142 - INTENSIFICATION OF SENSORY INTEGRATION AND STIMULATION BY CEREBRAL SYNTHESIS OF LIGHT AND SOUND: EFFECTIVENESS IN CHIDREN MOTOR LEARNING

C.J. SANTANA
R.C. LOPES
M.R. CALOMENI
V.F. SILVA
Universidade Castelo Branco – UCB (RJ) – Rio de Janeiro, BRASIL
E-mail: claudianesant@yahoo.com.br

INTRODUCTION

The human learning is in general a very complex phenomenon considering all its variations, is a biological, or sociological, or psychological. These discrepancies strongly influence the ability of the child to learn, a fact that has driven the search for understanding the factors that might impede the proper development of this process. Among the factors deemed relevant to the learning problems, sensory integration is a major, evidence deficit of sensory integration are related to low socioeconomic child's learning (LEITE, PINHO, KOEHLER, 2003; POLLOCK, 2006).

The sensory integration, coupled with a series of neurophysiologic mechanisms, develops during the course of the child's life. Along with her skills in motor planning and adapting to sensations from the body and the environment. However, many children fail to develop these skills efficiently and as a consequence of this deficit may arise for them, a series of problems of learning and development.

Often, these difficulties to be highlighted by the behavior, but in some cases, are hidden and difficult to diagnose. In this case, it is estimated that 40% of school-age children have such problems at some level (PEREIRA et al., 2005), resulting in a percentage of 54% in the first grade of elementary school, which contributes to the delay and possible dropout (OKANO et al., 2004).

However, it is known that some types of training can stimulate sensory functions, expanding functional levels of sensory integration and classifying certain types of motor skills, cognitive and/or language. One such training, enough to use for the stimulation of learning, is the permeation of light and sound intensities in protocols and the appropriate frequencies. The effects of training have been examined in the learning of bowling (Cardoso, 2004), the selective increase in capacity in a noisy environment associated with learning tasks, skilled motor (SANTOS, 2005) and cognitive and motor learning in individuals of different hemispheric (MARQUES et al., 2006).

In this light, this article focuses on verifying the theoretical possibility that learning a complex motor skill can result from a model of sensory integration and enhanced if it confirms this possibility may be even more effective depending on the technique brain stimulation by synthesizing photic and auditory.

METHODS

SAMPLE

This study was approved by the Ethics and Research of the Universidad Castelo Branco, protocol number 0133/2008, conducted by the Laboratory of Neuroscience.

The sample population inherent in classified was represented by twenty-one (n = 21) children aged between five and six years, of both genders, denizens of the private schools of the city of Ipatinga - Minas Gerais, without mental retardation, motor , auditory and/or visual that prevented the completion of training.

Individuals selected for the study were divided into three groups at random, where n = 7 in each. A control group (CG) subjected to motor training in poor stimuli; submitted to two experimental training program associated with a motor model of intensification of sensory integration: a non-conjugated and conjugated with other brain stimulation on photic and auditory synthesis. Were called G1 and G2 respectively.

INSTRUMENTS

The EEG instrument used to determine the pattern of cortical research sample consisted of an electronic device with EEG neurofeedback, called ProComp +, manufactured by Thought Technology Ltd. with program called BioGraph in version 2.1 that can handle eight channels simultaneously, two these specific EEG. Being high-tech equipment that uses electronic sensors has exacting standards for precision instrument, sensitivity, durability, and ease of use. All sensors are completely non-invasive, enabling the ProComp + to display data in real time.

To perform the test and transfer of motor training, we used a runway launch of aluminum, fixed on the floor with tape, measuring 134 cm long, 3 cm wide, 1.5 cm tall and weighing 288 g, a bolide metal on wheels, model Ferrari brand Fresh Metal, measuring 7.4 cm long, 2.8 cm wide, 2 inches tall and weighing 32 g (KELSO, NORMAN, 1978). We used the color black for the GC and red for the G1 and G2.

Brain stimulation by sintering photic and hearing took place, also through an electronic device called Sirius, manufactured by Mindplace composed of sunglasses equipped with 4 LEDs within each lens, a stereo headset and a PC on which it can determine the frequencies of brain waves to be stimulated.

PROCEDURES

For the first step of this research was conducted over the distribution of the Terms of Consent and questionnaires on the health of the person and the child, the parents of all children aged between 5 and 6 years of age, aiming to with it as many participants as possible.

