Mindprint - Math - 7 bins

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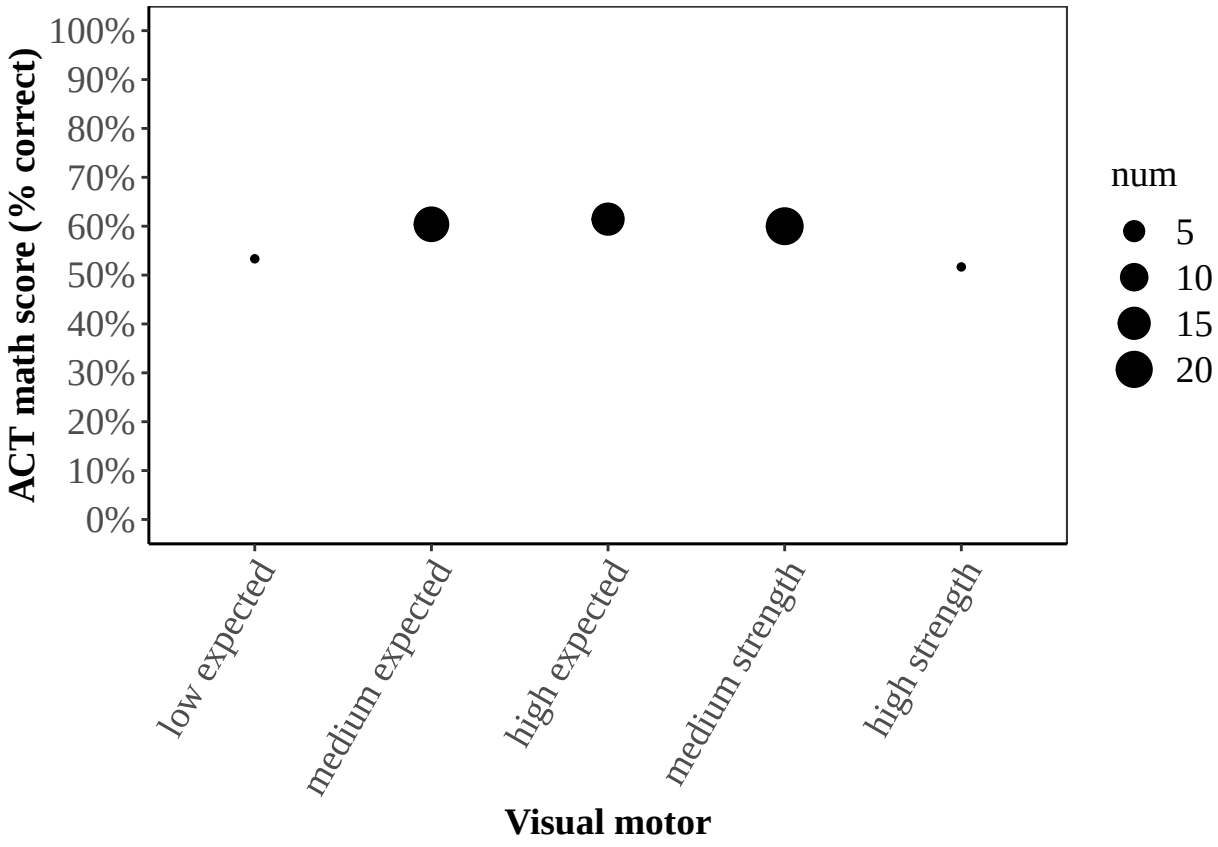
2018-08-05

Contents

ACT Math (n = 61) | 7 bins

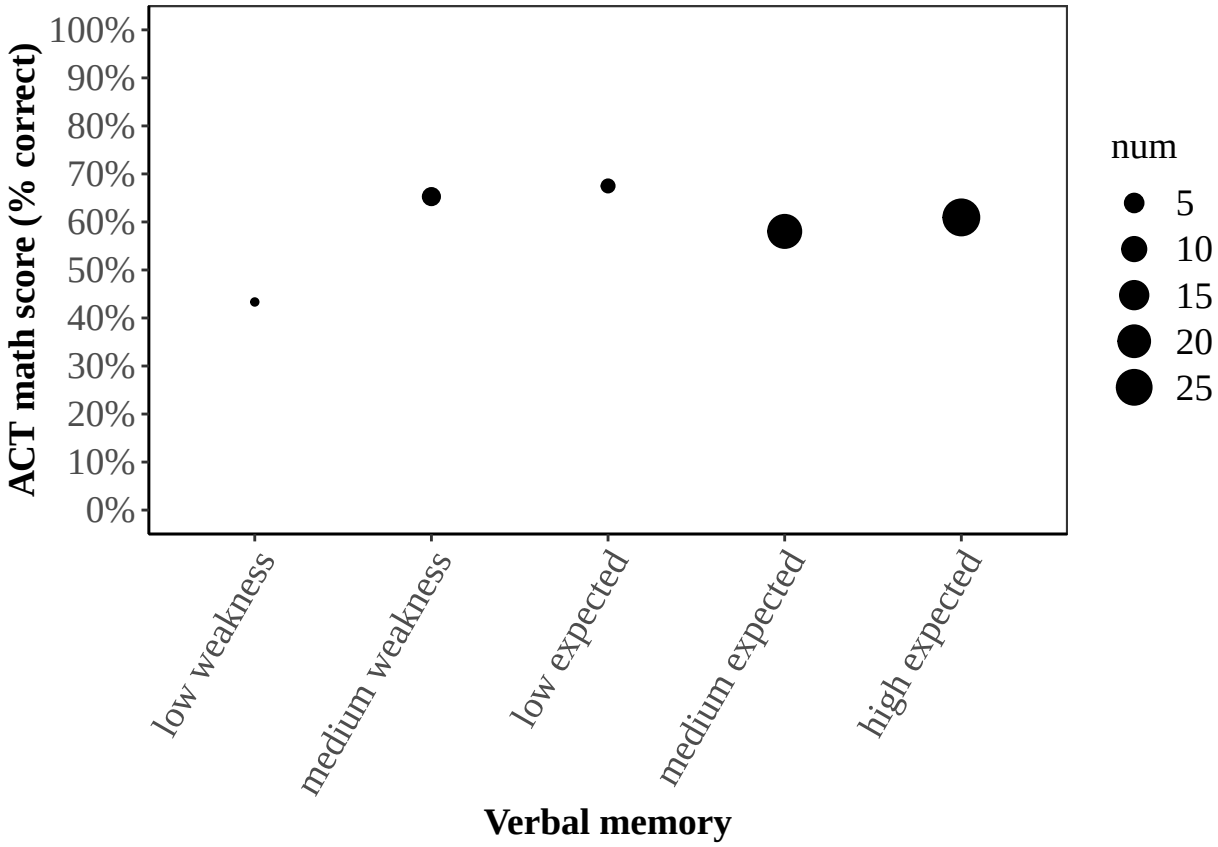
Overall score

Visual motor



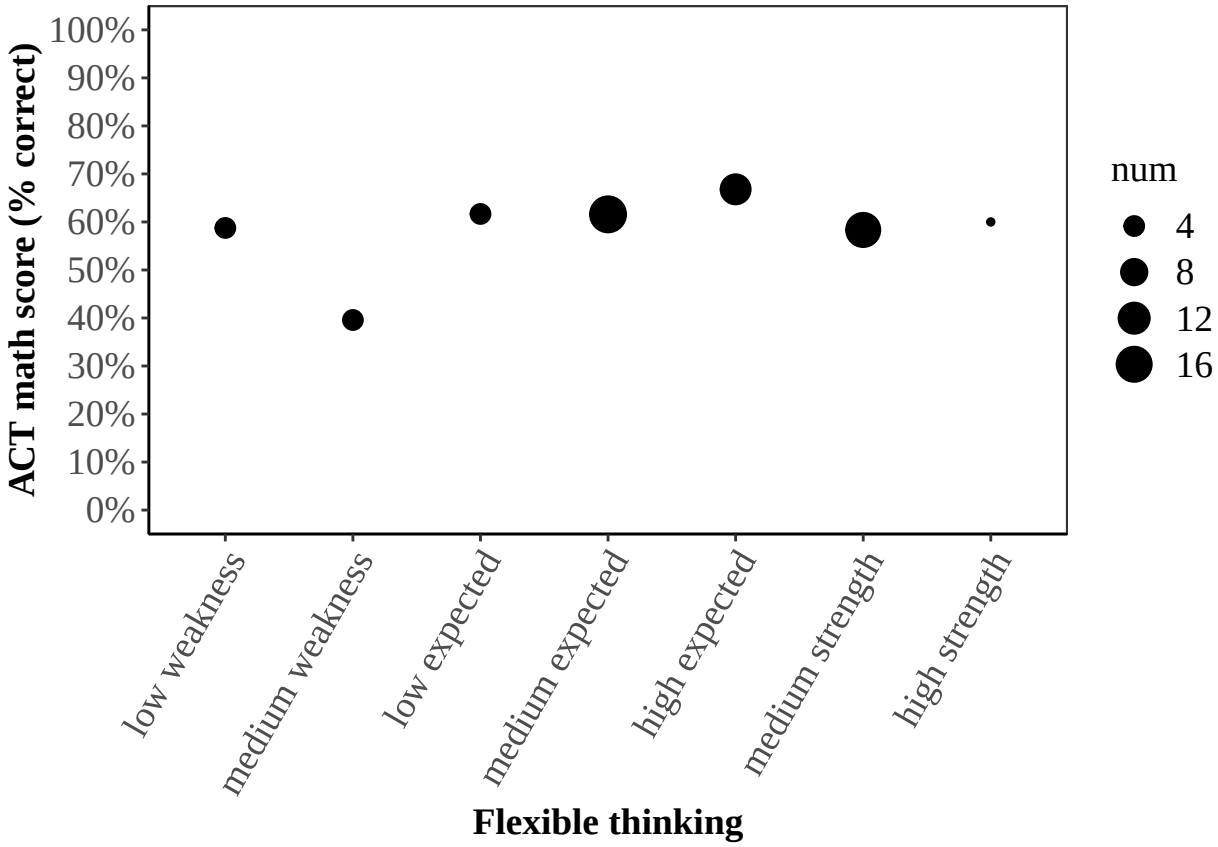

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = -0.22827, df = 3, p-value = 0.8341
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.9082286  0.8495387
## sample estimates:
##        cor
## -0.1306599
```

Verbal memory



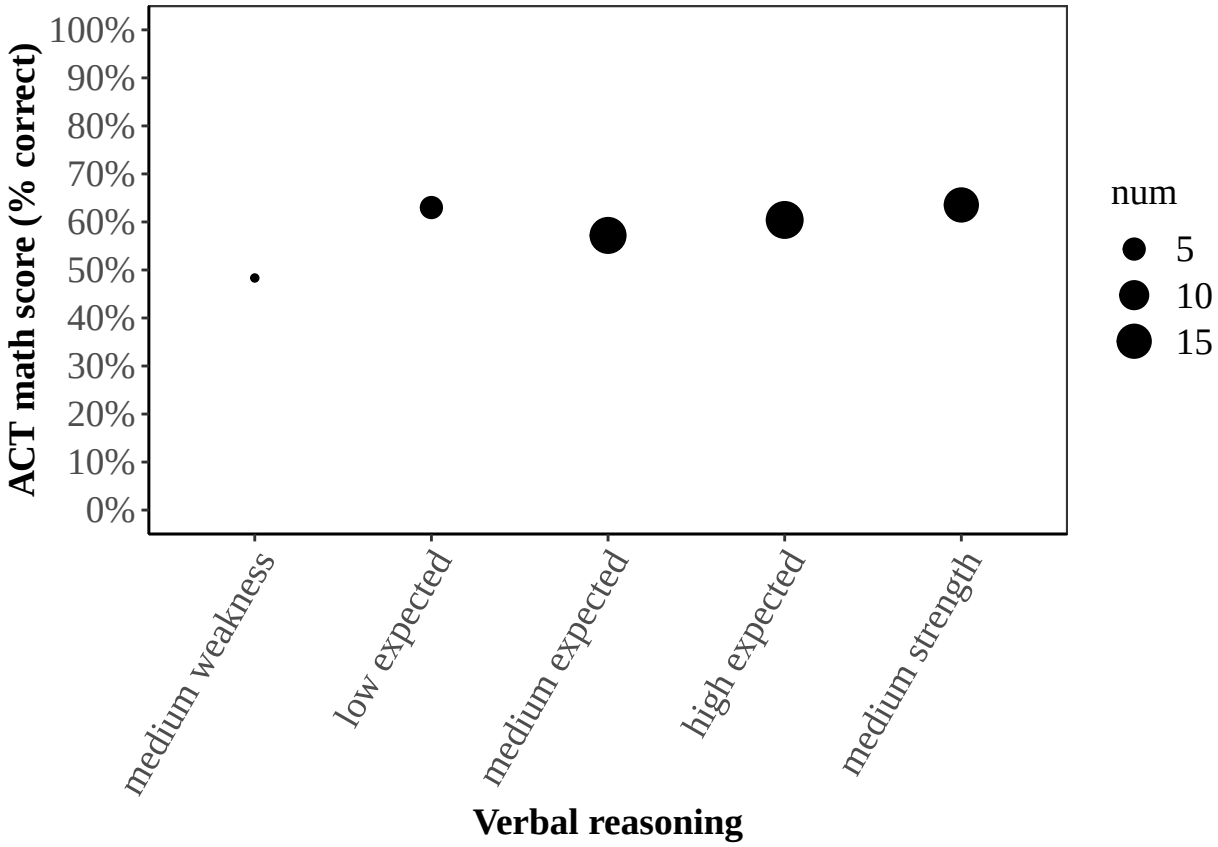

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.90991, df = 3, p-value = 0.43
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.7074919  0.9553437
## sample estimates:
##       cor
## 0.4650687
```

