Effectiveness of the EPI.com Computerized Tool to Enhance Comprehension and Expression in 3–6 Year-Old Schoolchildren

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ABSTRACT

The acquisition of comprehension and expression skills is the key in the learning process, especially given the difficulties of students. EPI.com is a computerized strategy based on the adaptation of hypertext to Early Childhood Education. It aims to improve the lexical, semantic and syntactic processes. The objective of this study was to analyze the effectiveness of EPI.com for improving overall and specific psycho-linguistic and verbal aspects (depending on the age). To this end, a total of 155 participants (3–6 years old) were classified into two groups, an Experimental Group (93 children who worked with EPI.com) and a Control Group (62 children who followed the traditional methodology). All of them completed the Illinois Test of Psycho-linguistic Abilities, and the Peabody test. The results showed the effectiveness of the strategy in the Experimental Group in the Psycho-linguistic Abilities. The 3 year-old children obtained the greatest benefits with the intervention. The analysis concluded that EPI.com is effective in improving psycho-linguistic abilities in this population sample.

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PALABRAS CLAVE
Comprehensiôn
Expresiôn
Interveniôn
Hiperstexto
Infantil

Eficacia del programa informatizado EPI.com para la mejora de la comprensión y la expresión de estudiantes de entre 3 y 6 años

RESUMEN

En el proceso de aprendizaje resulta clave la adquisición de habilidades de comprensión y expresión, sobre todo dadas las dificultades de los estudiantes. La estrategia informatizada EPI.com se basa en la adaptación del hipertexto a Educación Infantil con el fin de mejorar los procesos léxicos, semánticos y sintácticos. En este trabajo se plantea como objetivo analizar la eficacia de EPI.com en la mejora de aspectos psicolingüísticos y verbales de forma global y en función de la edad. Participaron 155 estudiantes (3–6 años) clasificados en grupo experimental (93 estudiantes que trabajaron con EPI.com) y grupo control (62 estudiantes que siguieron la metodología habitual). Todos ellos fueron evaluados con el Test de Illinois de Habilidades Psicolingüísticas y el test Peabody. Los resultados muestran la eficacia de la estrategia en el grupo experimental, con puntuaciones estadísticamente significativas en los aspectos psicolingüísticos frente al grupo control. Son los estudiantes de 3 años quienes obtienen un mayor beneficio. Se concluyó la eficacia de EPI.com sobre la mejora de los aspectos psicolingüísticos con la muestra utilizada.

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Introduction

The acquisition of Reading comprehension and writing skills is a key factor in learning processes and one many students show difficulties in (Gutiérrez, 2016; Ripoll & Aguado, 2014). For instance, reports on the assessment of reading comprehension such as the PISA report (Program for International Student Assessment; Organisation for Economic Co-operation and Development; OECD, 2014) or the PIRLS report (International Association for the evaluation of educational achievement; IEA, 2011) show the relevance of reading difficulties among Spanish students. In the first of those reports, the 25,313 students assessed scored 488, which is significantly below the average for the 34 participating nations. Besides, the PIRLS report also shows that the 8580 participant year 4 Spanish students Rank lower than average in the study, with a score of 513. All in all, the results obtained in the above mentioned studies highlight that, in this key area for learning, a large number of students have difficulties, using inefficient and ineffective strategies (Watson, Gable, Gear, & Hughes, 2012). Axpe, Acosta, and Moreno (2012) point out that the acquisition or development of general language skills, both expressive and comprehension, is one of the abilities that evidently correlate with learning to read. Those authors also emphasize that it is highly important for students to master increasingly longer and more complex morphosyntactic structures, a wider vocabulary and the sound system of Spanish.

In this sense, difficulties in reading are often related to psycholinguistic aspects (Axpe et al., 2012). Hence, those difficulties relate to the lack of a specific vocabulary (lexical reading processes; Ramus, Marshall, Rosen, & van der Lely, 2013), to the structure of texts, whose grammar may be complex (syntactic processes; Carretti & Motta, 2014), or to adequately relating concepts or ideas allowing to reach the actual meaning (semantic processes; Rapp, van den Broek, McMaster, Kendeou, & Espin, 2007). All in all, these comprehension skills problems or deficiencies do not necessarily derive from difficulties in decoding written words alone.

