P. (2006). Schulleistungen von Jugendlichen mit Migrationsintergrund: Die Rolle der Zusammensetzung der Schülerschaft. In J. Baumgart, P. Stanat & R. Watermann (eds.). *Herkunftsbedingte Disparitäten im Bildungswesen: Differenzielle Bildungsprozesse und Problem der Verteilungsgerechtigkeit* (S.189-219). Wiesbaden: VS Verlag für Sozialwissenschaften.

The Government of Manitoba (2011). *Kindergarten to grade 8 visual arts. Manitoba curriculum, framework of outcome.* Winnipeg, Manitoba, Canada: Manitoba Education.

The Stationery Office of the Government of Ireland (1999). *Visual arts. Arts education. Teacher guidelines.* Dublin: Government Publications.

Tseng, M.H., & Cermak, S.A. (1993). The influence of ergonomic factors and perceptual-motor abilities on handwriting performance. *American Journal of Occupational Therapy*, *47*(10), *919-926*.

Tseng, M.H., & Chow, S.M.K. (2000). Perceptual-motor function of school-age children with slow handwriting speed. *American Journal of Occupational Therapy*, *54*(1), *83-88*.

Weil, M.J., & Cunnigham Amundson, S.J.C. (1994). Relationship between visuomotor and handwriting skills of children in kindergarten. *American Journal of Occupational Therapy, 48*(11), *982-988*.

Westendorp, M., Hartman, E., Houwen, S., Smith, J., & Visscher, C. (2011). The relationship between gross motor skills and academic achievement in children with learning disabilities. *Research in Developmental Disabilities, 32*(6), *2773-2779*.

Willett, L. (1992). *The efficacy of using visual arts to teach math and reading concepts*. Paper presented at the 73rd Annual meeting of the American Educational Research Association, San Francisco, CA.

Wood, N.E. (1977). Directed art, visual perception, and learning disabilities. *Intervention in School and Clinic*, *12*(4), *455-462*.