Flexible thinking



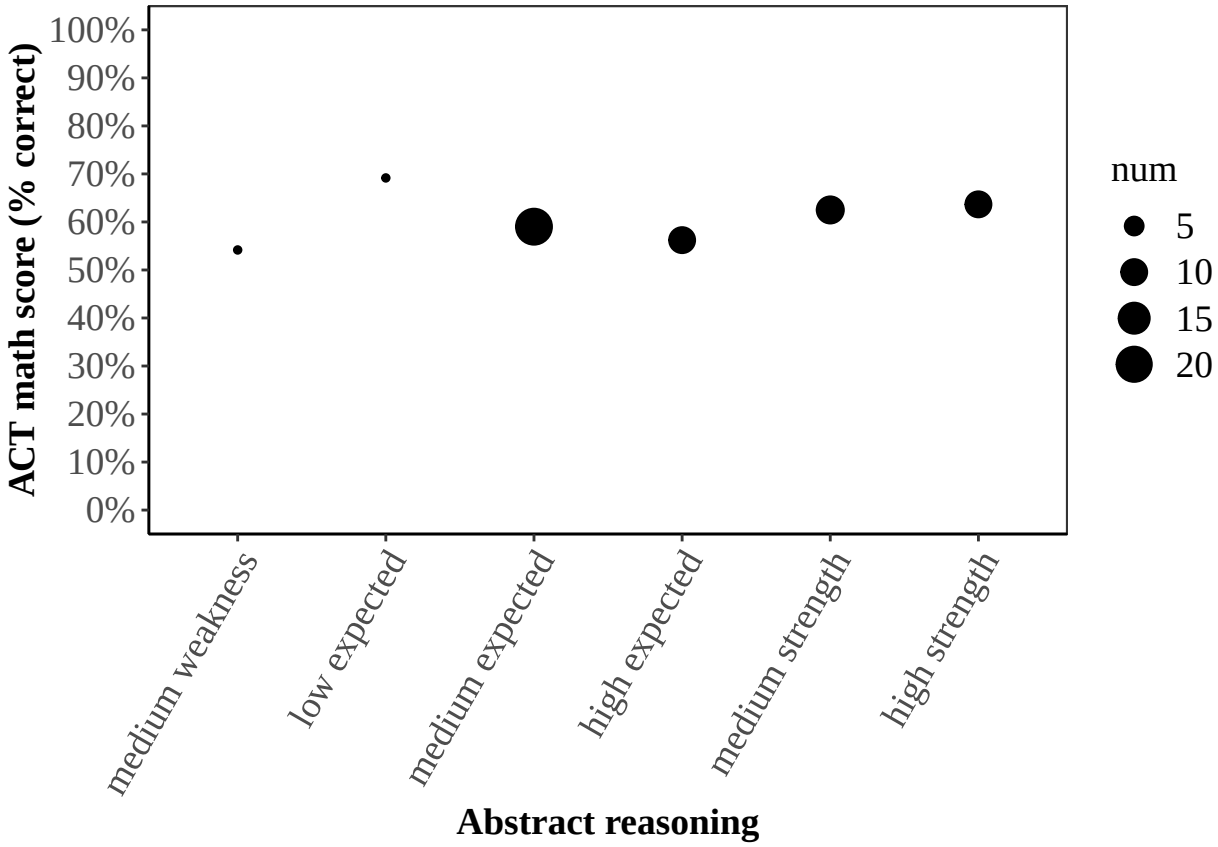

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 1.0181, df = 5, p-value = 0.3554
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.4923164  0.8897763
## sample estimates:
##       cor
## 0.4143643
```

Verbal reasoning



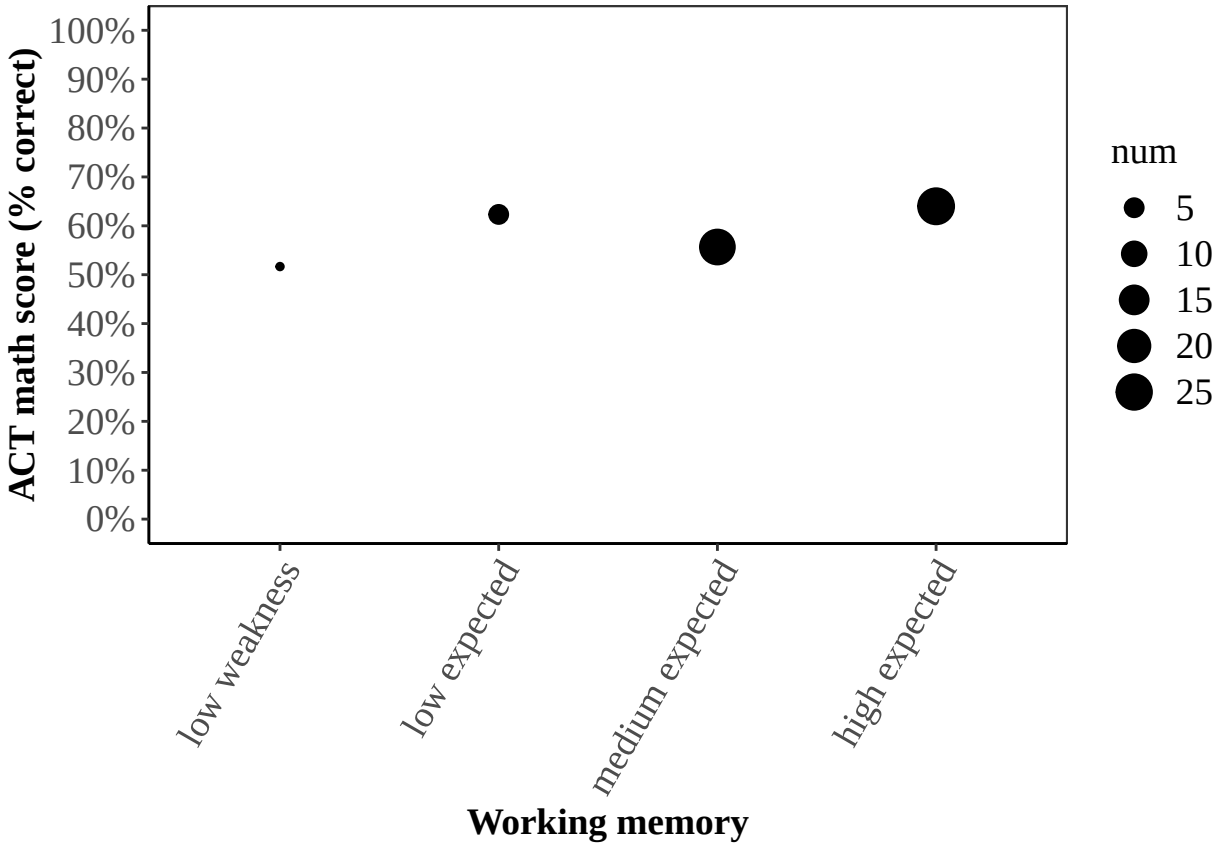

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 1.738, df = 3, p-value = 0.1806
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.4637769  0.9788659
## sample estimates:
##       cor
## 0.7083136
```

Abstract reasoning



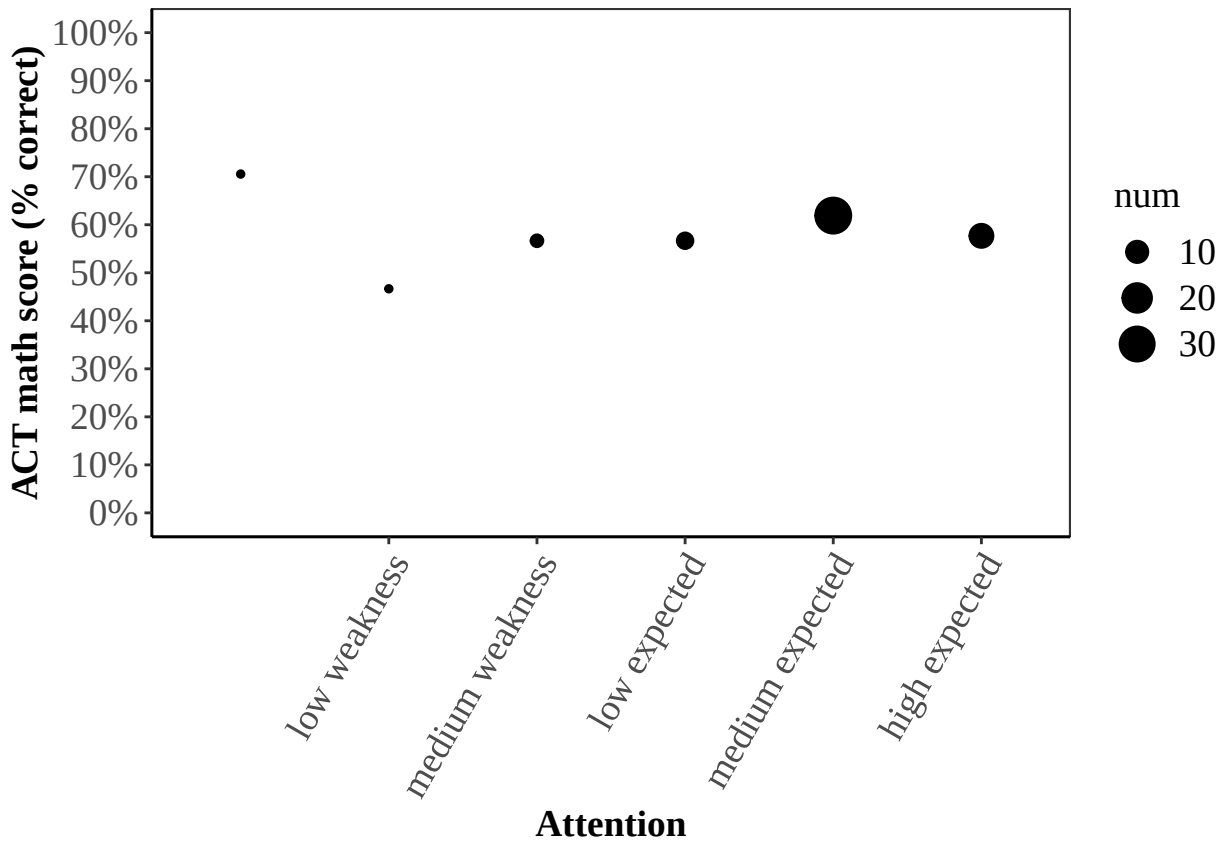

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.49784, df = 4, p-value = 0.6447
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.7089996  0.8805031
## sample estimates:
##      cor
## 0.241547
```

Working memory



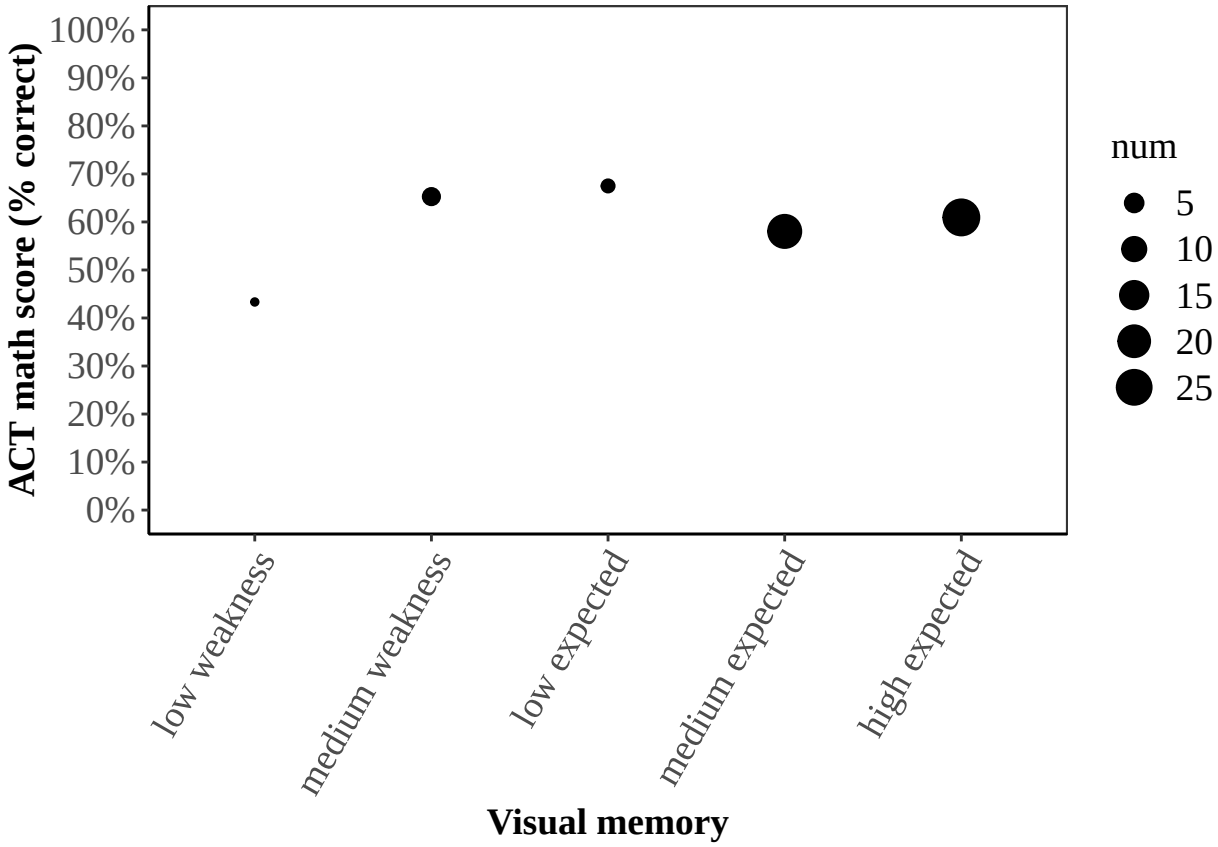

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 1.5665, df = 2, p-value = 0.2577
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.7634653  0.9941464
## sample estimates:
##     cor
## 0.74226
```

Attention



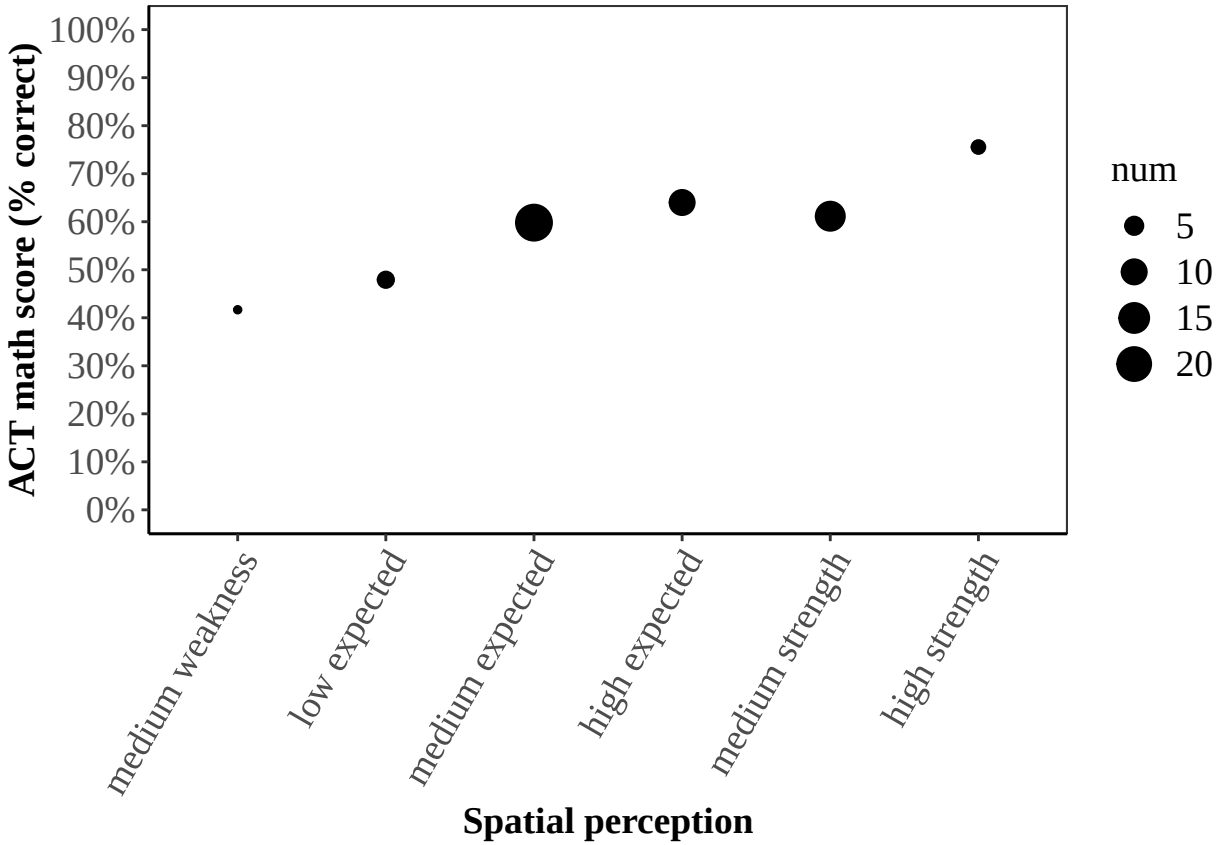

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = -0.25705, df = 4, p-value = 0.8098
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.8509971  0.7630244
## sample estimates:
##       cor
## -0.127474
```

Visual memory




```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.90991, df = 3, p-value = 0.43
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.7074919  0.9553437
## sample estimates:
##       cor
## 0.4650687
```

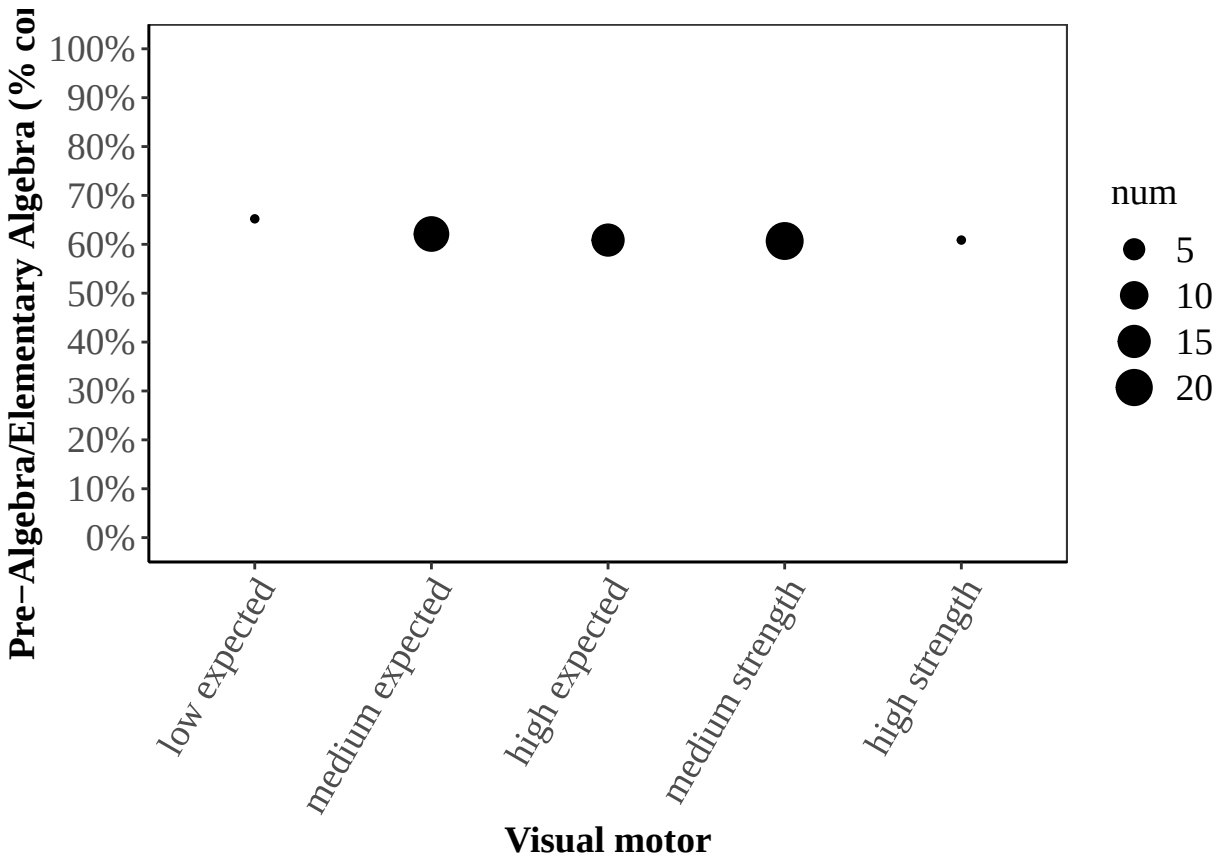
Spatial perception (p = 0.004, r = 0.95)