After selecting the sample, all individuals included in the study underwent pre-test, in which each subject performed 20 attempts to launch a bolide, and evaluation of the EEG done during 5 minutes before and after that block of 20 trials. This procedure was adopted because of the need to study the changes in EEG tracing of each individual before and after the completion of the task and thus be able to detect the possible effects of the same. The launch of the bolide was explained to the components of the sample, such as throwing a cart to a stop sign (stop).

Thereafter, began the training of skilled-motor task, divided into phases of acquisition and transfer (VIEIRA et al., 2006), and 13 occurred during training sessions, 3 times per week, with 50 attempts per day.

GC carried out the task-skilled motor on a track of low-release stimuli. The experimental groups G1 and G2, in a rich

platform for illustrative stimuli with lights that delimited the reference site (stop), has received several verbal guidance to need a force appropriate to be used on every pitch. In addition, the G2 also received sessions of photic and auditory stimulation, using a specific protocol for learning, where they were stimulated predominantly alpha waves, during a time 25 minutes before the practice session for the skilled-motor task. There was much positive reinforcement at the beginning and during all launches, since there was interest to determine the effects of a model of sensory integration and enhanced the stimulation by sintering photic and auditory learning of skilled motor task reference.

At the last practice session for the skilled-motor task were performed 40 shots and also the Transfer Test, composed of 10 throws (VIEIRA et al., 2006; BRUZI et al., 2006; TERTULIANO et al., 2007), for a total of 650 pitches, 13 for training sessions, with 50 attempts per day.

Finally, all children selected for the survey conducted the post-test along the lines of pre-test described above.

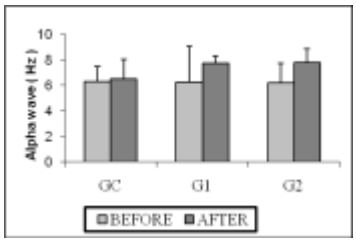
STATISTICS

The collected data were analyzed with the purpose to testing the hypotheses of the study were used for this model descriptive statistics and inferential. Points of interest descriptive statistics were means and standard deviations of the groups on the scores obtained in the tests proceeded. Likewise, these scores were examined in the inferential model, through analysis of variance and because of their nature; the analysis was the type parametric and nonparametric. In non-parametric model, we selected the Kruskal Wallis test and the parametric model, ANOVA ONEWAY, the software used was SPSS 11.0. All tests effectuated obey the criterion of $p \leq 0.05$

RESULTS

Initially data will appear in pre-and post-test groups that participated in the study. The study sample consisted of twenty-one (n = 21) participants of both genders, 13 (61.9%) males and 8 (38.1%) females, aged between five and six years, divided into three distinct groups: one control group (n = 7) and two experimental (G1 = 7 and G2 n = 7).

Figure 1 is demonstrated that the mean wave amplitude between the groups Alfa GC, G1 and G2 before and after the completion of the task to launch the meteorite to a reference site (stop) for the implementation of the Post-test. One can observe a trend of increased cortical activity, especially in the experimental groups (G1 and G2); these groups underwent a training program associated with a motor model of intensification of sensory integration. However, the value, despite the observed increase is not significant statistically.



ANOVA: * $p \leq 0,05$

FIGURE 1. Average amplitude of alpha wave, between groups GC, G1 and G2 before and after the completion of the task to launch the meteorite to a reference site (stop), while applying the post-test.

Following are the data acquisition phase and the phase of transfer with respect to the CG, G1 and G2. The variable measured during the acquisition phase and the transfer was dependent on the average absolute errors. Table 1 describes the variable mean absolute errors in the first and last days of motor training, the task of launching the meteorite to a reference site (stop) between the CG, G1 and G2 during the acquisition phase, and shows that there were no statistically significant differences between the samples.

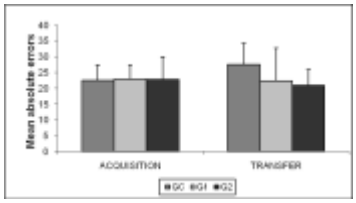
However, you can also check as well as what happened with the data shown in Figure 1, a clear reduction in the average absolute errors, for patients undergoing a program of motor training associated with a model of intensification of sensory integration , G1 and G2, analyzing the first and last day of training skilled motor.

TABLE 1. Mean absolute errors between the groups GC, G1 and G2, the first and last days of skilled motor training, the task of launching the meteorite to a reference site (stop) during the acquisition phase.

