The Use of a Novel Anatomical Mental Rotation Test to Enhance Understanding of Repetitive Visual-Spatial Training on Learning Outcomes in a Human Anatomy Course.

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Introduction

This study addresses the importance of visual-spatial abilities for medical trainees as they learn human anatomy and aims to improve understanding of how visual-spatial ability transfers to an anatomy learning context.

The specific aims of this study are:

- Create and validate a novel Anatomical-based Mental Rotation Test (AMRT) that can be utilized as a subject-specific cognitive test.
- Establish if visual-spatial ability can be improved by repetitions (13-15X) and short-term (5 minutes) training that is either anatomy figure focused or abstract-figure focused.

Methods

- **Study Population**: University of Colorado-Anschutz Medical Campus graduate students and anatomy education colleagues who completed an Informed Consent Form (N = 69).
- **AMRT Scoring**: Same scoring as MRT.
- **Visual-Spatial Testing**: The Vandenberg and Kuse Mental Rotation Test (MRT), a general spatial ability test, is used to predict an accurate success of visual-spatial training.
- **Abstract Intervention**: 125 - 15X, each < 5 minutes
- **Anatomical Intervention**: 125 - 15X, each < 5 minutes

Results

There was a significant increase (p = .005) in the lab exam scores of the control group compared to the lab exam scores of the anatomical intervention group.

- **May have been a result of the control group forming by fall-out participants.**

By interspersing, no other significant difference (p > .05) was found between exam scores and initial and final AMRT score (Fig. 4) and no correlation was found between AMRT scores and exam scores.

Conclusions

- **Results indicate that the novel AMRT developed has concurrent validity with the well-validated MRT.**

- **Neither visual-spatial training intervention had an impact on the learning outcomes in human anatomy or visual-spatial ability as indicated by exam scores and changes in AMRT scores.**

This study does not support the processed-based theory of learning transfer; there is some support for the instance-based theory since an overall increase in AMRT scores is observed.

Limitations

- **Population tested all completed at least some graduate level course-work, thus results from this study are limited to graduate level students and beyond.**
- **AMRT scores may have been impacted by amount of times participants had taken anatomy courses prior.**
- **Intervention groups tested were small due to limited testing population size.**
- **Spatial visual training was short term and only took place during one unit of the full anatomy course.**
- **The control group during the intervention formed automatically by fall-outs, this may have skewed results because control participants may have felt they did not need supplemental training because they were already at a high level of anatomy knowledge from past experiences.**

Future Directions

- **Further testing of the AMRT should be done to determine the effectiveness of this test at predicting anatomy outcomes.**
- **More visual-spatial training interventions of longer time lengths should be tested to better understand transfer of this cognitive ability to anatomical science education.**
- **Other spatial abilities that relate to human anatomy should be considered in future studies.**

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References


Materials

- **Spatial-based theories**: Visual-spatial training is validated in a similar cogntive task because related skills are assessed through practice, enhancing cognitive ability.
- **Distance-based theories**: Visual-spatial tasks are solved by recalling previously stored information about that same task and then reproducing the task as a result of enhancing retrieved mechanisms.

Results

**Correlation Between MRT and AMRT**

Results indicated a significant positive correlation (r = 0.500) between MRT and AMRT scores for all participants (p < 0.05). The positive correlation was maintained across all subgroups (sex, age, past work experience, and previous visual-spatial ability).

**AMRT by Prior Spatial Learning Experience**

No significant differences (p > 0.05) were found between AMRT scores across sex, age, or prior work experience.

**AMRT by Self-Perceived Spatial Ability**

No significant differences (p > 0.05) were found between AMRT scores across sex, age, or prior work experience.

**AMRT Test Scores by Intervention Groups**

Aim 1: Results indicate that the novel AMRT developed has concurrent validity with the well-validated MRT.

Aim 2: Neither visual-spatial training intervention had an impact on the learning outcomes in human anatomy or visual-spatial ability as indicated by exam scores and changes in AMRT scores.

Aim 3: Neither visual-spatial training intervention had an impact on the learning outcomes in human anatomy or visual-spatial ability as indicated by exam scores and changes in AMRT scores.