Comprehension abilities are strongly related to expression abilities (Berninger & Abbott, 2010). Authors like Carretti and Motta (2014) point out that comprehension predicts quality of expression. Abbot, Berninger and Fayol’s meta-analysis (2010) shows that comprehension has an effect on composition among children in school years 2–6. Carretti and Motta (2014) also indicate that, just like comprehension, expression is a complex activity requiring cognitive abilities such as planning, transcription and revision and does not only imply producing ideas, but also organizing them in a way that is coherent and consistent with the objectives to be transmitted.

Bearing all this in mind, students showing comprehension and expression difficulties form a largely heterogeneous group with different profiles, degrees and levels (Watson et al., 2012). Aiming at alleviating these difficulties, authors have tried to find out which are the most adequate working methodologies in specific intervention (Gutiérrez, 2016; Ponce, López, & Mayer, 2012). These reading comprehension difficulties do not decrease with the repetitive reading technique (Pressley, 2006), although the Spanish educational system puts special emphasis on coding and decoding abilities and on fluency. Ripoll and Aguado (2014) highlight that, in languages with systems like the Spanish one, reading comprehension skills. Authors like Swanson, Howard, and Sáez (2006) highlight that students require training in how to use strategies, thus benefitting from explicit instruction methodologies.

According to Ponce et al. (2012), a strategy is an action or a sequence of systematic steps taken in order to obtain key information forma text in order to ease its comprehension and later expression. In order to reach these objectives, students must have a good knowledge of how the strategies work and when to implement those.

In order to establish a specific teaching methodology, different authors highlight some of the main components in strategies used when learning to read (De Corte, Verschaffel, & van de Ven, 2001; Mayer, 2008). For example, De Corte et al. (2001) point at four main strategies: activating prior knowledge, clarifying difficult words, making a schematic representation of the text, and formulating the main idea. Reading comprehension strategies may also, according to Mayer (2008), be grouped into levels relating to the cognitive processes backing them up. The SOI (Selection, Organization, Integration) model by Mayer (2008) suggests that comprehension strategies must comprise three cognitive processes: selecting information, which requires attention being paid to relevant content; organizing or constructing a coherent structure; and integrating information and previous knowledge. In order to reach those three cognitive processes it is necessary to implement explicit instructional strategies allowing students to acquire the ability. An aspect these two models have in common is the relevance of representation structures (Álvarez & González-Castro, 2012; Álvarez & Soler, 2005). These strategies allow for the development of the three types of processing that are relevant to comprehension and expression: lexical processing (main concepts are highlighted and defined in the structure of representation, which allows for an increase in vocabulary), syntactic processing (grammatical structure is established through an adequate representation that tries to ease the expression and composition of relevant information) and semantic processing (propositions are coherently related and integrated in order to enhance their being understood, comprehended and, hence, expressed).

Aiming at establishing a coherent representation structure addressed at working on reading comprehension through the three processing types, Álvarez and Soler (2005) develop the so-called Hypertext strategy. Hypertext is based on neoconnectionist learning theories (Cobos, 2005) and on Ausubel’s significant learning. Ausubel, Novak, and Hanesian (1978) describe significant learning as that by which students relate new information to the one they already may have, readjusting and rebuilding knowledge throughout the process. Based on these theories, hypertexts are organizers of knowledge or web-like conceptual representations whose parts or structural nodes relate to each other through significant links (Álvarez & Soler, 2005). This strategy is aimed at older students (its implementation is normally started in year 3, though students gain autonomy in its usage from Secondary Education onward), as this is the moment when the highly conceptual load of the curriculum calls for information comprehension and representation abilities. However, authors like Gil and Vicent (2009) and Gutiérrez (2016) highlight the importance of intervention strategies from early school years in order to reduce possible risks of later developing difficulties that are more specific. To this aim, an adaptation of Hypertext for Early Years and the first stage in Primary Education was developed, through a software tool called EPI-Pro which was devised in order to stimulate psycholinguistic abilities relating to lexical, syntactic and semantic processing (the key areas in comprehension and expression processes).