GROUPS	FIRST	LAST	LEVENE	ANOVA
	s	s	p	p
GC	22,43 ± 4,99	27,43 ± 6,9		
G1	22,29 ± 4,46	10,48 ± 3,96	0,402	0,088
G2	22,71 ± 7,32	5,08 ± 1,92		

ANOVA: * $p \leq 0,05$

This trend of improvement, as mentioned above, can be thought of as explicit when comparing the mean absolute error, among all groups, and to refer the Acquisition Phase and Transfer. That is, the average of these errors, as shown in Figure 2, strongly decreases as the practice of launching the meteorite to the stop sign (stop) increases in time. This improvement, however, occurred only for the G1 and G2. For the control group, it was not even true. Indeed, in transferring this group showed a deteriorated performance in relation to its acquisition phase.



ANOVA: * $p \leq 0,05$

FIGURE 2. Mean absolute errors between the groups GC, G1 and G2 phases of acquisition and transfer phase, the

task of launching the meteorite to a reference site (stop).

DISCUSSION

Motor learning is the set of processes associated with practice or experience leading to relatively permanent changes in the ability to perform skilled performance-driving (PINHO et al., 2007). This is the change of behavior made possible by the plasticity of neural cognitive processes, which evolve gradually, as is the maturation of the prefrontal cortex, which in turn is mediated by intentionality, values and history of the individual (ANDRADE, LUFT, ROLIM, 2004). The explanation for this fact is that the cerebral cortex is susceptible to changes in various aspects during learning (BASTOS et al., 2004).

The motor learning also causes an increase in alpha activity (slow and rhythmical 8-12 Hz) in the premotor and motor brain (LUFT, ANDRADE, 2006), and this wave allows for greater ease of learning (BONINI-ROCHA et al., 2008). A similar phenomenon to that shown in Figure 1, which shows an increase in average amplitude of alpha, even without statistical significance, showed a trend of increased cortical activity, indicative of functional improvement in post-test in all groups.

Comparing the first and last days of motor training, we observed a decrease in mean absolute errors, thus characterizing some increase in learning during the acquisition of the task in the experimental groups (G1 and G2). This observed effect, although it has not found a statistical significance reported in studies such as Cruz (2003), which states that motor training for the adaptation of the sensor motor cortex and the learning process, skilled driving, starts with an individual is confronted with a task that requires action of skeletal muscle to achieve your goal.

Once known the task, the process moves to stage engine to refine the skill and efficiently organize the movement patterns, developing coordination and motor control. Finally, after extensive practice, the more complex motor activity over the new patterns that have emerged during the experiment will be stored and automated. Yet, unlike Bonini-Rocha et al. (2008), the results aimed at the improvement observed in our study were not significant.

It is still important to emphasize that the experimental groups received motor training associated with a model of intensification of sensory integration. And the literature defines the ability of sensory integration as a process that enables man to experience the world, receive, log, modular, organize and interpret information reaching the brain through the senses (POLLOCK, 2006), being a facilitator in learning ability (GUERREIRO, MAIÃO, 2007). In addition, the G2, which received sensory integration combined photic brain stimulation and hearing, even without statistical significance, showed the best performance motor-able for the other groups. This lack of statistical evidence on learning-skilled driving not in accordance with the work of Cardoso (2004), Marques et al. (2006) and Silva et al. (2008), which point to photic and auditory stimulation as a valuable tool in promoting this type of learning.

Comparing also the acquisition phase with the transfer phase, there was an increase in motor performance by reducing the average absolute errors in the transfer phase. A study in this line of research has shown that the transfer phase allows the student to differentiate the transient effects of learning of relatively permanent (TERTULIANO et al., 2007). And, it optimizes the learning (TANI, MEIRA Jr., GOMES, 2005), in addition to promoting an adaptive more visible in the tasks tested in the acquisition phase (BARREIROS, 2006).

The hypothesis considering the effectiveness of two factors - brain stimulation and sensory intensification on the task of learning - did not receive full support when the inferential analysis of data. Yet the descriptive data of the groups make clear an effective part, enforcing the notion of positive possibility of using these teaching resources. In a way, the results listed above indicate that this statistical evidence can be achieved. In other words, respecting the limitations imposed by the method and the observed constraints in terms of sample size used and does not represent the general population, it was established that the use of such resources serves as a platform for directing professional learning that seek alternative ways to streamline its working methods.

It is important to report that this research points to the possibility of opening a promising field of study regarding the effects of sensory integration and auditory and photic stimulation in terms of skillful motor-learning child.