```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 5.8891, df = 4, p-value = 0.004157
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.5844392 0.9943403
## sample estimates:
##       cor
## 0.9468851
```

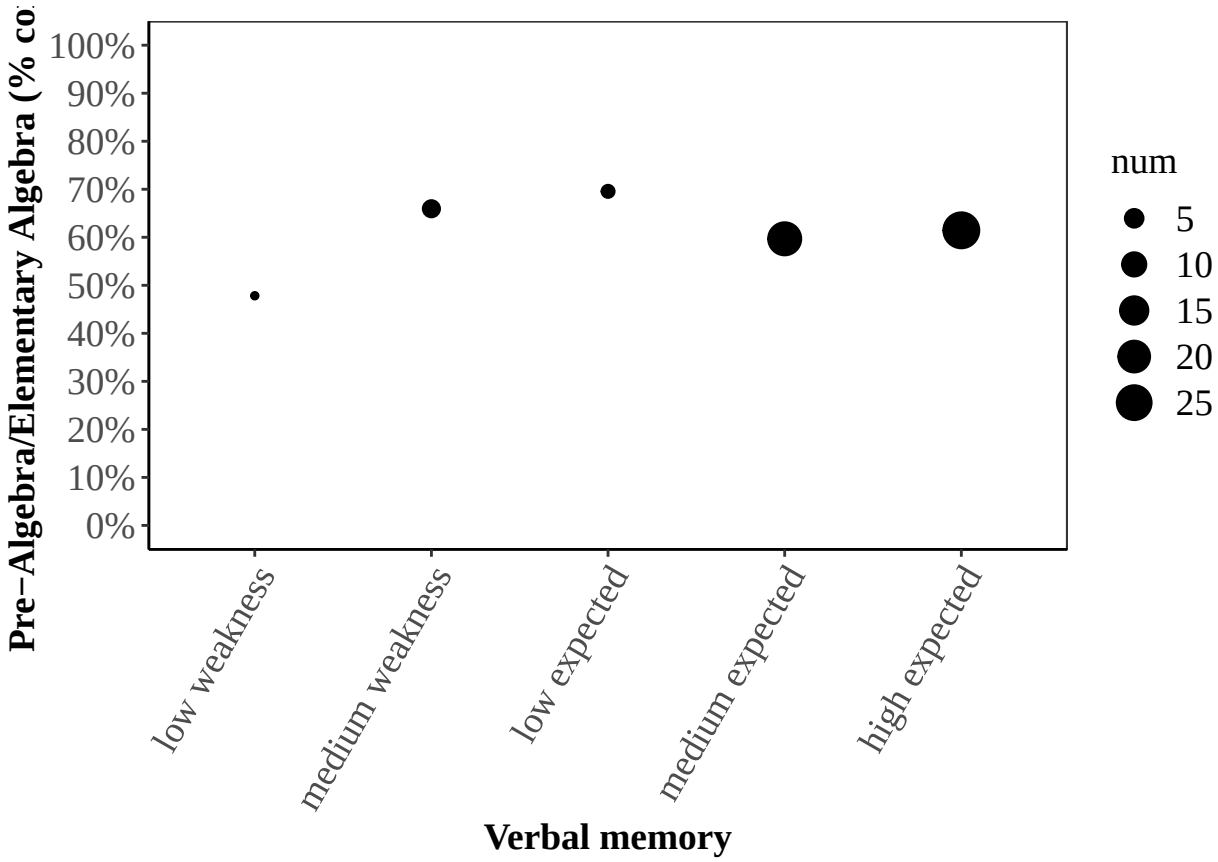
EA/ Pre-Algebra/Elementary Algebra Subsection

Visual motor



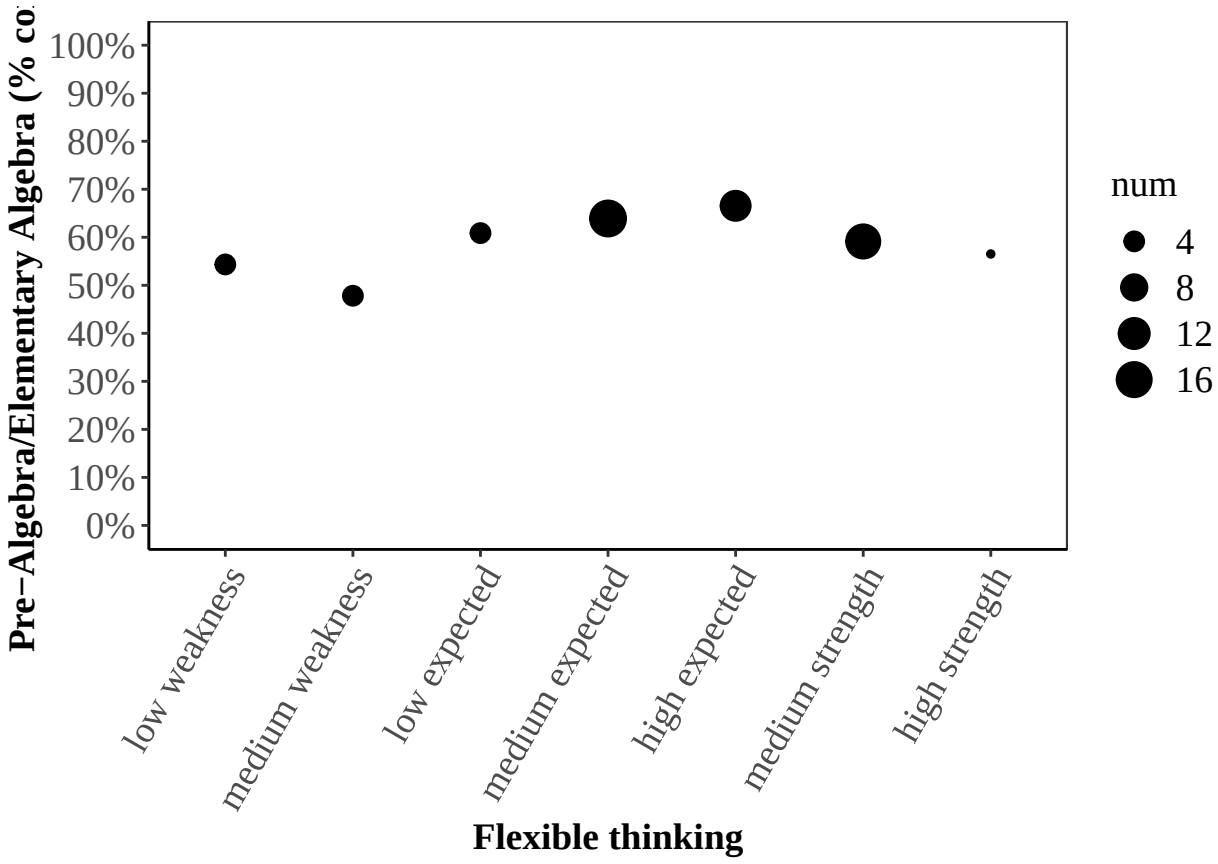

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = -2.6465, df = 3, p-value = 0.07723
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.9889412  0.1739534
## sample estimates:
##       cor
## -0.8367285
```

Verbal memory



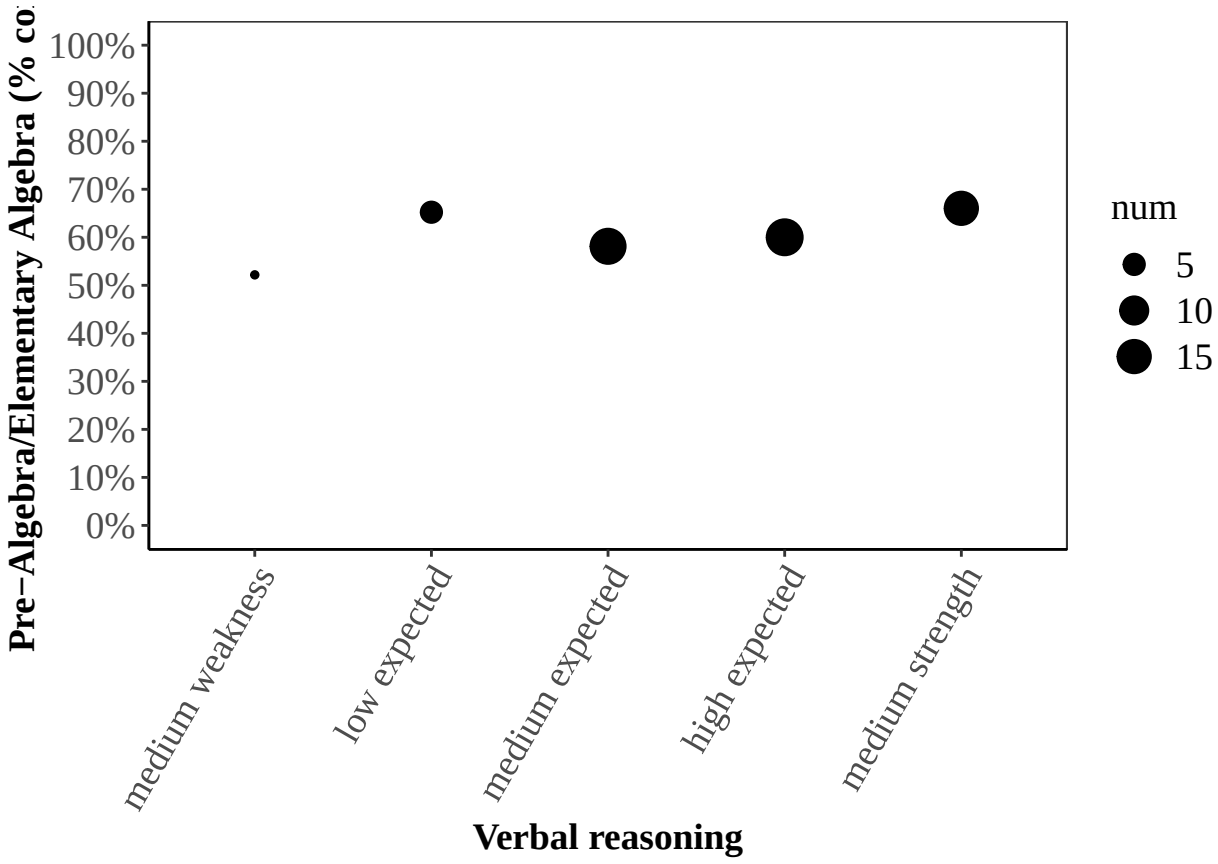

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.75938, df = 3, p-value = 0.5028
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.7444681  0.9479718
## sample estimates:
##       cor
## 0.4015328
```

Flexible thinking



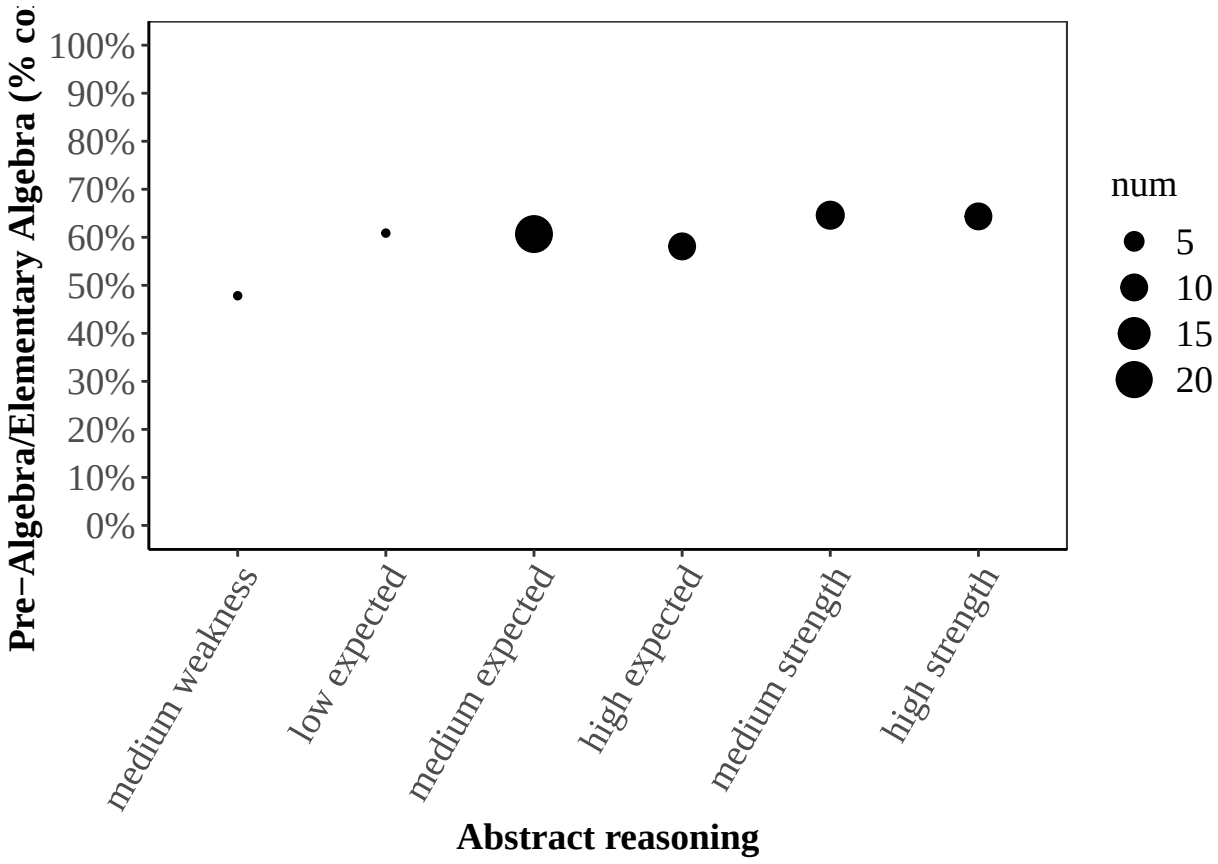

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 1.0618, df = 5, p-value = 0.3369
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.4787487  0.8934164
## sample estimates:
##       cor
## 0.4289608
```