On the other hand, as Sung, Chang, and Huang (2008) point out, difficulties in implementing the reading strategies at school may be lessened through Technology (computers, tablet PCs, digital boards, etc.). Authors point at various advantages obtained through the introduction of computers and computerized systems when teaching to read. First, those systems may provide immediate individual feedback based on learning conditions. Second, computer-aided learning allows students to monitor their own learning pace. Third, through the different representations, motivation is reinforced. In their study with 130 year 6 students, Sung et al. (2008) observe that students significantly improve in the usage of efficient reading comprehension strategies through the implementation of a strategic program based on Mayer’s SOI. As for Early Years, no studies...
have been found that analyze the effectiveness of computer-based strategies on comprehension and expression, something understandable due to the difficulties in assessing those aspects at such early ages. Besides, only quite recently did computers reach classrooms in most Western countries, after which incorporating Technologies to schools and classrooms has been among the aims of educational systems. However, and despite the fact that digital boards are not yet habitual resources in everyday classes, some studies show that using these new technologies allows for an improvement in teaching and learning processes (Lazakidou & Retalis, 2010). All in all, as authors like Burin, Coccimiglio, González, and Bulla (2016) point out, it is not without criticism that the efficiency of new technologies is being viewed. For example, Purvis, Aspden, Bannister, and Helm (2011) stress that in order for new technologies to be really effective in teaching and learning processes they must bear in mind learning theories and those guidelines and activities that are required in order to fully back educational processes up.

Bearing in mind how beneficial programs implemented through new technologies are and how necessary interventions addressed at early school years are, the present study aims at analyzing the efficiency of EPL.com in the improvement of psycholinguistic and verbal processes. To this aim, apart from globally considering improvements in children aged 3–6, differences concerning three age groups (three, four and five-year-olds) are also considered, since EPL.com includes different functions according to developmental moment.

Method

Participants

Participants in this investigation are a total of 155 children, aged 3–6 (M = 4.185, SD = .824), 80 girls and 75 boys attending four schools in the Principality of Asturias (Spain). The sample is obtained by means of an intentional procedure and convenience sampling. Assigning the schools to one of the experimental conditions was done at random: Experimental Group (n = 93; follows the EPL.com intervention) and Control Group (n = 62; follows traditional methodology). The final sample comprises six classes at two schools having only one class per year as part of the EG and 6 classes at two schools having only one class per year as part of the CG.

Aiming at analysis of profiles according to students’ age, the sample is classified into three age groups: Group 1 (65 students, 33 boys y 32 girls aged between 3 and 3 years 11 months), Group 2 (55 students, 27 boys y 28 girls aged between 4 and 4 years 11 months), Group 3 (35 students 10 boys y 15 girls aged between 5 and 5 years 11 months).

No statistically relevant differences according to age were found among participants in the analysis F(1, 153) = .548, p = .460, η² = .004; nor the IQ F(1, 153) = .074, p = .786, η² = .000 between both functions (EG and CG); neither were significant differences found according to sex in the selected sample χ²(1) = .161, p = .688.

Instruments

The PEABODY picture vocabulary test (Dunn, Dunn, & Arribas, 2010) is aimed at adults and children aged 2.5 and up. It takes 10/20 min to assess verbal aspects through the test. To this aim it contains 192 flashcards showing four pictures each. The child must indicate which of the images best represents the meaning of a given word. In the original version of the test, Cronbach’s alpha shows values near .90, ranging from .80 to .99, with even/odd correlation values between .89 and .99 and test/retest reliability between .91 and .94.

The Illinois Test of Psycholinguistic abilities ITPA (Ballesteros & Cordero, 2011; Kirk, McCarthy, & Kirk, 1986) aims at assessing psycholinguistic functions. It allows a three/dimensional study of psycholinguistic profiles: communication channels, psycholinguistic processes and levels of organization. (1) communication channels are the routes through which communication contents flow. The ITPA incorporates auditory-vocal and visual-motor channels; (2) there are three main psychological processes involved in the acquisition and use of language: receptive, expressive and associative. The receptive process evaluates the aptitude required to recognize and/or understand what is seen or heard (visual and auditory comprehension); the expressive process evaluates the abilities needed to express ideas or respond verbally or through gesture (verbal and motor expression); and the associative process includes internal manipulation of perceptions, concepts and linguistic symbols (visual and auditory association); (3) Levels of organization may be automatic (grammatical and auditory integration, sequential auditory memory and sequential visual-motor memory) and representative (the sum of the tree psycholinguistic processes). All in all, the test provides information concerning eleven variables: auditory comprehension, visual comprehension, auditory association, visual association, verbal expression, motor expression, grammatical integration, visual integration, auditory integration, sequential auditory memory and sequential visual-motor memory. These variables are related to the three types of processing, which, though interdependent, are linked to association and expression at the lexical level, to comprehension at the lexical level and to integration at the syntactic level.

