

SHORT REPORT

Dominant preference and school readiness among grade 1 learners in Bloemfontein

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Background. There is a paucity of published research with regard to dominant preference and school readiness in preschool children, and what is available has become somewhat outdated.

Objectives. To determine the dominant preference among grade 1 learners in Bloemfontein, and to determine whether the establishment of a dominant profile had an influence on school readiness of grade 1 learners in Bloemfontein. An additional purpose was to determine whether there was a statistically significant difference in obtaining school readiness between children with a mixed dominant preference profile and those with a pure dominant profile.

Methods. The Aptitude Test for School Beginners, which measures school readiness, and performance tests to determine the child's dominant eye, ear, hand and foot, were conducted on each of the 353 grade 1 learners who participated in the study. There were 161 boys and 192 girls from five different primary schools in Bloemfontein involved in this study.

Results. The results found that 62% of the children preferred their right eye, 68% preferred their right ear, 92% preferred their right hand and 90% preferred their right foot. A total of 54% of the children exhibited a mixed lateral preference, while only 46% exhibited a pure lateral preference of which only 4.2% had pure left dominance. Insignificant differences were found between the dominant profiles of boys and girls.

Conclusion. Most of the participants were right-side dominant; gender did not influence dominant preference and dominant preference had no significant influence on school readiness.

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There is a paucity of published research with regard to dominant preference and school readiness in preschool children, and what is available has become somewhat outdated. Both left and right sides are almost always involved in most motor activities and

educational tasks, with one side being the preferred or dominant side, and the other being the non-preferred or non-dominant side. Left-right preference is known as dominance.^[1]

Dominance implies being able to use one side of the body more competently than the other side.^[2] Dominant preference is the term

used when use of one eye, ear, foot or hand is favoured over the other by an individual. It is a natural result of the maturation of a child through a normal developmental sequence, and should occur spontaneously.^[3] Children aged 4 years have some basic reference to left and right but are still not confident by 5 years, and laterality is only established at 7 years.^[3] Because of natural preference, the dominant side will unconsciously be trained to perform more complex tasks than the non-dominant side. The aetiology of dominant preference is not the focus of this study, but has been suggested to be influenced by several factors, including, but not limited to, genetic inheritance, fetal position, hormonal imbalance, anatomical asymmetries, cerebral dominance, body centre of gravity, eye dominance and social conditioning.^[2] Several studies and observations over time have concluded that 90% of people have been right handed.^[3] Boys are slightly more likely than girls to be left handed, and the age at which stable hand preferences are observed is later for boys than for girls.^[4,5]

According to Beaton,^[6] 'As a general rule, one half of the brain is connected primarily, though not exclusively, with the opposite (contra-lateral) side of the body'. Thus the right hand is controlled largely by the left cerebral hemisphere. Dominant preference is important in that it serves as a possible neuropsychological indicator of underlying brain development and may, in addition, reveal the manner in which cognitive functions are localised to the right or left brain hemispheres. It has also been stated that 'lateral preference plays a significant role in future academic learning and success in motor skills.'^[3]

In a study done by Maples,^[7] it was found that there was no significant difference in the reading score between right- and left-handers in grades 1 - 5. However, there was a significant difference in the total reading score and reading comprehension scores between uni-dominant and cross-dominant children, with the former scoring higher. Associations have been found between handedness and developmental disorders of speech, language and reading, yet these associations are weak and many would deny the existence of any association at all.^[4] This proposed link between brain function, intellectual ability

and dominant preference raises a question of particular interest: Does dominant preference systematically relate to individual differences in school readiness?