Verbal reasoning



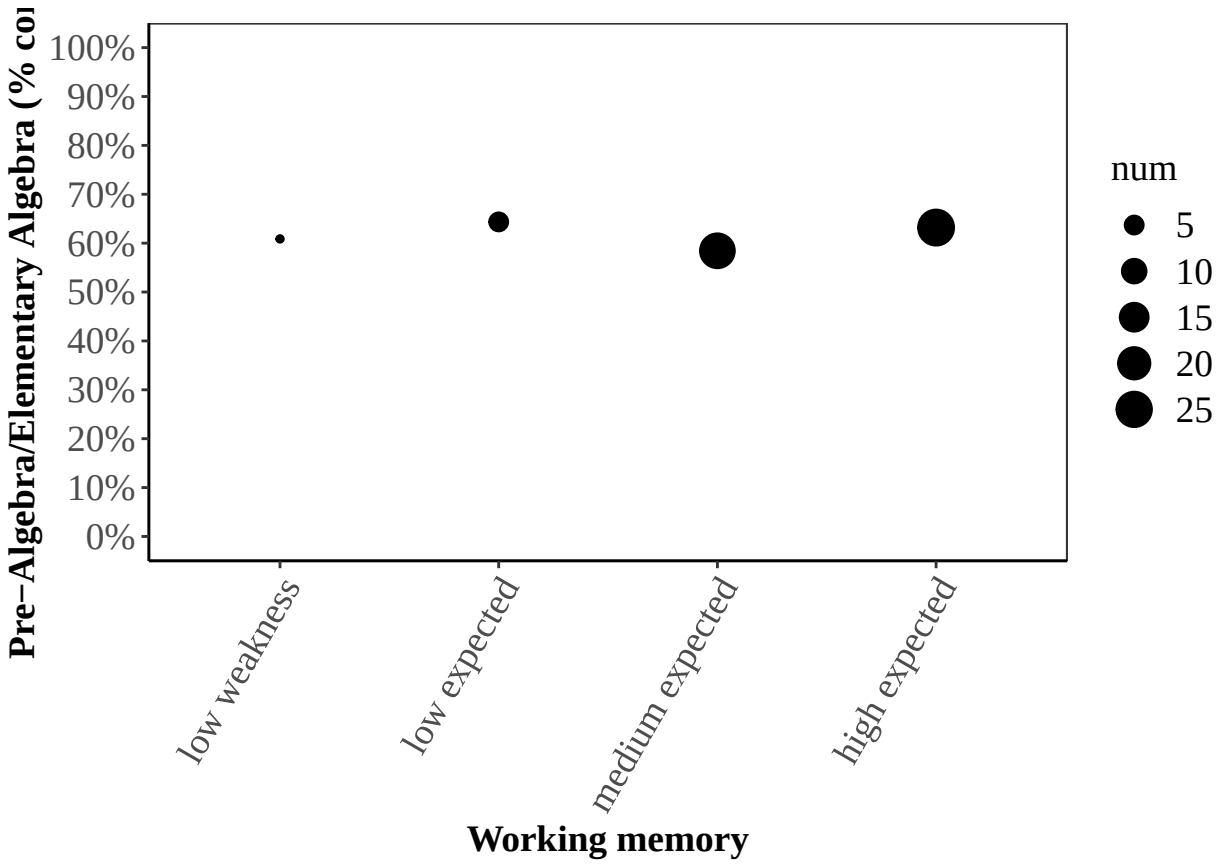

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 1.4019, df = 3, p-value = 0.2555
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.5689207  0.9719216
## sample estimates:
##      cor
## 0.629132
```

Abstract reasoning



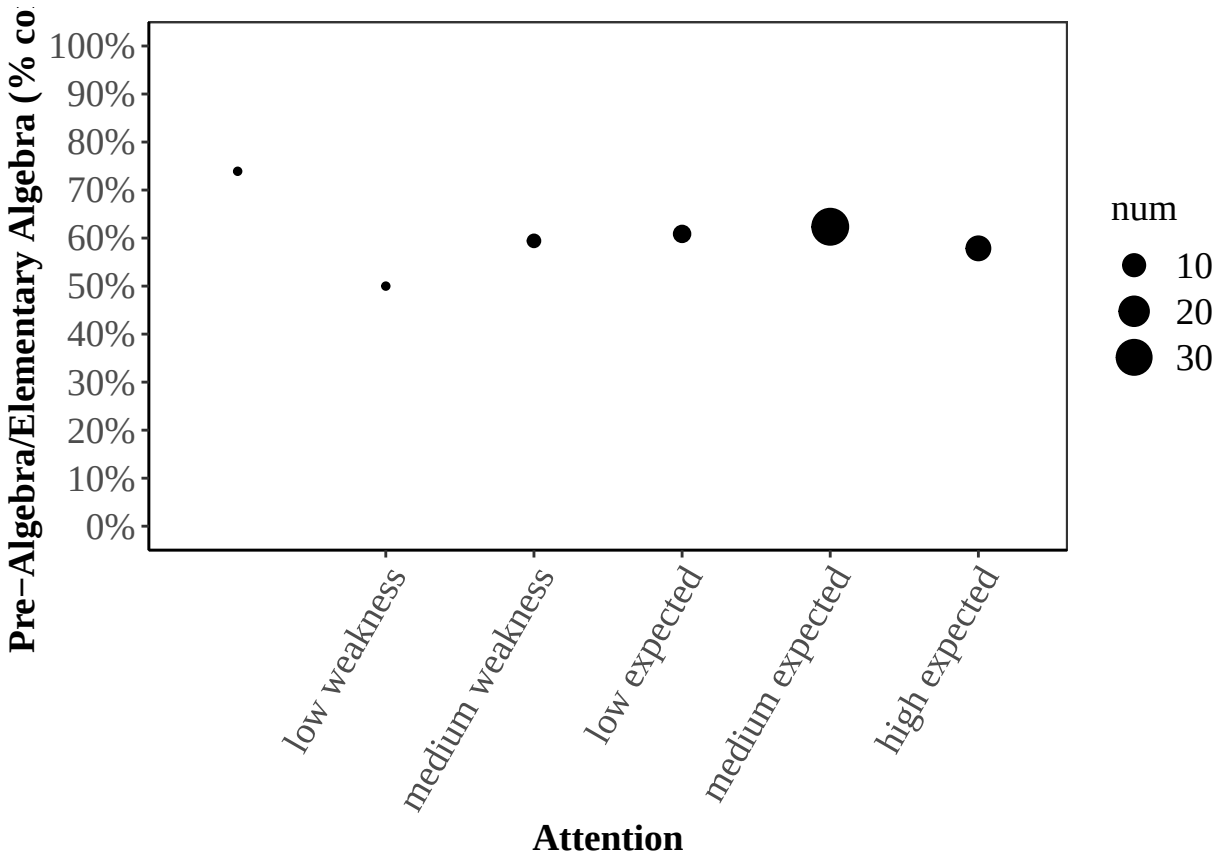

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 2.5694, df = 4, p-value = 0.06202
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.06243007  0.97577475
## sample estimates:
##       cor
## 0.7891122
```

Working memory



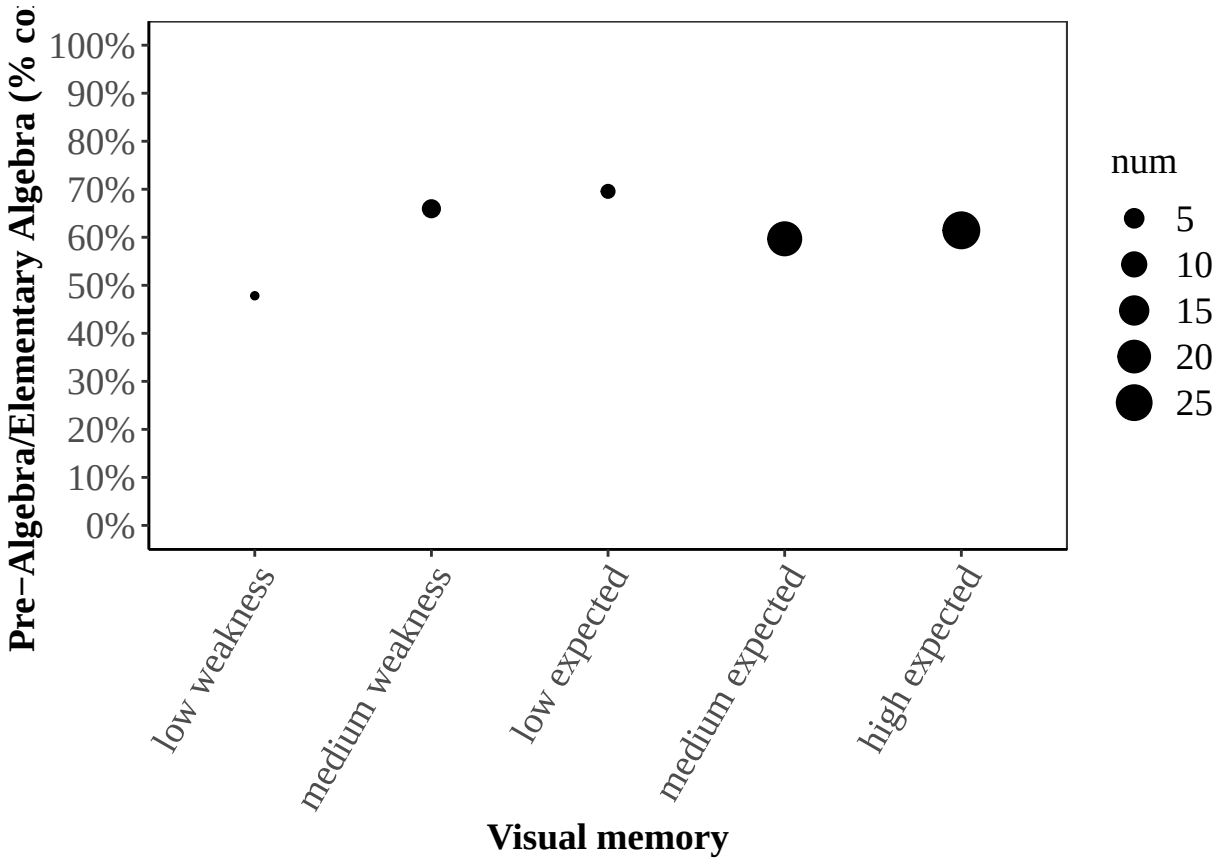

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.14433, df = 2, p-value = 0.8985
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.9525017  0.9681460
## sample estimates:
##      cor
## 0.101527
```

Attention



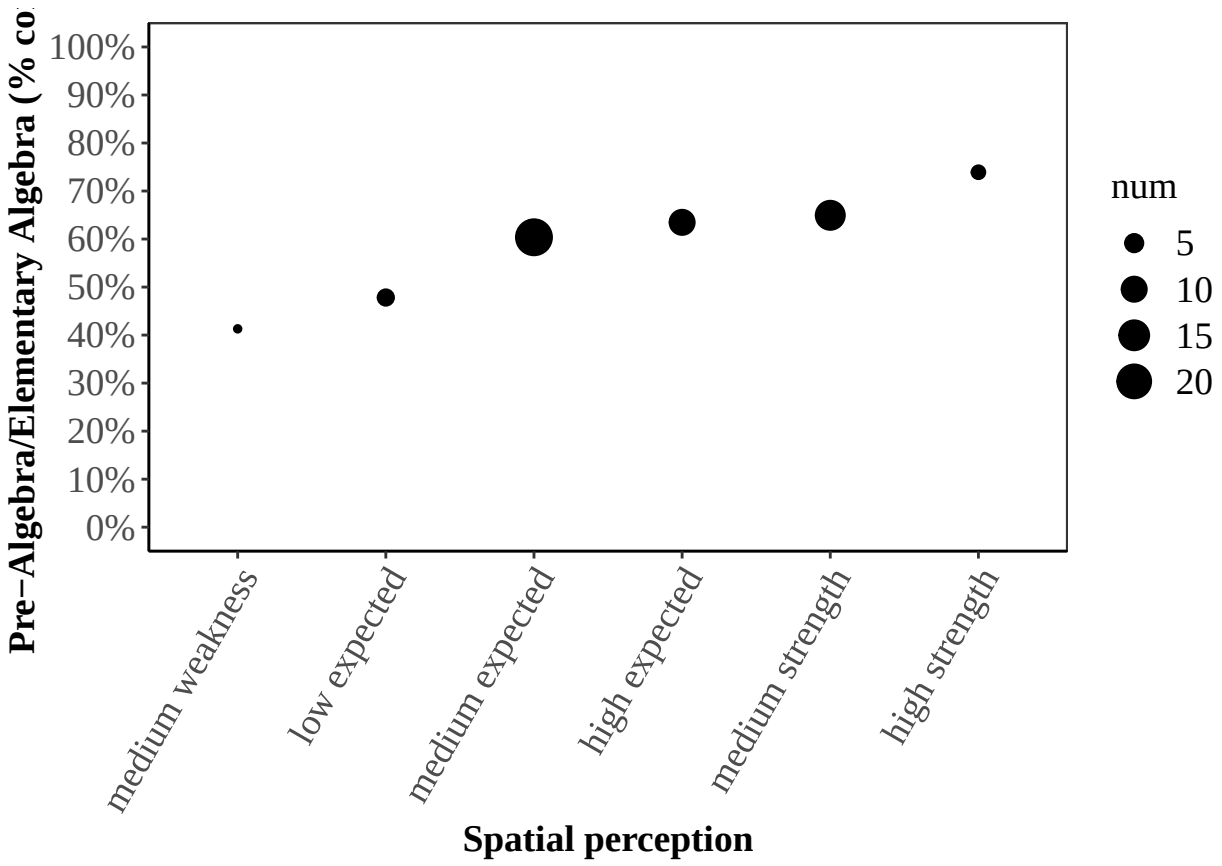

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = -0.59983, df = 4, p-value = 0.5809
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.8910864  0.6836823
## sample estimates:
##        cor
## -0.2872717
```

Visual memory




```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.75938, df = 3, p-value = 0.5028
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.7444681  0.9479718
## sample estimates:
##       cor
## 0.4015328
```

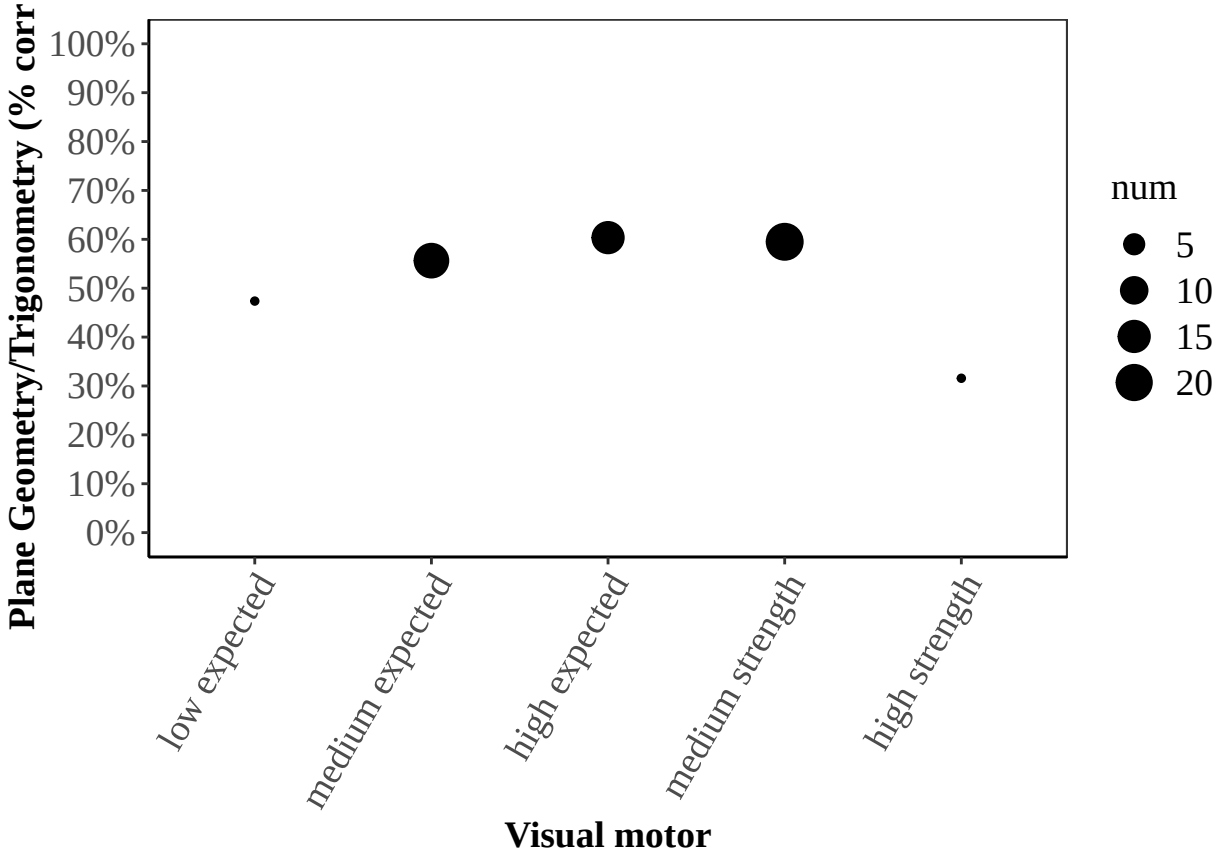
Spatial perception (p = 0.001, r = 0.97)




```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 8.1198, df = 4, p-value = 0.001251
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.7520036 0.9969415
## sample estimates:
##       cor
## 0.9709792
```