The original version of the test has a reliability index between .74 and .90, with a construct validity of .97 for the representative level and .99 for the automatic level. In this study, and with the sample used, the scores in the pretest are .973 for Cronbach α, .972 in the posttest, with McDonald ω of .993 and .992 for each (McDonald, 1999). In this sense, if any of the items were omitted, the improvement would represent an insubstantial variance, not less than .923. The value of the Average Variance Extracted obtained for the ITPA is .970, exceeding the recommended minimum (.70). On the other hand, the Composite reliability (CR) obtain values from .872 to .969, above the acceptable minimum (.50).

Intervention tool: EPL.com

The program EPL.com is a computerized tool deriving from an adaptation for pre-primary and primary education of the program Hypertexto (González-Pienda et al., 2008). This tool aims at stimulating information processing through the stimulation of psycholinguistic abilities relating to lexical, semantic and syntactic processing. Processing is understood as a weblike set of structures that are internally and externally related in such a way that any content will be more easily remembered if the interacting connectors are activated (González-Pienda et al., 2008). Understanding will not exclusively depend on how information in interpreted or constructed, but also on the way it is selected, related and transmitted, both verbally and in written form. Hence the importance of working on comprehension-expression processes as a single block, making students participate actively in translating, interpreting and extrapolating what is being learnt. To do this, a transformation of linear messages into interrelated web-like structures, hypertextlike, is required.

This transformation is produced and stimulated with EPL.com by integrating three fundamental aspects for comprehension: the representation, organization and integration of information. Those three aspects develop at the same time when using the EPL.com strategy. The representation of information starts with simple messages presented through images (iconic representation), images associated to words
hypertexts

Data analysis

Due to the objectives set for this study, Univariate (ANOVA) and Multivariate (MANOVA) Analyses of Variance were carried out, together with statistic descriptive analyses. First, differences between the Experimental Group (EG) and the Control Group (CG) were analyzed in terms of variables such as age, school year and sex. Differences are not statistically significant, so these variables were not included as covariate in the analyses following. The criterion used in interpreting effect sizes is that in the well-known work by Cohen (1988) which establishes that an effect is small when $\eta^2_p = .01$ (d = 0.20), medium when $\eta^2_p = .059$ (d = 0.50) and large if $\eta^2_p = .138$ (d = 0.80).

Results

Table 1 below shows the statistical descriptions of the variables included in the study. Prior to analysis of differences, variables were checked for a normal distribution. According to the criterion presented by Finney and DiStefano (2006), by which scores between 2 and −2 in asymmetry and 7 and −7 in kurtosis correspond to sufficiently normal distribution, we may conclude that all the variables included in the study show a normal distribution.

Differences in the pre-test were first analyzed, with no statistically significant results neither in the verbal aspects measured by means of the Peabody test $F(1, 153) = 1.53, p = .22$, $\eta^2_p = .001$ nor the psycholinguistic aspect measured using ITPA Wilks’ $\lambda = .967$, $F(11, 143) = .42, p = .035, \eta^2_p = .033$. Due to the absence of significant differences, these variables are not regarded as covariate in later analyses.

As regards post-test scores, they do not show statistically significant differences between the EG and the CG in verbal aspects (Peabody) $F(1, 153) = 3.479, p = .064, \eta^2_p = .022$, but they do in psycholinguistic aspects (ITPA) Wilks’ $\lambda = .454$, $F(11, 143) = 15.640, p < .001, \eta^2_p = .546$. The analyses of inter-subject effects show that those differences are found in all the ITPA variables (auditory comprehension, visual comprehension, visual memory, auditory association, auditory integration, verbal expression, grammatical integration, motor expression and auditory integration), as shown in Table 1. On the other hand, the size of the effects proved small (from lowest to highest -- auditory comprehension, auditory integration, motor expression, medium (visual association, visual comprehension, auditory association, visual memory), and even large (visual integration, verbal expression, grammatical integration). It is worth noting the grammatical integration variable, with a size of the effect of .24.
Table 1

Means and standard deviations for the pre-test and post-test variables in the PEABODY test and ITPA