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Endereço para correspondência:
Claudiane José Santana.
Av. 26 de outubro, 2284, Bela Vista, Ipatinga – MG, CEP 35160-208.
Telefone: (31)3823-2830/ (31)8609-9799 E-mail: claudianesant@yahoo.com.br

INTENSIFICATION OF SENSORY INTEGRATION AND STIMULATION BY CEREBRAL SYNTHESIS OF LIGHT AND SOUND: EFFECTIVENESS IN CHIDREN MOTOR LEARNING

ABSTRACT

The theoretical possibility examined in this study reflects the notion that learning a complex fashion, driving can be enhanced by sensory integration intensified and strengthened in terms of brain stimulation. Sample of 21 children, between 5 and 6 years in 3 groups. Collected is data on the cortical activity related to motor performance. Descriptive statistics showed that there was some increase in amplitude of brain waves and post-training decrease of errors in groups, but the inferential statistics showed these differences not as relevant. The same occurred during the transfer compared to the acquisition. Although not significant, differences between the scores pre-and post-sensory stimulation and practice have proved positive. The same occurred during the transfer.

KEY WORDS: Learning; light stimulation; auditory stimulation

MISE A L'ECHELLE D'INTEGRATION SENSORIELLE ET STIMULATION DU CERVEAU POUR SINTETIZAÇÃO LUMINEUSE ET L'AUDITION: L'EFFICACITÉ DANS SPÉCIALISÉS-MOTOR D'APPRENTISSAGE DES ENFANTS RÉSUMÉ

La possibilité théorique observée dans cette étude reflète l'idée que l'apprentissage complexe automotrice qualifiés peut être renforcée par l'intégration sensorielle intensifiée et renforcée en termes de stimulation cérébrale. L'échantillon se composait de 21 enfants entre 5 et 6 ans, répartis en 3 groupes. Les données ont été recueillies sur l'activité corticale liée à la performance motrice. Des statistiques descriptives ont montré qu'il existait une certaine augmentation de l'amplitude des ondes cérébrales après l'entraînement et de réduire les erreurs dans les groupes, mais les statistiques inférentielles n'ont montré aucune différence, comme pertinents. Cela a également eu lieu dans la phase de transfert par rapport à l'acquisition. Bien qu'aucune différence significative entre les scores avant et après stimulation sensorielle et la pratique se sont révélés positifs, les mêmes se produisent dans le transfert.

MOTS CLÉS: apprentissage; stimulation lumineuse, la stimulation auditive

INTENSIFICACIÓN DE LA INTEGRACIÓN SENSORIAL Y LA ESTIMULACIÓN CEREBRAL POR LA SÍNTESIS DE LUZ Y SONIDO: HABIL-EFICACIA DE MOTOR EN EL APRENDIZAJE DE LOS NIÑOS

RESUMEN

La posibilidad teórica examinado en este estudio refleja la idea de que el aprendizaje de una manera compleja, se puede mejorar la conducción de la integración sensorial intensificado y fortalecido en términos de estimulación cerebral. Muestra de 21 niños, entre 5 y 6 años en 3 grupos. Son los datos recogidos sobre la actividad cortical en relación con el rendimiento del motor. Estadística descriptiva e inferencial reveló un aumento en la amplitud de las ondas cerebrales después de la formación, la reducción de errores en los grupos con el modelo de la intensificación de la integración sensorial, independientemente de la estimulación. Lo mismo sucedió durante la transferencia en comparación con la adquisición. Aunque no es significativo, las diferencias entre las puntuaciones previas y posteriores a la estimulación sensorial y la práctica han demostrado ser positivas. Lo mismo ocurre en el envío.

PALABRAS CLAVE: Aprendizaje; fótica estimulación, estimulación auditiva

INTENSIFICAÇÃO DA INTEGRAÇÃO SENSORIAL E ESTIMULAÇÃO CEREBRAL POR SINTETIZAÇÃO FÓTICA E AUDITIVA: EFICÁCIA NA APRENDIZAGEM HÁBIL-MOTORA DE CRIANÇAS

RESUMO

A possibilidade teórica verificada neste estudo reflete a noção de que a aprendizagem hábil-motriz complexa possa ser melhorada por integração sensorial intensificada e reforçada em função de estimulação cerebral. Amostra foi constituída de 21 crianças, entre 5 e 6 anos, divididas em 3 grupos. Coletaram-se dados sobre a atividade cortical relacionada à performance motora. Estatística descritiva mostrou que houve algum aumento de amplitude das ondas cerebrais pós-treino e diminuição de erros nos grupos, contudo a estatística inferencial não apontou essas diferenças como relevantes. Isso também ocorreu na fase de transferência comparada à de aquisição. Embora não significativas, as diferenças entre os escores pré e pós-estimulação e prática sensorial revelaram-se positivas, o mesmo ocorrendo na transferência.

PALAVRAS-CHAVE: Aprendizagem; estimulação fótica; estimulação auditiva

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