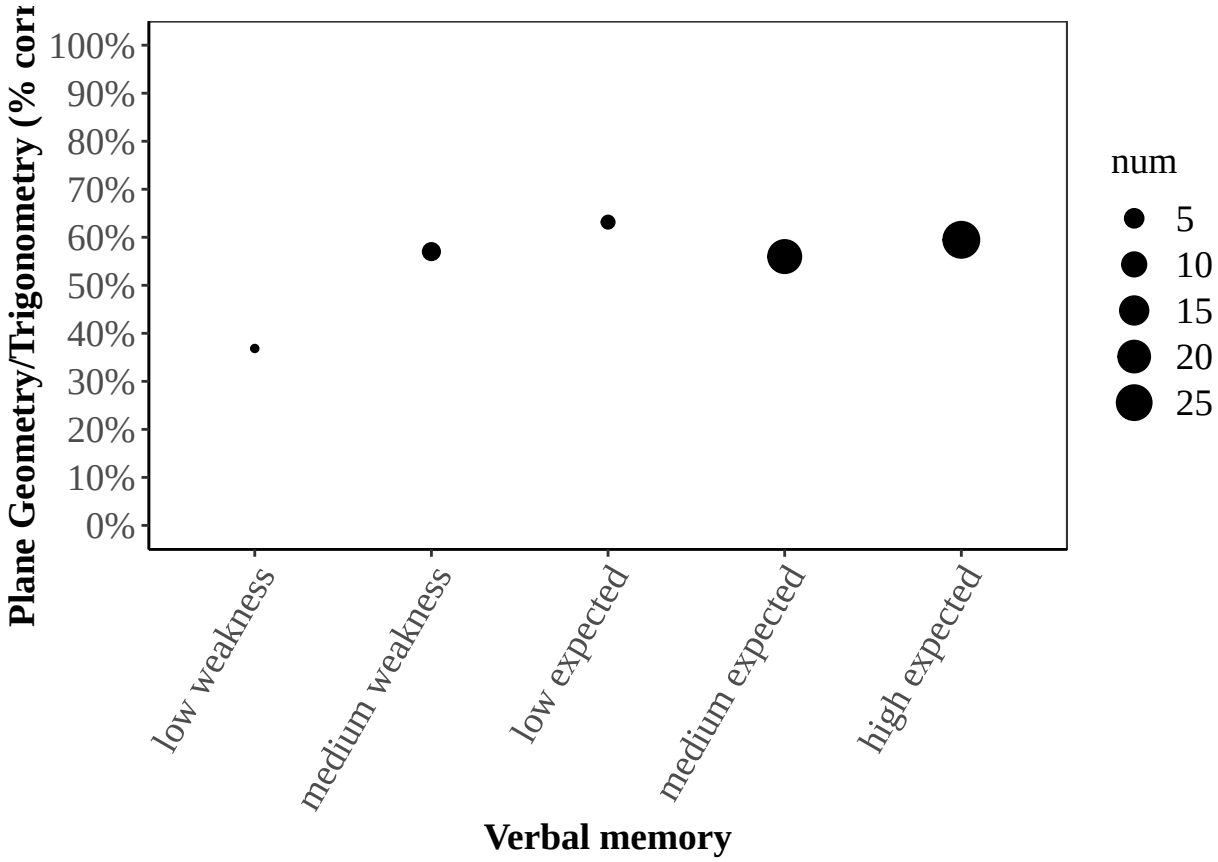
GT/ Plane Geometry/Trigonometry Subsection

Visual motor



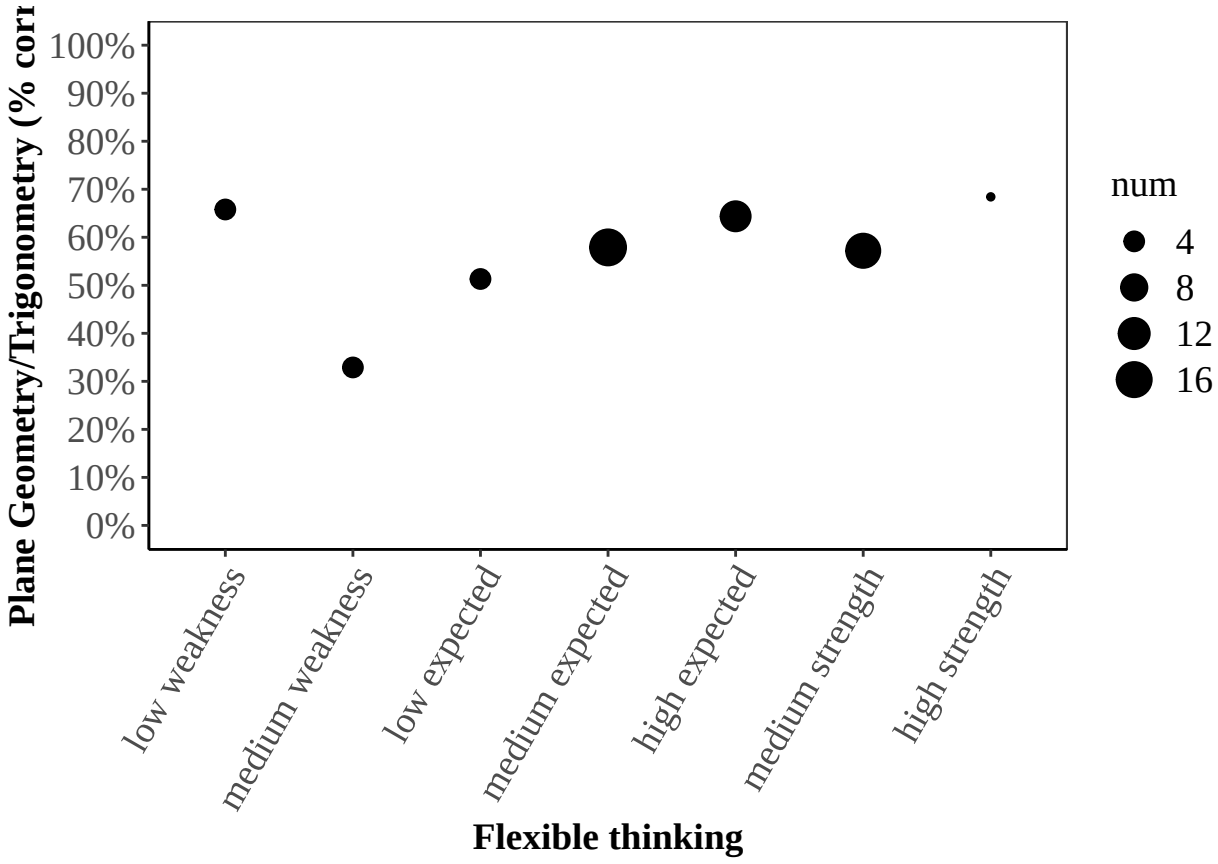

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = -0.68273, df = 3, p-value = 0.5438
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.9436668  0.7621329
## sample estimates:
##        cor
## -0.3667127
```

Verbal memory



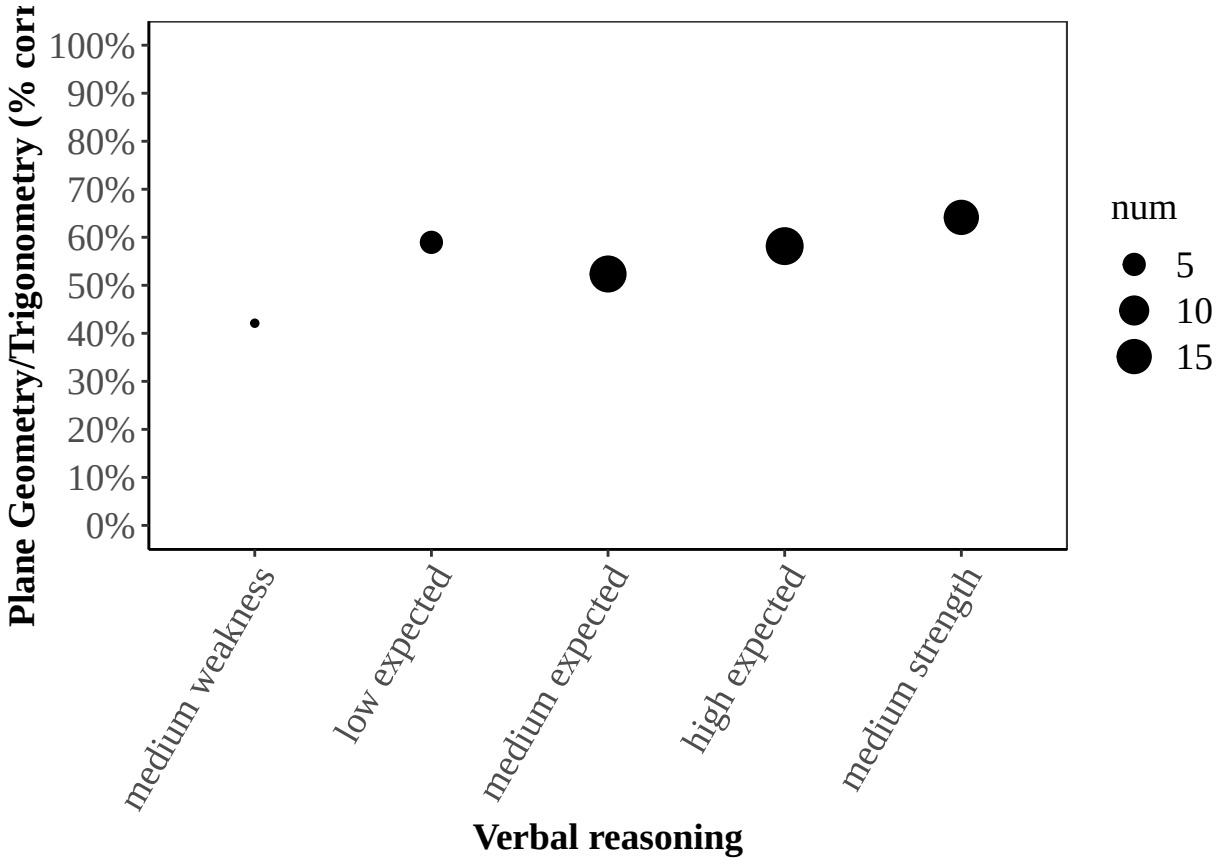

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 1.617, df = 3, p-value = 0.2043
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.5022425  0.9766604
## sample estimates:
##      cor
## 0.682406
```

Flexible thinking



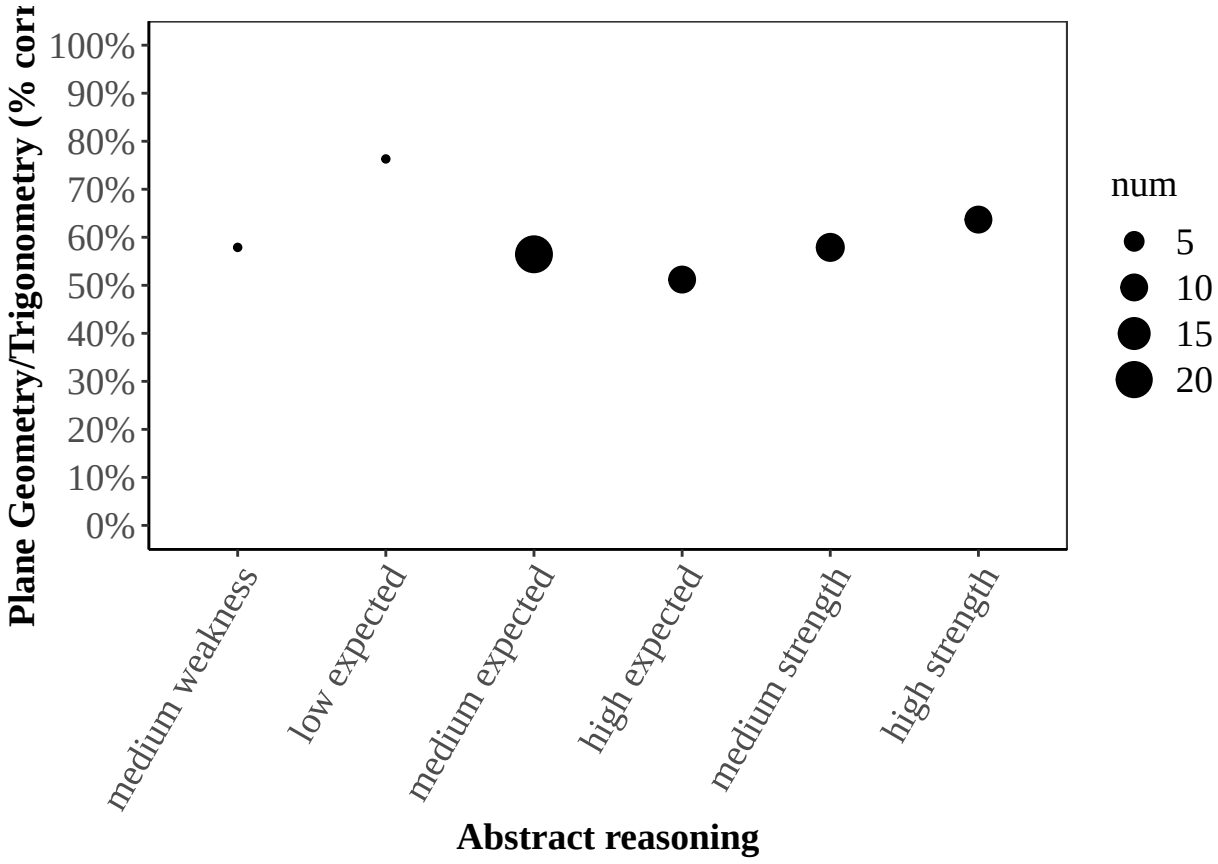

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 1.1082, df = 5, p-value = 0.3182
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.4642509  0.8971167
## sample estimates:
##       cor
## 0.4440509
```

Verbal reasoning



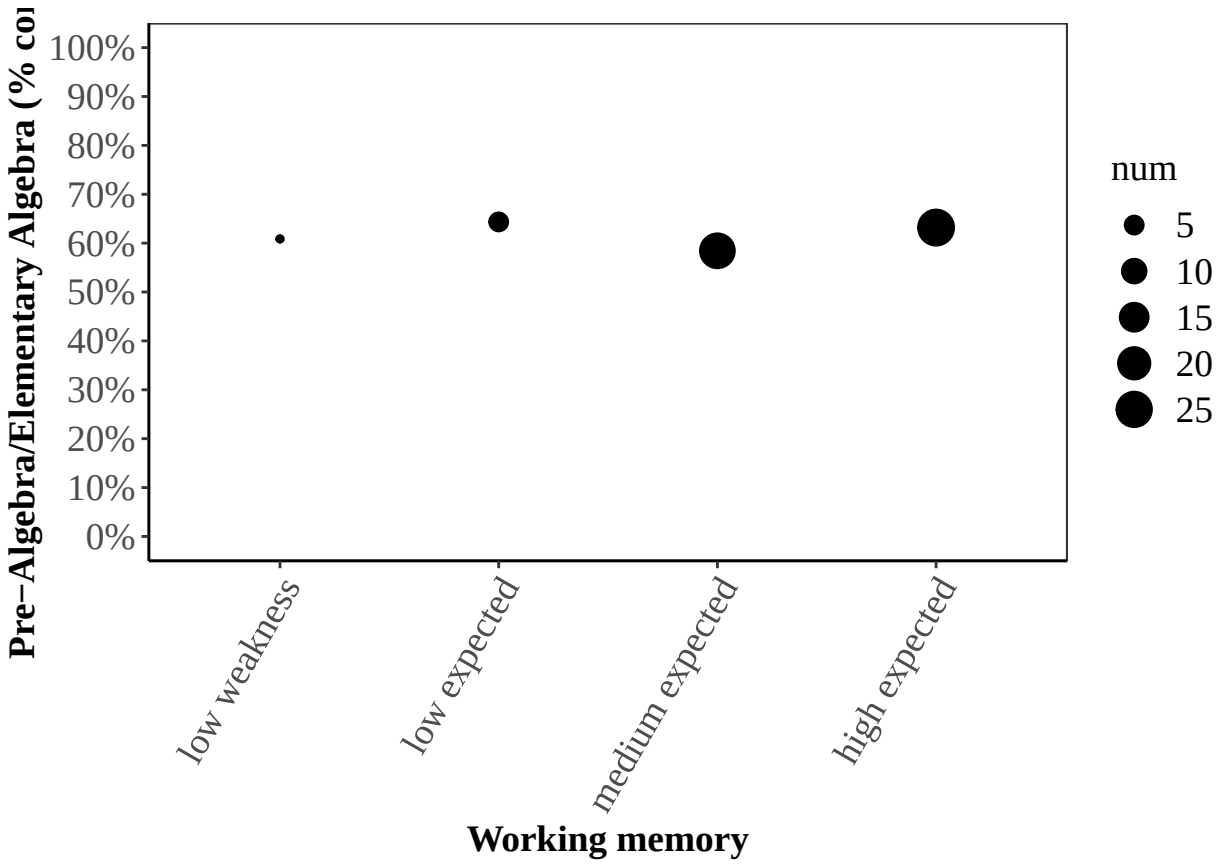

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 2.4332, df = 3, p-value = 0.09306
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.2403209  0.9873058
## sample estimates:
##       cor
## 0.8146797
```