<table>
<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th>Post-test</th>
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<tbody>
<tr>
<td></td>
<td>EG (n = 93)</td>
<td>CG (n = 62)</td>
</tr>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Peabody</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auditory Comprehension</td>
<td>41.78 (19.07)</td>
<td>40.59 (17.68)</td>
</tr>
<tr>
<td>Visual Comprehension</td>
<td>7.83 (3.93)</td>
<td>7.35 (4.27)</td>
</tr>
<tr>
<td>Visual Memory</td>
<td>2.05 (2.32)</td>
<td>1.93 (2.30)</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>7.81 (4.44)</td>
<td>7.38 (5.07)</td>
</tr>
<tr>
<td>Auditory Memory</td>
<td>3.95 (1.96)</td>
<td>3.77 (2.19)</td>
</tr>
<tr>
<td>Visual Association</td>
<td>5.67 (4.96)</td>
<td>5.30 (5.40)</td>
</tr>
<tr>
<td>Visual Integration</td>
<td>13.47 (4.73)</td>
<td>12.67 (5.47)</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>15.41 (8.58)</td>
<td>14.58 (9.18)</td>
</tr>
<tr>
<td>Grammatical Integration</td>
<td>7.17 (4.16)</td>
<td>6.83 (4.59)</td>
</tr>
<tr>
<td>Motor Expression</td>
<td>11.77 (5.19)</td>
<td>11.06 (5.80)</td>
</tr>
<tr>
<td>Auditory Integration</td>
<td>6.30 (4.39)</td>
<td>5.61 (4.60)</td>
</tr>
</tbody>
</table>

M: mean; SD: standard deviation; EG: Experimental Group; CG: Control Group.

* p < .05.
** p < .01.
*** p < .001.

Age-based profiles

This study also aims at testing the efficiency of the tool in three age groups: Group 1 (aged 3), Group 2 (aged 4), and Group 3 (aged 4). With regard to Group 1, differences between the GE (n = 38) and the CG (n = 27) are statistically significant Wilks’ Λ = .412, F(12, 52) = 6.189, p < .001, η²p = .588. The analyses show that those differences do not appear in the Peabody results, though they are present in all the variables in the ITPA (see Table 2), with medium-sized effects (from smallest to largest – auditory integration, motor expression, auditory comprehension, visual comprehension and auditory memory) and large effects (auditory association, visual memory, visual association, verbal expression, visual integration and grammatical integration).

As for Group 2, differences between the GE (n = 32) and the CG (n = 23) are statistically significant Wilks’ Λ = .299, F(12, 42) = 8.217, p < .001, η²p = .701. The analyses show that those differences do not appear in the Peabody results nor in three ITPA variables (auditory comprehension, motor expression and auditory integration). Statistically significant differences appear in the rest of variables, with sizes of effect that are medium (from smallest to largest – auditory memory, visual memory, visual comprehension, auditory association and visual association) and large (visual integration, verbal expression, grammatical integration).

Finally, in Group 3, differences between the GE (n = 12) and the CG (n = 23) are again statistically significant Wilks’ Λ = .205, F(12, 22) = 7.094, p < .001, η²p = .795. The analyses show none of those differences in the Peabody test nor in four of the ITPA variables (auditory comprehension, visual memory motor expression and auditory integration). The differences are statistically significant in the remaining variables, with sizes of effect that are medium (from smallest to largest – auditory memory and visual association) and large (auditory association, visual integration, visual comprehension, verbal expression and grammatical integration). As can be observed by considering the effects sizes, the variable with the largest explicative power is grammatical integration, with a large size of effect in all cases.

Discussion

This paper aims at analyzing the effectiveness of the computerized tool EPL.com in improving psycholinguistic and verbal processes in 155 pre-school students. Results show a significant improvement in psycholinguistic aspects on the part of those using the tool. It may be concluded that the strategy EPL.com proves to be effective in interventions on those aspects, hence the importance of implementing interventions at early ages which lay the foundation for future learning. Besides, although the improvement in verbal aspects is not significant, the means observed show higher scores in the EG than in the CG.

