AULA Virtual Reality based attention test: factorial validity and convergent validity with EDAH scale and DSM criteria

Background

AULA is a Virtual Reality based neuropsychological test for evaluating attention and support ADHD diagnosis in children between 6 and 16 years-old (Díaz-Orueta et al. 2012, 2014; Zulueta et al., 2013), with high test-rest reliability (Fernández-Fernández et al., 2012), sensitivity and specificity (Rufo et al., 2012). It is a test based on a CPT paradigm with different tasks and distracting conditions, presented in a virtual scenario of a school classroom (Climent & Banterla, 2011).

AULA is composed by 2 main exercises:
- A No-X paradigm based exercise: “Press the button when you DO NOT see or hear apple”.
- An X paradigm based exercise: “Press the button whenever you DO see or hear seven”.

Stimuli are presented both on a visual basis (on the classroom blackboard) and on an auditory basis (the patient listens to them with the headphones); and, at the same time, visual, auditory or combined distractors of ecological nature (i.e. equal to those that may appear in a real classroom environment), are presented.

Objective

The objective of the current study was to study the factorial validity of AULA and its convergent validity with EDAH scale and DSM-IV criteria.

Sample and Method

Two exploratory factorial analyses of the 18 main variables of AULA were performed with 2074 children from different Spanish schools and clinical centres. Both a 1-dimensional structure and a 3-dimensional structure (accounting for aspects of inattention, impulsivity and hyperactivity —see table) were explored, by means of ULS (Unweighted Least Squares) method.

For the convergent validity analysis with EDAH and DSM-IV, ADHD subsamples of 188 and 360 children were respectively analyzed, performing cosine similarity analyses.

Part I: Factorial Validity Analysis

Eighteen studied variables tend to saturate a single factor (F-values from .527 to .946). When three factors are extracted, 2 of them clearly appear as residual dimensions. The adequacy of the variables correlation matrix was analyzed in order to perform the factorial analysis (Barlett = 55505.0, P < 0.00001; Kaiser-Meyer-Okin = 0.89), indicating a good data adjustment (RMSEA = 0.071; GFI = 0.98), with a total explained variance of 66% for the single dimension.

AULA main indexes

<table>
<thead>
<tr>
<th>Description</th>
<th>Related to</th>
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<tbody>
<tr>
<td>Omission errors</td>
<td>Inattention</td>
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<tr>
<td>Commission errors</td>
<td>Impulsivity</td>
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<tr>
<td>Reaction time</td>
<td>Processing speed</td>
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<tr>
<td>Variability in reaction time</td>
<td>Sustained attention, surveillance</td>
</tr>
<tr>
<td>Motor activity</td>
<td>Hyperactivity</td>
</tr>
<tr>
<td>Quality of attention focus</td>
<td>Inattention</td>
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</tbody>
</table>

Part II: Convergent validity with EDAH and DSM

Results show low to moderate correlations between AULA and EDAH, being the highest correlations for inattention (from .406 to .544): between AULA and DSM-IV, the highest correlation values are also for inattention (from .379 to .473).

Conclusion

Results support the structure of AULA of one single factor that comprises the cognitive variables correlating with ADHD in any of its subtypes.

With regards to convergent validity, different nature of AULA as an objective cognitive measure and EDAH and DSM-IV as observational scales: suggest they target different aspects or dimensions of patients’ behaviour and, hence, they may complement each other in the increase of ADHD diagnosis accuracy. Future analysis of the data will require to establish a relationship between AULA indexes and EDAH and DSM-IV items one by one, in order to establish more accurate relationships between objective and observational data.