Abstract reasoning



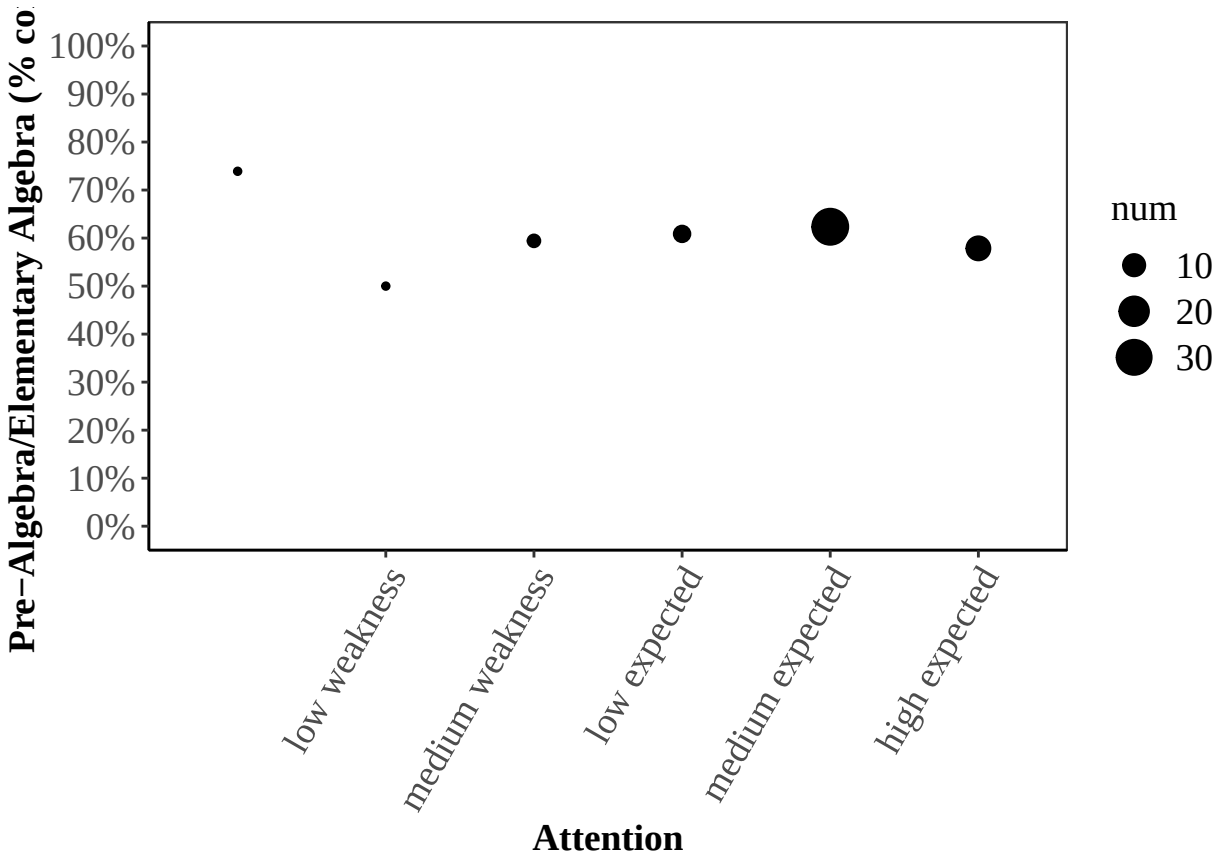

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = -0.3965, df = 4, p-value = 0.712
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.8688973  0.7327361
## sample estimates:
##       cor
## -0.194467
```

Working memory



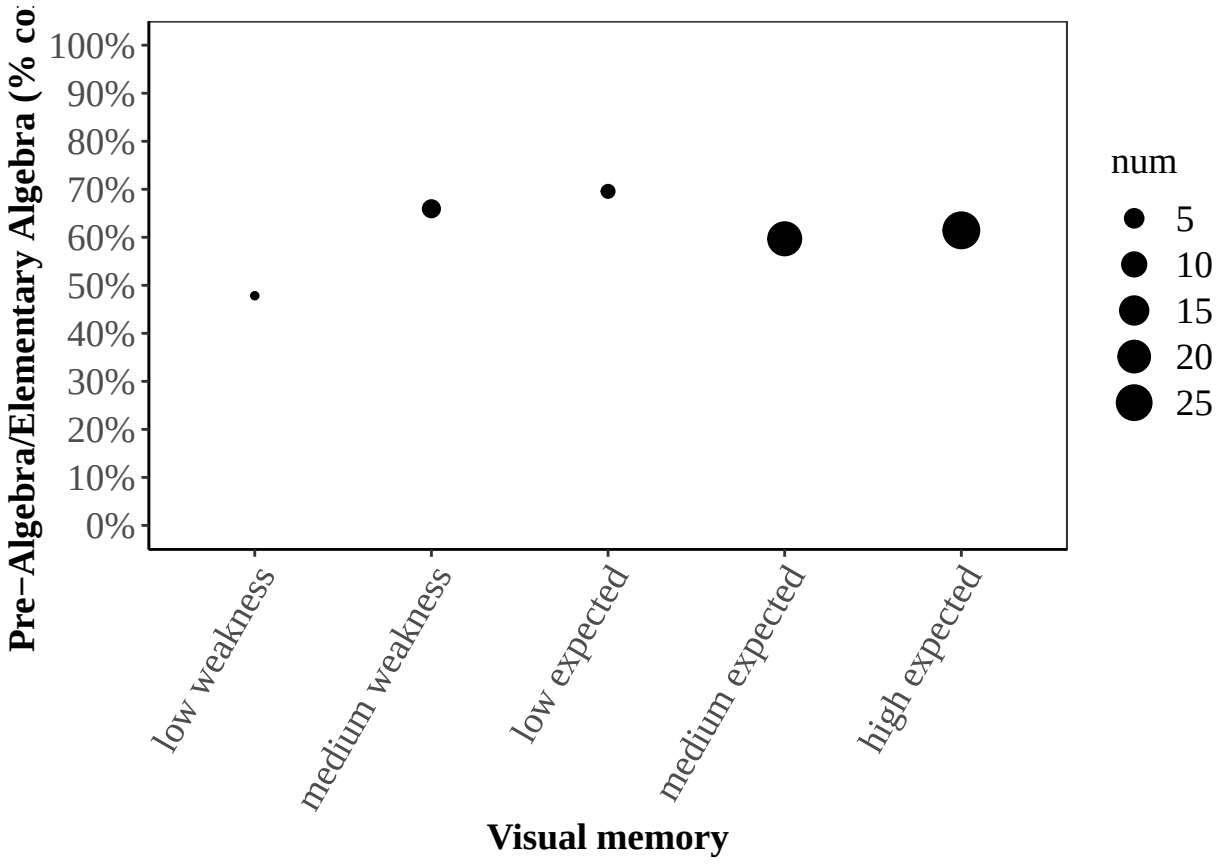

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.14433, df = 2, p-value = 0.8985
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.9525017  0.9681460
## sample estimates:
##      cor
## 0.101527
```

Attention



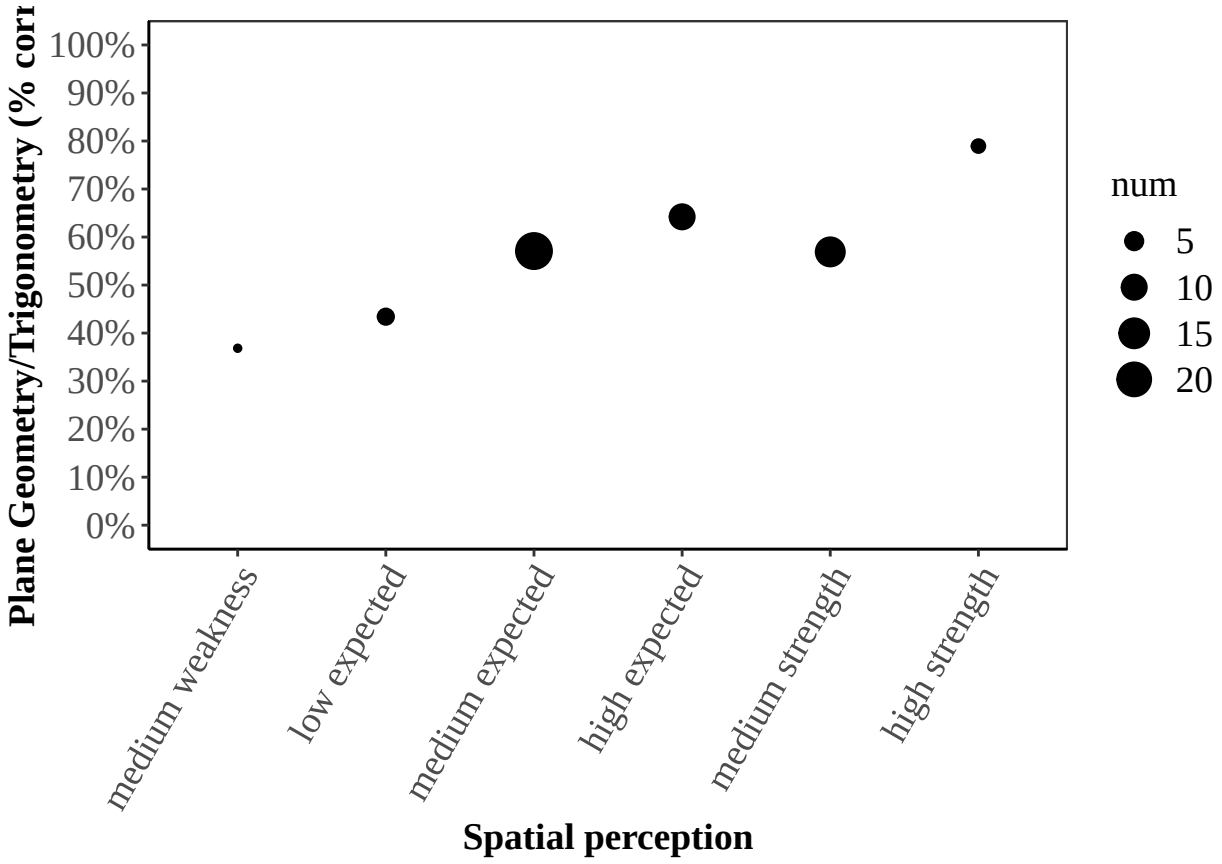

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = -0.59983, df = 4, p-value = 0.5809
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.8910864  0.6836823
## sample estimates:
##        cor
## -0.2872717
```

Visual memory




```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.75938, df = 3, p-value = 0.5028
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.7444681  0.9479718
## sample estimates:
##       cor
## 0.4015328
```

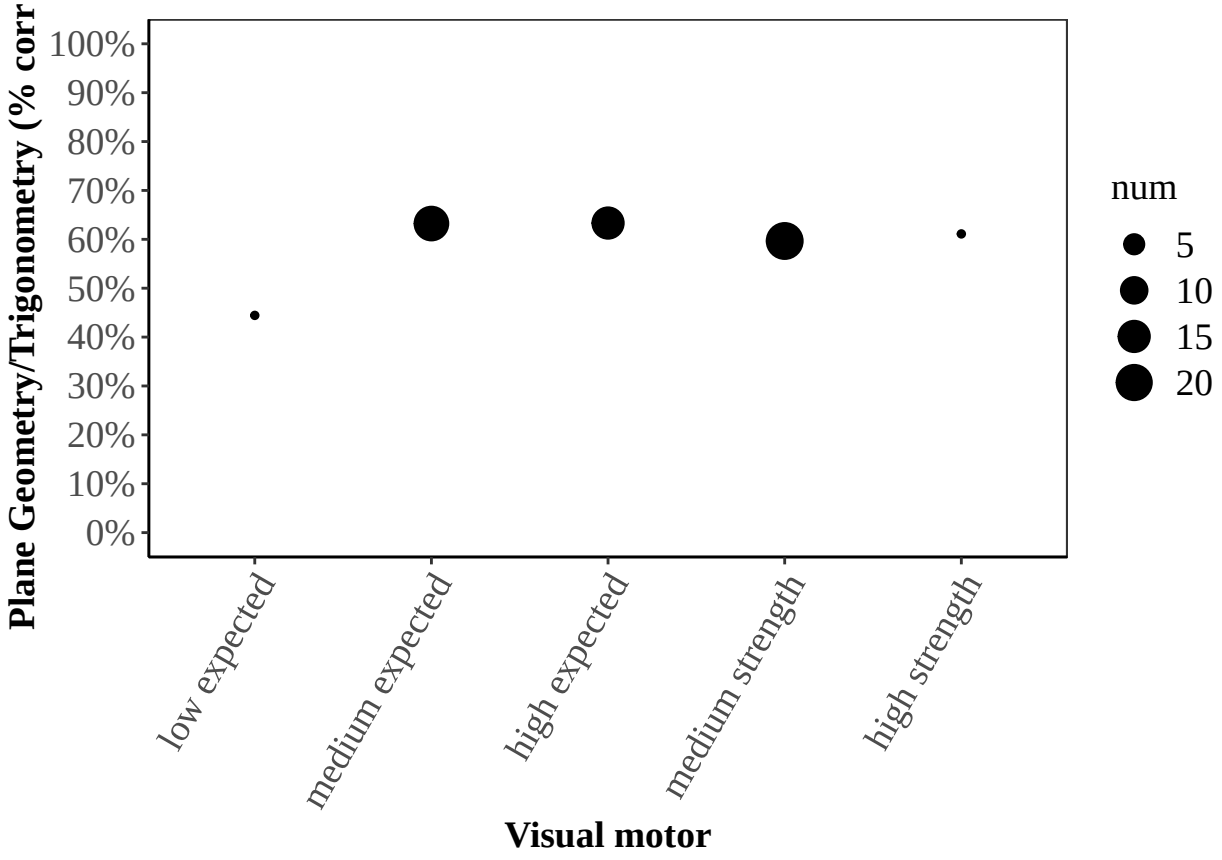
Spatial perception (p = 0.009, r = 0.92)




