Extended Summary

Purpose

We can state that the interdisciplinary researches take on important tasks in order to be able to attain the findings as to where and how the mathematical reasoning has occurred. (Dündar and Bulut, 2014). As the results of the researches carried out, we get information about how the mathematical nerve activity functions. The objective of the interdisciplinary studies seeking answers to the question as to how the learning process takes place in the human brain is to be able to understand the nature of learning and to study how each cell is connected to the other in the process of learning, what regions of the brain is active and the relationship of the other activities occurring in these regions with each other. (Goswami, 2004). In this context, thanks to the interdisciplinary studies, having the knowledge of the structure of the brain and acquiring detailed information on the brain functions during the learning process will contribute to the re-evaluation of the learning process since the learning process takes place in the brain.

The differences between the information processing skills and tendencies of the individuals, such as the highly gifted and talented students with cognitive style, originate from the individualistic differences. On one hand, there are significant differences on the behavioural level, while, on the other hand, the differences/diversities observed and assessed in the cognitive processes fall short of a sensible interpretation. (Jausovec, 1994). It can expected that a certain level of such individualistic behavioural differences bring along individualistic differences in the nervous system, as well.

In this study, the differences among the brain activations of the students showing diversities according to their cognitive styles in the process of solving arithmetical problems were investigated.

Method

In this study, the explanatory model, one of the combined method model in which quantitative and qualitative research methods are used together, was applied. In the participant selection of the research, the criterion sampling, which is one of the purposive sampling methods, was used. (Yıldırım and Şimşek, 2006). In this research, the group of participants were formed with the participation of 149 teacher candidates of the 1st grade elementary department of the Faculty of Education in a state university. In order to determine the participants to take part in the research, a participant group was formed by applying the selection criteria. 55 teacher candidates who provided the selection criteria for the study were incorporated in the practice. However, the number of participant groups was limited to 20 people for the cognitive differentiation to be enhanced by the researcher. This limitation process was performed by including those getting the highest and the lowest scores from the cognitive style.

Consequently, this research was carried out along with 10 field-independent and 10 field-dependent students with cognitive style. In the research, 7
different materials were used to collect data, which were Neuroheadset device (Emotiv Epoc), Register software (EEG data register software- TestBench-), Mapping Software (2-D) (Brain Activity Map software), Hand Asymmetry Test, The Group Embedded Figures Test (GEFT), Interview Form and Problem Test (PT). The data obtained from the Emotiv Epoc device are recorded through medium of TestBench Software. In order to process these recorded data, the SIMSS interface program was developed by using the MATLAB program. The data acquired from the device through this program are subjected to certain processes, and thus, the elimination of artifacts and the classification of wavebands can be performed. With this software, the data sources obtained in the wake of the signals processed are acquired in the Excel format. From the obtained band values, the Asymmetry Index value was used for determining the cortical activation difference among individuals. (Glass, Butler and Carter, 1984; O'boyle, Alexander and Benbow, 1991). The data obtained from the interview forms were also subjected to the content analysis, and the views of the participants were, hence, evaluated.

Result

While solving Question 1 which involved the basic arithmetic operations, a statistically significant difference was observed in the Fronto-Central Lobe according to the Alfa 1 waveband of the field-independent and field-dependent students with cognitive style. More activation was found in the right fronto-central lobes of the field-independent students with cognitive style in comparison to the field-dependent ones. When the answers given to Question 1 by the field-independent and field-dependent students were analyzed, the students with both of the cognitive styles were seen to have answered Question 1 correctly. It was also seen that the field-independent students solved this problem in 20,517 seconds on average, whereas the field-dependent ones solved it in 23,683 sec on average. 80% of the field-independent students solved this problem by using a pencil, while 20% of them solved it in their minds; on the other hand, 100% of the field-dependent ones solved the problem by using a pencil. Considering the views on the difficulty level of this question, the students with cognitive style stated that the problem was easy. Considering the views on the anxiety or excitement levels, 10% of both groups were seen to have felt anxious or excited while solving the problem. When Table 2 is analyzed, it is seen that while solving Question 2, there was a statistically significant difference in the asymmetry index values among the brain lobes of the field-independent and field-dependent students with cognitive styles according to their wavebands. When the answers given to Question 2 by the field-independent and field-dependent students were analyzed, it was seen that 90% of the field-independent students and 60% of the field-dependent ones answered this problem correctly. The field-independent students solved this problem in 32,463sec on average, while the field-dependent ones solved it in 35,142sec on average. 90% of the field-independent students solved this problem by using a pencil, while 10% of them solved it in their minds; on the other hand, 100% of the field-dependent ones solved the problem by using a pencil. Considering the views on the difficulty level of this question, the students with cognitive style stated that the problem was easy.
Considering the views on the anxiety or excitement levels, it was observed that 20% of the field-independent students stated that they felt anxiety or excitement in solving the problem, whereas the dependent ones said they did not experience it.

The results of this study, as well as paving the way for new tendencies in the educational field as to where and how the cognitive conditions occur in the brain, are of an instructive and worthwhile quality for the prospective researches. By applying different cognitive style tests and performing mental activities, patterns of the characteristic structure of the brains of individuals can be found. If such studies as this one or similar ones are going to be conducted, it is recommended that a detailed classification of the individuals to participate in the studies be made as well as performing it with a wide range of participation of those individuals.

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