Considering the age of participants in the research, detecting a positive evolution is particularly relevant. Authors like González-Valenzuela, Martín-Ruiz, and Delgado-Río (2012) or Gutiérrez (2016) point at the relevance on early-age interventions. However, in pre-school education, students maturity levels is not sufficient at the instrumental level allowing for this type of interventions. Through an adaptation of Hypertext to Pre-School Education with the EPL.com program, an intervention is possible, which, in the sample used, shows an improvement in psycholinguistic processes. To be more precise, the interpretation of significance and the sizes of effect allows us to detect an improvement both in the variables relating to comprehension and in the students’ expression (variables such as visual and auditory comprehension, grammatical integration, etc.).

Although similar investigations in pre-school education have not been found, these results are compatible with those in studies like the one by Sung et al. (2008), who observe positive results when dealing with reading comprehension in primary school children through a strategic program based on Mayer’s SOI model. EPL.com is developed under the logic of Mayer’s model, and, as the author claims (Mayer, 2008), the process leading to significant learning depends both on the way the student processes information and on the material being presented. Thus, promoting learning depends both on improving the way students process information and on the way materials are presented. It is therefore relevant for the program to allow for adequate structures in which information is adapted by means of iconic representation to the student’s level from age 3. Besides, simple content and wording are selected, which facilitate their structuring into processing networks from that age, progressively sequencing difficulty levels.

Results are also analyzed according to three age groups (3, 4, 5-year olds). The evolution observed proved more positive among the youngest students, since in that age group all the variables show a significant evolution. This may be linked to the way iconic information is presented, which, according to Barner, is the most appropriate for information processing during early childhood (Bruner, Goodnow, & Austin, 2001).
It's worth noting that, both in the analyses with the whole sample and in those by age groups, effect sizes are systematically larger in three variables: visual integration, verbal expression and grammatical integration, the last of which presents the largest effect size. These results point at a more positive evolution in semantic processing (variables such as visual comprehension) and also in syntactic processing (visual, grammatical... integration), as opposed to lexical processing. The lack of differences in verbal aspects (assessed by means of the Peabody Vocabulary Test), may be associated to a greater emphasis on these abilities on the part of the educational system, resulting in no significant differences between the Control Group and the Experimental Group.

It is finally necessary to highlight some limitations that should be addressed in future work. It must be stated that no advice from the corresponding Ethics Committee was sought. It is also worth noting that sample sizes by groups and age levels is limited, thus conditioning the generalization of the results obtained and the scope of the conclusions reached. Besides, the execution process is not analyzed and the effectiveness of the program is not compared to that of other computerized programs in order to check the benefit that using new technologies may bring by itself.

As for future lines of work, it might be convenient to include an evaluation of the process students perform when under the strategy. On the other hand, a Reading comprehension test for students aged 5–6, who have already started with the reading processes, should be included. Besides, since a pen-and-paper version of the strategy is also available, an analysis of the effectiveness of the program according to the format used (computerized or pen-and-paper) would provide a deeper insight into the effectiveness of the computerized strategy. Finally, it would be interesting to observe the benefits achieved when incorporating the tool, not only to the educational sphere, but to the family sphere too, as it might come to reinforce the acquisition of comprehension and expression abilities.

References


Table 2

Means and standard deviations for the three age groups in the Peabody and IPTA variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Comprehension</td>
<td>6.86(3.80)</td>
<td>5.46(4.22)</td>
<td>5.64(4.03)</td>
</tr>
<tr>
<td>Visual Comprehension</td>
<td>6.97(4.52)</td>
<td>6.61(4.13)</td>
<td>6.67(4.14)</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>7.26(4.22)</td>
<td>6.93(4.44)</td>
<td>7.05(4.16)</td>
</tr>
<tr>
<td>Auditory Memory</td>
<td>7.62(4.29)</td>
<td>7.33(4.14)</td>
<td>7.39(4.12)</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>8.41(4.27)</td>
<td>7.85(4.10)</td>
<td>7.87(4.10)</td>
</tr>
<tr>
<td>Visual Association</td>
<td>7.22(5.01)</td>
<td>6.77(4.80)</td>
<td>6.79(4.81)</td>
</tr>
<tr>
<td>Grammatical Integration</td>
<td>10.02(4.50)</td>
<td>9.40(4.69)</td>
<td>9.44(4.66)</td>
</tr>
<tr>
<td>Motor Integration</td>
<td>3.20(3.90)</td>
<td>2.98(3.40)</td>
<td>2.88(3.36)</td>
</tr>
<tr>
<td>M: mean, SD: standard deviation, EG: Experimental Group, CG: Control Group</td>
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* p < .05  ** p < .01