```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 4.7437, df = 4, p-value = 0.009012
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.4357562 0.9915315
## sample estimates:
##       cor
## 0.9214524
```

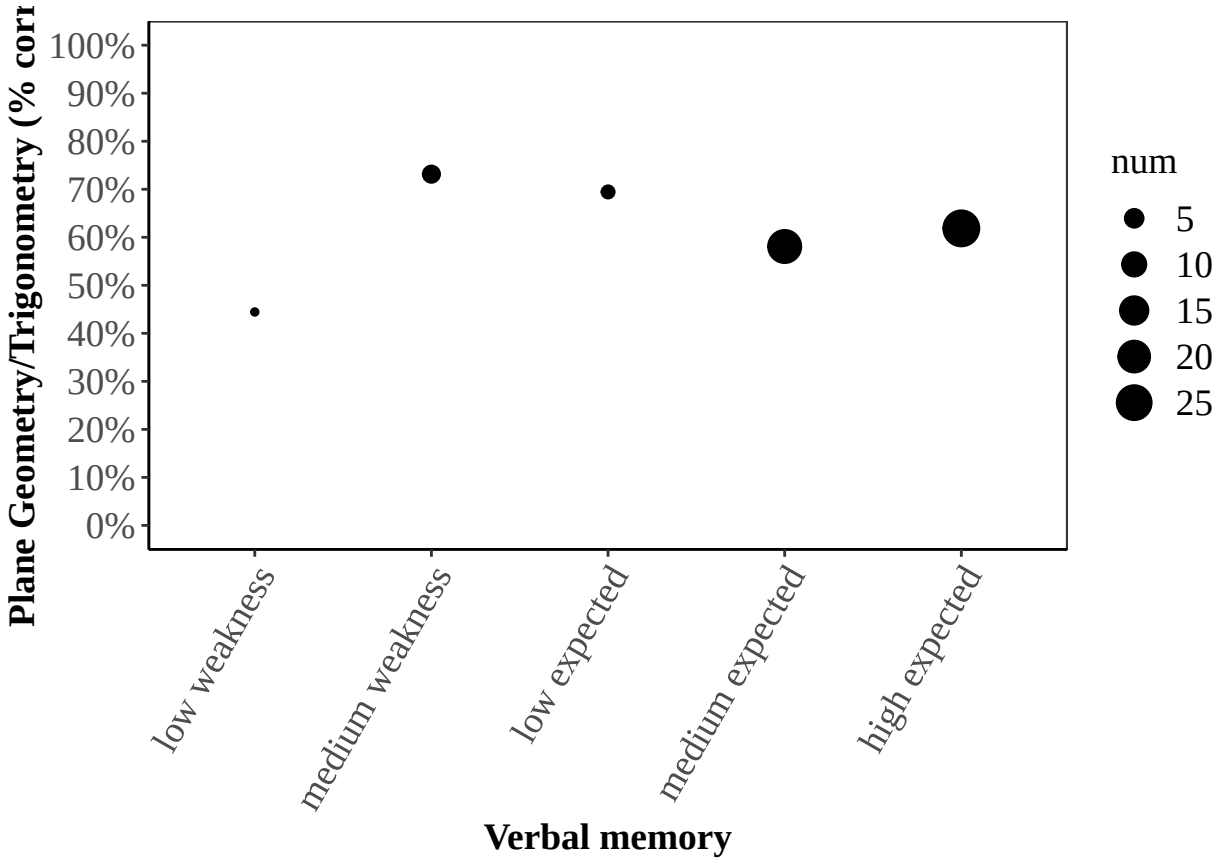
AG/ Intermediate Algebra/Coordinate Geometry Subsection

Visual motor



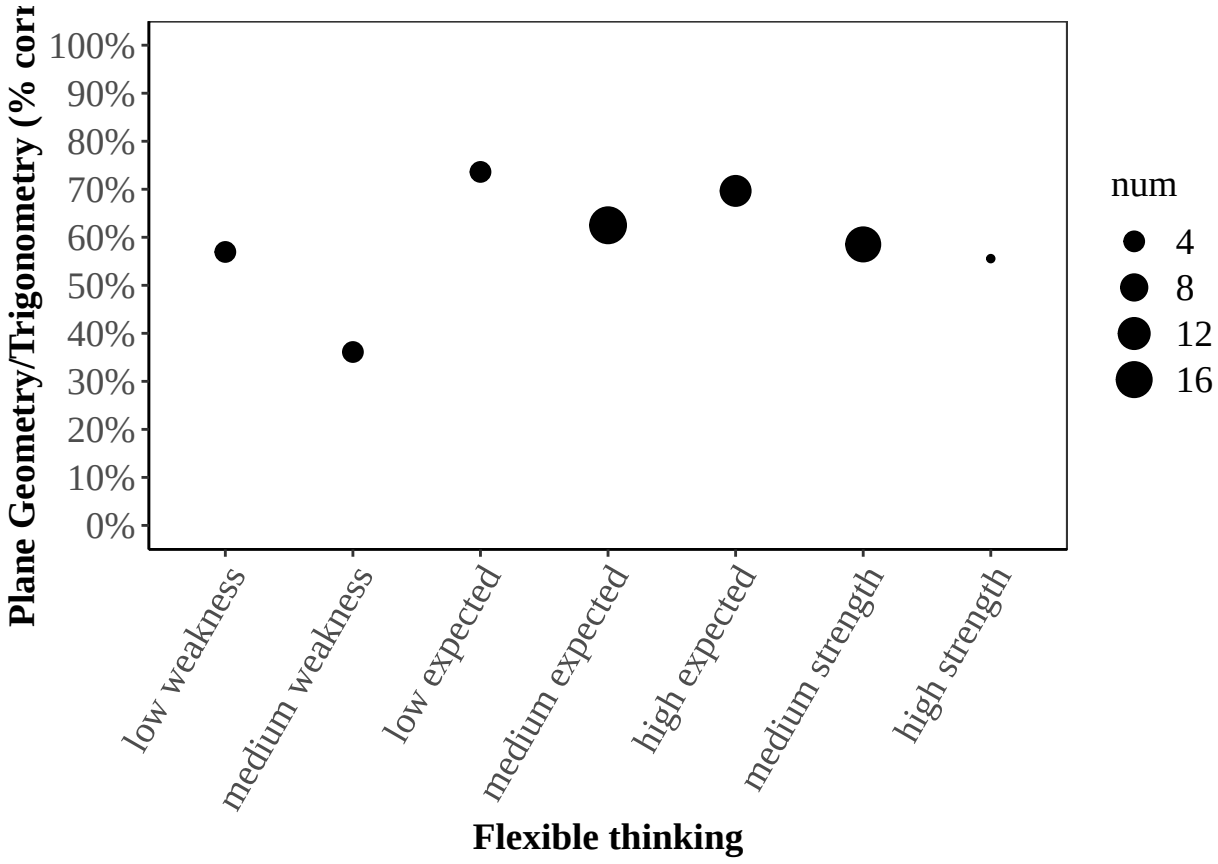

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 1.2782, df = 3, p-value = 0.2911
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.6059085  0.9686149
## sample estimates:
##       cor
## 0.5937726
```

Verbal memory



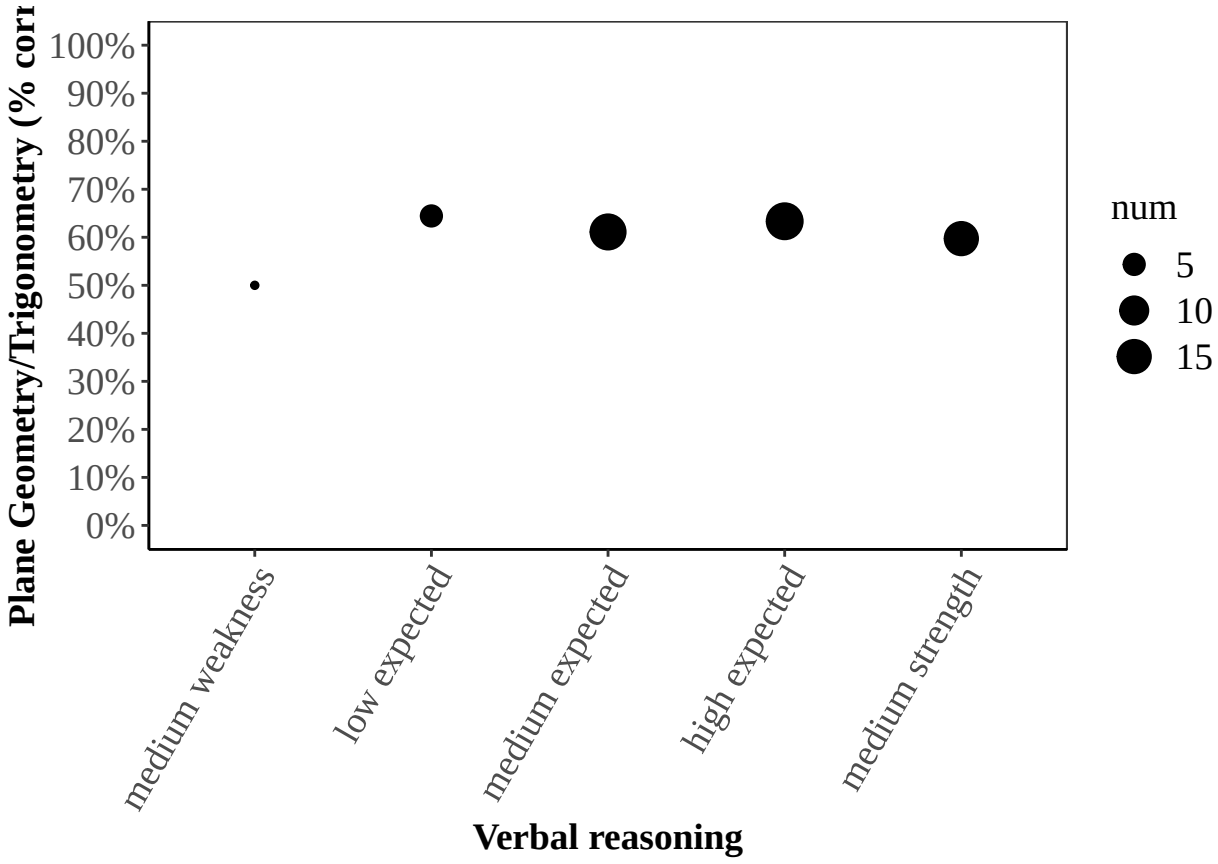

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.50297, df = 3, p-value = 0.6496
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.8003008  0.9318629
## sample estimates:
##       cor
## 0.2788691
```

Flexible thinking



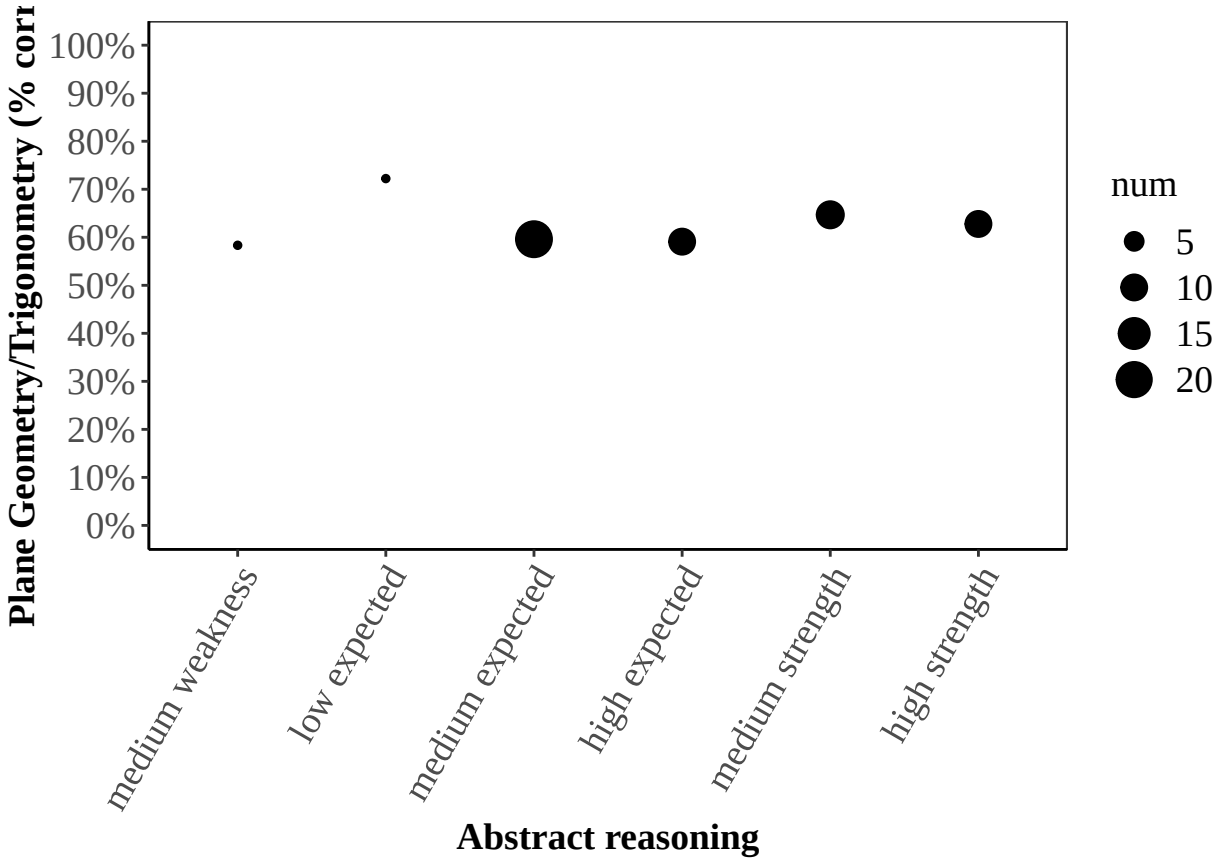

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.53777, df = 5, p-value = 0.6138
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.6301985  0.8391279
## sample estimates:
##       cor
## 0.2338294
```

Verbal reasoning



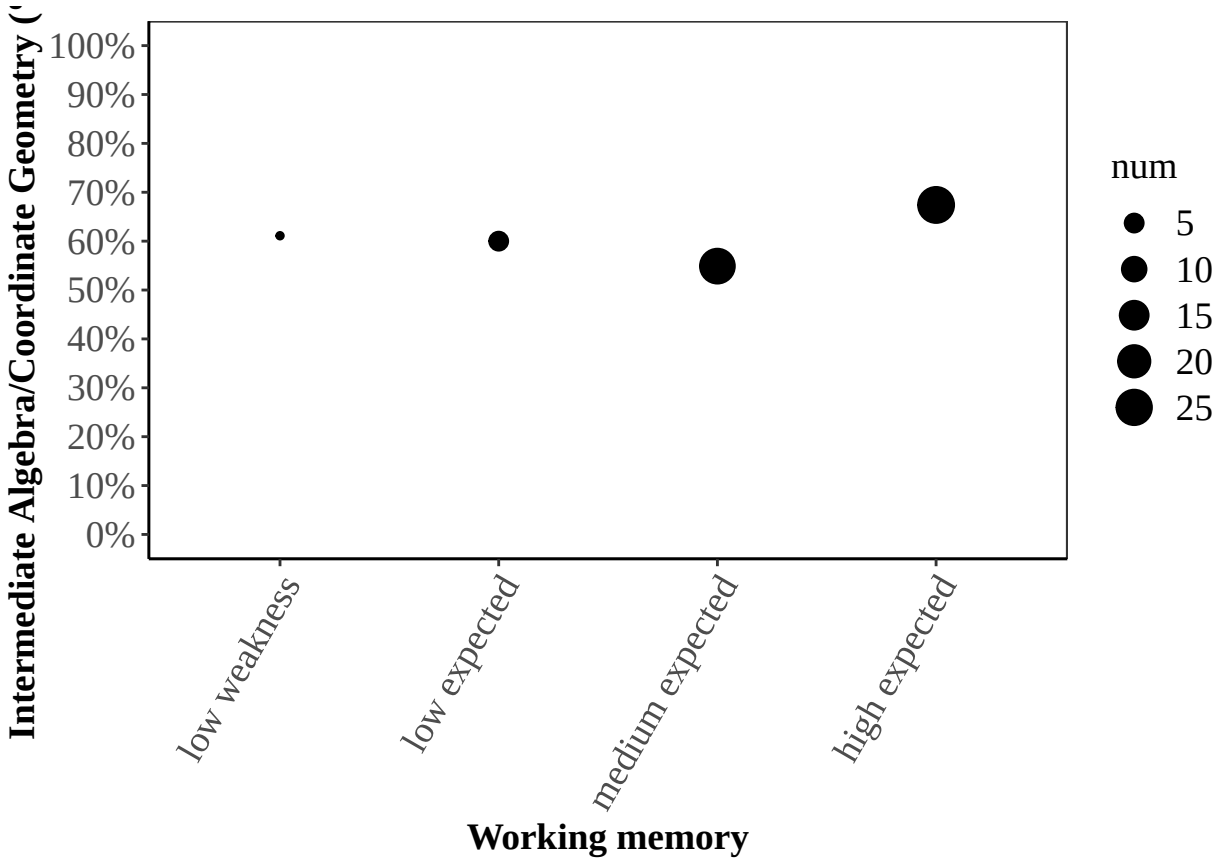

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 1.0134, df = 3, p-value = 0.3855
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.6804197  0.9596854
## sample estimates:
##     cor
## 0.50501
```

Abstract reasoning



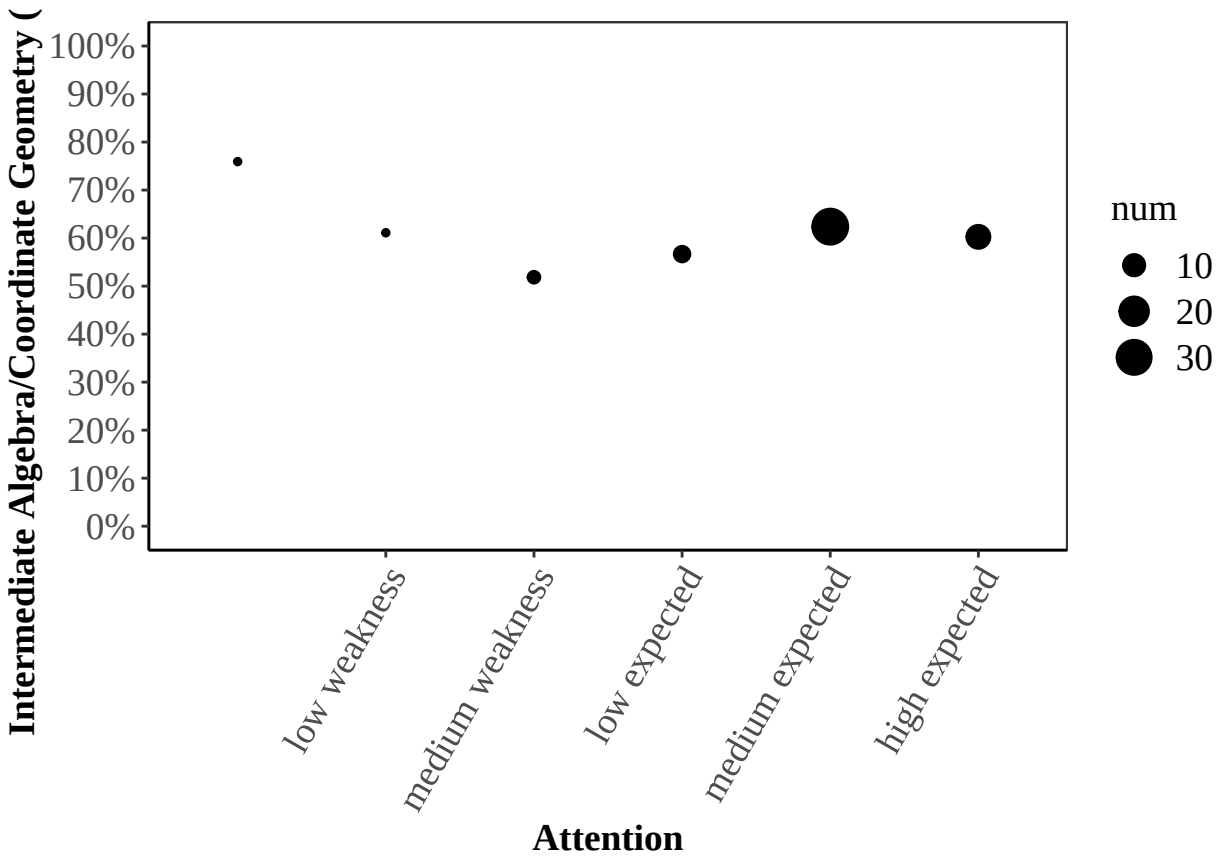

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = -0.018467, df = 4, p-value = 0.9862
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.8146898  0.8083855
## sample estimates:
##          cor
## -0.009233302
```