School readiness is a stage in a child's development where he or she has the ability to learn easily, effectively and without emotional disturbance. It cannot be considered a definite point in development, as it is a steady, continuous process. Rather, it is a condition or state on a continuum where the child has achieved certain cognitive, maturational, developmental and emotional attributes that indicate that he or she is ready and able to learn.^[8]

Methods

Study design

A study done on the validity and reliability of utilising a behavioural dominant preference test or a questionnaire found that there was a strong correlation between the two methods for testing dominant preference.^[9] The body awareness test from Cheatum and Hammond^[3] was chosen for the behavioural test for practical reasons, including time and cost-effectiveness. The subjects were tested at their schools by interkineticists-in-training, who were specifically trained for the testing procedures. A questionnaire to determine the school readiness of each child was conducted by a trained professional who tested each child using the Aptitude Test for School Beginners (ASB), developed by Olivier and Swart.^[10]

Participants

Thirteen schools were targeted to take part in the research project, of which five agreed

to participate, and a stratified sampling method was used. The participating schools were all located in the Bloemfontein area. The Department of Basic Education and the principal of each school gave permission for the research to be conducted on the school premises during the Life Orientation periods. Approval was obtained from the ethics committee of the Faculty of Health Sciences, University of the Free State (ECUFS57/2012). The parents of the children had to complete an informed consent form for each child participating in the study. All children in the identified classes were considered for inclusion in the study. Exclusion criteria were age outside the expected range of 5 - 8 years, failure to obtain parental permission, incomplete consent forms and geographical relocation during the study period. A total of 353 learners in grade 1 (ages 5 - 8 years) took part in the study. The sample comprised boys ($n=161$) and girls ($n=192$) as well as various ethnic groups (white, $n=324$; mixed race, $n=11$; hispanic, $n=2$; black, $n=16$).

Measuring instruments

To measure dominant preference

The body awareness test from Cheatum and Hammond^[3] was used to test dominant preference. Difference activities were used to determine lateral preference with regards to ear, eye, hand and foot preference of each child. Hand preference was determined by the hand the child used to pick up an object placed centrally in front of the child. Eye preference was determined by the eye the child used to look through a tube. The foot the child used to kick a stationary ball placed centrally in front of the child was

Table 1. Dominance preferences for all participants

| | Eye | | Ear | | Hand | | Foot | |
|----------------|------|------|------|------|------|-----|------|-----|
| | RD | LD | RD | LD | RD | LD | RD | LD |
| Preference | | | | | | | | |
| Percentage (%) | 62.1 | 37.9 | 68.3 | 31.7 | 92.1 | 7.9 | 90.4 | 9.6 |

RD = right dominant; LD = left dominant.

Table 2. Dominance profile for all participants

| | Mixed profile | Pure profile |
|----------------|---------------|--------------|
| Percentage (%) | 54 | 46 |

Table 3. Dominance preference by gender

| | Ear | | | | Eye | | | | Hand | | | | Foot | | | |
|----------------|--------|------|------|------|--------|------|------|------|--------|-----|------|-----|--------|-----|------|------|
| | Female | | Male | | Female | | Male | | Female | | Male | | Female | | Male | |
| Preference | RD | LD | RD | LD | RD | LD | RD | LD | RD | LD | RD | LD | RD | LD | RD | LD |
| Percentage (%) | 68.7 | 31.3 | 67.7 | 32.3 | 64.1 | 35.9 | 59.7 | 40.3 | 91.7 | 8.3 | 92.5 | 7.5 | 91.7 | 8.3 | 88.8 | 11.2 |

RD = right dominant; LD = left dominant.

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used as the determinant of the preferred foot. Lastly, ear preference was determined by the ear a child turned towards an object when instructed to listen what's on the other side. Each child performed the set of activities once.

To measure school readiness

The measuring instrument used in this study to test each learner's school readiness level was the ASB as designed by Olivier and Swart.^[10] This norm-based approach was chosen as it tests school readiness of children already attending grade 1. It is composed of eight subtests that measure the development of perception, spatial orientation, reasoning, numerical ability, gestalt, coordination, memory and verbal comprehension.^[11]

The ASB specifically determines a child's reading age, numerical age and emotional age. The purpose of the ASB is to obtain a differential impression of certain necessary skills needed by school beginners. The ASB is a standardised test with intact statistical reliability (consistency of test measures expressed as a coefficient) and validity.^[11] Therefore if any one of the developmental areas are affected, it could influence the child's school performance accordingly.^[12] The mark obtained is converted to a standard mark that ranges from one (indicating a poor grade) to five (indicating an excellent grade).

Statistical analysis of data

Data from the respective questionnaires was captured electronically in Microsoft Excel by the researchers. Further analysis was done by

a biostatistician using SAS version 9.2 (SAS Institute Inc, USA). Descriptive statistics, namely frequencies and percentages, were calculated for categorical data. Medians and percentiles, or means and standard deviations were calculated for numerical data. The means for the different groups of dominant profile, mixed and pure, were compared using the standard *t*-test. Gender differences for dominant profile were compared using the χ^2 statistic or the Fisher's exact test. A significance level of $p < 0.05$ was used throughout the study.

Results

Dominant preference profile

The median age of all participants was 6.8 years, with a lower quartile of 6.6 on the 25th percentile, and an upper quartile of 7.2 on the 75th percentile (range 5.8 - 8.9).

The findings illustrated in Table 1 show the individual percentages of dominant preference for eye (right 62.1%; left 37.9%), ear (right 68.3%; left 31.7%), hand (right 92.1%; left 7.9%) and foot (right 90.4%; left 9.6%) dominance for all learners tested ($n=353$). As found in previous research, we found that the majority of individuals were right-side dominant.

Table 2 illustrates the dominant profile of the learners tested during the study. The majority of individuals (54%) had a mixed lateral profile, meaning they had both left and right preferences. For example, they may be right-hand dominant but prefer to use the left eye. Pure dominant profiles were found in 46% of individuals. Pure dominance refers to all preferences being on one side of the body.

Table 3 illustrates the dominant preference for males ($n=161$) and females ($n=192$) separately. Males were found to have a slightly higher prevalence of left eye (40.3%) and left foot (11.2%) preference compared with their female counterparts (left eye 35.9%; left foot 8.3%). It is also apparent that left eye and ear (female

31.3%; male 32.3%) dominance is much more frequent than that of left hand (female 8.3%; male 7.5%) and foot (female 8.3%; male 11.2%) dominance for both male and female participants.

Lateral profiles by gender are illustrated in Table 4. This shows consistency with Table 2 as the prevalence of a mixed dominance profile occurs more frequently than that of a pure lateral profile. Males have a higher prevalence of a mixed dominant profile (57.8%) compared with females (51.1%).

School readiness

The mean scores obtained during the ASB were compared with dominance profiles as well as left- and right-handedness (regardless of dominance profile). A value of 1 represents a poor score and 5 represents an exceptional score.

Table 5 illustrates the means achieved on the subtests of the ASB. No comparisons could be made between pure left and pure right due to the fact that only 4.3% of children exhibited a pure left-dominant profile, therefore no inferential statistics could be made. With reference to the mixed and pure dominant profile groups as well as the left-handed and right-handed children, no significant differences were found between the two dominant profile groups and any of the subtests. In most of the subtests, the mean performance was nearly identical.

Discussion

This study found that the majority of participants were right-side dominant with preferences for right hand (92.1%), right foot (90.1%), right eye (62.1%) and right ear (68.3%).

As illustrated in Table 1, the prevalence of preferred left eye (37.9%) is more frequent than that of left hand (7.9%) or foot (9.7%) dominance. These percentages

Table 4. Dominance profile by gender

| Female | | Male | |
|--------|-------|-------|-------|
| Mixed | Pure | Mixed | Pure |
| 51.1% | 48.9% | 57.8% | 42.2% |

Table 5. Mean values of the subtests of the Aptitude Test for School Beginners

| Variable | Dominance | | | Handedness | | |
|----------------------|----------------------------------|-----------------------------------|-----------------|------------------------------|--------------------------------|-----------------|
| | Pure dominance, mean ($n=163$) | Mixed dominance, mean ($n=190$) | <i>p</i> -value | Left-handed, mean ($n=28$) | Right-handed, mean ($n=325$) | <i>p</i> -value |
| Perception | 4.7 | 4.7 | 0.95 | 4.7 | 4.6 | 0.89 |
| Spatial | 3.8 | 3.8 | 0.48 | 3.8 | 3.8 | 0.76 |
| Reasoning | 4.2 | 4.1 | 0.32 | 4.2 | 4.0 | 0.27 |
| Numerical | 3.5 | 3.6 | 0.44 | 3.7 | 3.5 | 0.18 |
| Gestalt | 3.7 | 3.8 | 0.38 | 3.6 | 3.7 | 0.59 |
| Coordination | 2.7 | 2.8 | 0.74 | 2.6 | 2.7 | 0.59 |
| Memory | 4.2 | 4.2 | 0.81 | 4.4 | 4.1 | 0.11 |
| Verbal comprehension | 3.4 | 3.5 | 0.12 | 3.5 | 3.4 | 0.53 |

differ slightly to those found in previous studies. Lane's^[2] study found that 41.6% and 12.9% preferred the left eye and left hand, respectively. A more recent study done by van der Elst *et al.*^[13] found the incidence of left-hand dominance to be greater than the scores collected in this study, with a 16.3% occurrence, while they found that only 30.9% preferred the use of the left eye, a value considerably less than the 37.9% found in this study. In general, it can be stated that the trends in left eye and hand preference in the three studies are similar. The general conclusion that can be drawn from the combined data is that the prevalence of a right-sided limb being preferred by young children is generally more frequent than preference of a left-sided limb.

It is evident from Table 2 that 54% of individuals had a mixed dominant profile, while 46% showed a pure dominant profile. Insignificant differences were found between the dominant profiles of males and females, indicating that gender has little or no effect on dominant profiling. It is apparent from Table 3 that the incidence of left eye (female 35.9%; male 40.3%) and ear (female 31.3%; male 32.3%) dominance is more frequent than that of left hand (female 8.3%; male 7.5%) and foot (female 8.3%; male 11.2%) dominance, consistent with results obtained from previous studies in which Van der Elst *et al.*^[13] found that left eye (female 28.6%; male 33.7%) and ear (female 40.0%; male 44.4%) preference occurs more frequently than left hand (female 17.9%; male 14.5%) and foot (female 19.9%; male 18.1%) preference. The data found by van der Elst *et al.*^[13] showed a greater prevalence of left-side dominance for all limbs except that of the left eye.^[13]

A last comparison that can be drawn is between that of dominant profiling between this study and previous studies. The latest data indicates that 46.6% of children have a pure dominant profile with 42.6% being pure right and the remaining 4.0% being pure left.^[13] These data are consistent with those obtained in this study, which found that 45.9% had a pure dominant profile. However, the current study also found that 95.6% of these pure dominant profile children preferred the right side, with only 4.3% preferring the left side.

From Table 5, it can be concluded that an individual's dominant profile has no impact on his or her school performance as determined by the ASB. Thus dominant preference profile (mixed or pure) or right-handedness and left-handedness (regardless of whether the hand dominance is pure or mixed) has no significant impact on a child's school performance.

Study limitations

A major limitation in the study was the fact that there was very little previous research done on this topic. Most of the existing research on dominant preference was outdated, having been conducted some 20 - 30 years ago; this made it challenging to gather current data and definitions. No research had been done on dominant preferences and the effect on school readiness.

Conclusion

The purpose of this study was to determine whether or not an individual's dominance preference (right or left) or their dominant profile (pure or mixed) would have any impact on the school performance of the child, as determined by the ASB. From our findings, it is clear that neither an individual's dominant preference nor dominant profile has any significant impact on school readiness, as there were no significant differences ($p > 0.05$) for any subtest variables of the school readiness test when compared with dominant preference or profile.

While no significant differences were found between school performance and laterality, the study can confirm that most individuals within society have a predominantly right-sided bias, which is consistent with previous studies. A final conclusion that can be drawn from this study is that although minor gender differences do exist in relation to dominant preferences and profiles, with males having only a slightly higher tendency to demonstrate a mixed lateral profile, they were not found to be statistically or clinically significant.

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