Working memory



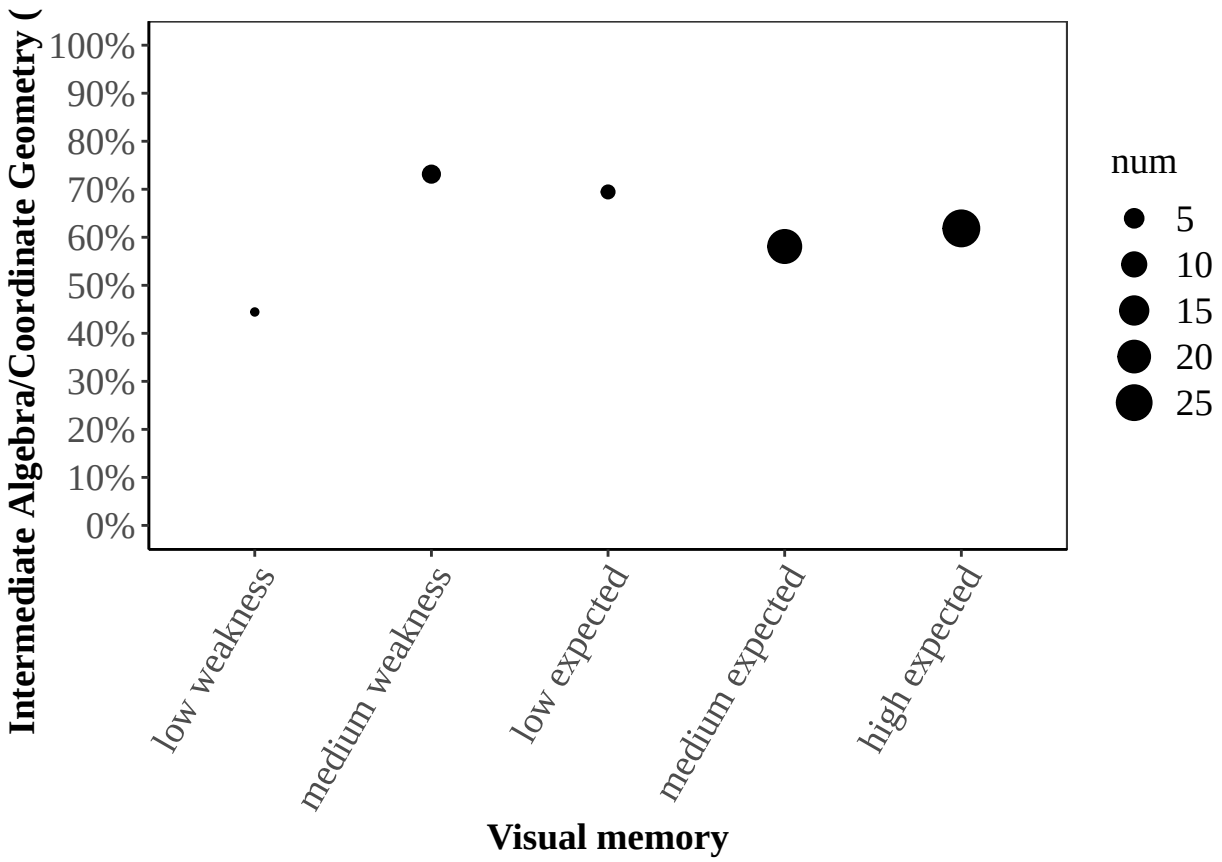

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.36771, df = 2, p-value = 0.7484
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.9357583  0.9765504
## sample estimates:
##       cor
## 0.2516401
```

Attention



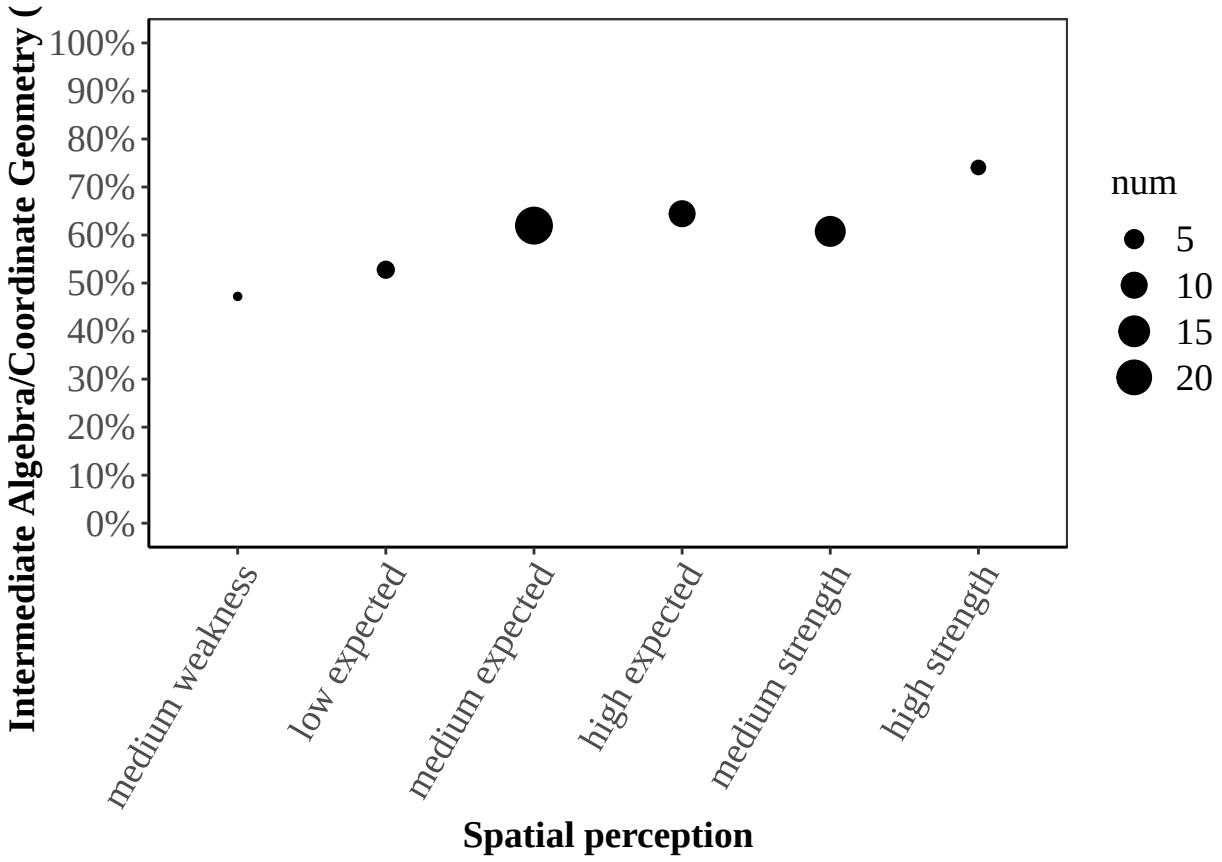

```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = -1.0387, df = 4, p-value = 0.3576
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.9260673  0.5602046
## sample estimates:
##       cor
## -0.4609008
```

Visual memory




```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 0.50297, df = 3, p-value = 0.6496
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.8003008  0.9318629
## sample estimates:
##       cor
## 0.2788691
```

Spatial perception (p = 0.01, r = 0.92)

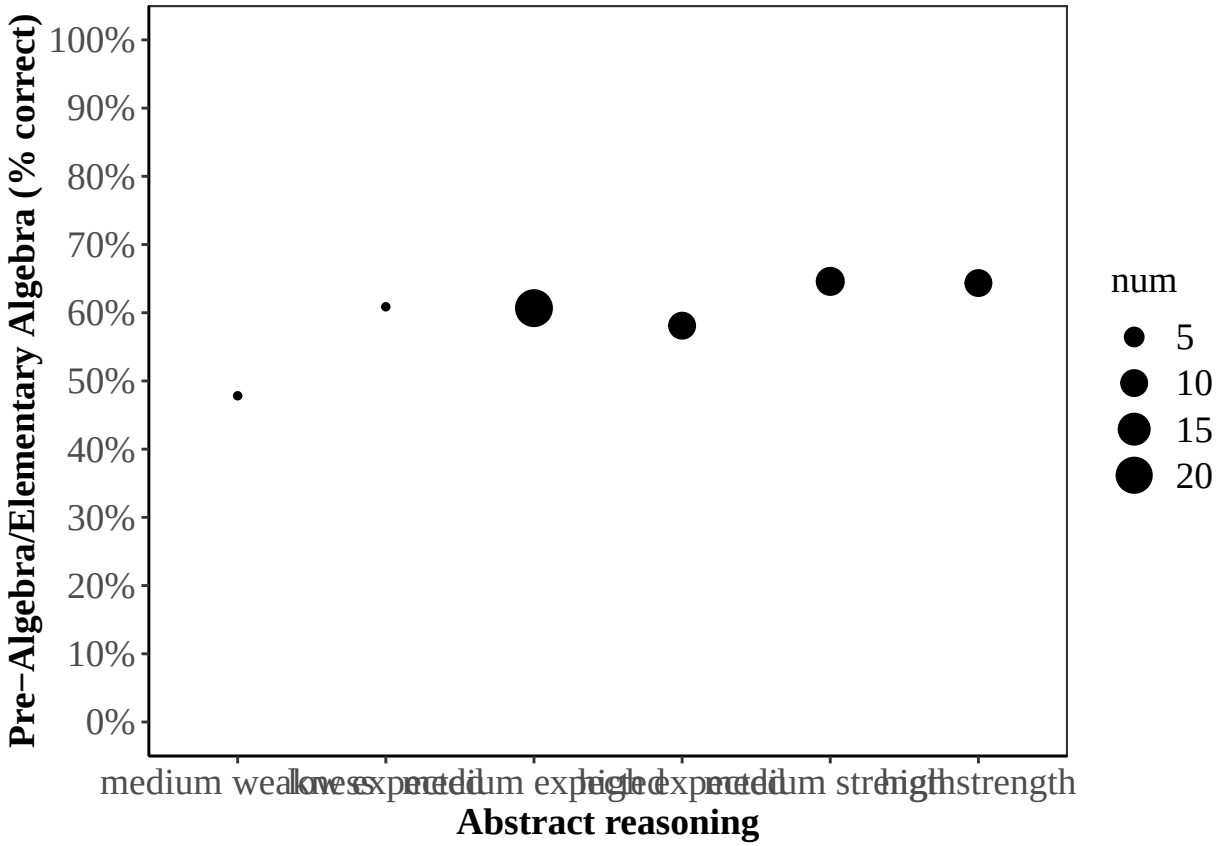



```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgMath
## t = 4.6397, df = 4, p-value = 0.009737
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.4190758 0.9911802
## sample estimates:
##       cor
## 0.9183135
```

Appleseed Suggested Analyses

EA - abstract reasoning model

```
##
## Call:
## lm(formula = EAscore ~ bin, data = EA_AbsRea)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.41489 -0.08703  0.01989  0.10330  0.26080
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.51250    0.07323   6.998 2.72e-09 ***
## bin          0.01996    0.01409   1.416    0.162
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1423 on 59 degrees of freedom
## Multiple R-squared:  0.03289,    Adjusted R-squared:  0.0165
## F-statistic: 2.006 on 1 and 59 DF,  p-value: 0.1619
```



```
##
##  Pearson's product-moment correlation
##
## data:  goo$bin and goo$avgEA
## t = 2.5694, df = 4, p-value = 0.06202
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.06243007  0.97577475
## sample estimates:
##       cor
## 0.7891122
```

Elementary algebra is not predicted by abstract reasoning accuracy (p=0.645).

EA - abstract reasoning broken down by difficulty of questions

Level 1 EA

```
##
## Call:
## lm(formula = EA1 ~ bin_absrea, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.43567 -0.02729 -0.00710  0.12903  0.14922
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.837316   0.080758  10.368 6.52e-15 ***
## bin_absrea  0.006732   0.015542   0.433    0.667
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1569 on 59 degrees of freedom
## Multiple R-squared:  0.00317,    Adjusted R-squared:  -0.01373
## F-statistic: 0.1876 on 1 and 59 DF,  p-value: 0.6665
```

Level 2 EA

```
##
## Call:
## lm(formula = EA2 ~ bin_absrea, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.65521 -0.11392  0.05237  0.13608  0.28172
```

```
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.65634    0.10850   6.049 1.07e-07 ***
## bin_absrea   0.02065    0.02088   0.989    0.327
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2108 on 59 degrees of freedom
## Multiple R-squared:  0.0163, Adjusted R-squared:  -0.0003722
## F-statistic: 0.9777 on 1 and 59 DF,  p-value: 0.3268
```

Level 3 EA

```
##
## Call:
## lm(formula = EA3 ~ bin_absrea, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.55661 -0.28321 -0.03321  0.21679  0.46679
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.43961    0.14593   3.013  0.00381 **
## bin_absrea   0.02340    0.02808   0.833  0.40809
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2835 on 59 degrees of freedom
## Multiple R-squared:  0.01163,    Adjusted R-squared:  -0.005122
## F-statistic: 0.6942 on 1 and 59 DF,  p-value: 0.4081
```

Level 4 EA

```
##
## Call:
## lm(formula = EA4 ~ bin_absrea, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.39938 -0.31864 -0.06604  0.26729  0.68136
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.50702    0.16341   3.103  0.00294 **
## bin_absrea  -0.02691    0.03145  -0.856  0.39561
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3175 on 59 degrees of freedom
## Multiple R-squared:  0.01226,    Adjusted R-squared:  -0.004482
## F-statistic: 0.7323 on 1 and 59 DF,  p-value: 0.3956
```

Level 5 EA

```
##
## Call:
## lm(formula = EA5 ~ bin_absrea, data = finalDF3)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.1737 -0.1673 -0.1640 -0.1576  0.8424
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.180122   0.193726   0.930    0.356
## bin_absrea  -0.003216   0.037283  -0.086    0.932
##
## Residual standard error: 0.3764 on 59 degrees of freedom
## Multiple R-squared:  0.0001261,  Adjusted R-squared:  -0.01682
## F-statistic: 0.007443 on 1 and 59 DF,  p-value: 0.9315
```

Elementary algebra is not predicted by abstract reasoning accuracy.

GT - abstract reasoning & spatial perception

```
##
## Call:
## lm(formula = GTscore ~ bin_absrea + bin_spaper, data = GT_DF2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.52936 -0.16284  0.03439  0.14535  0.40091
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.3701409  0.1291859   2.865   0.0058 **
## bin_absrea  -0.0009498  0.0195707  -0.049   0.9615
## bin_spaper   0.0450297  0.0217292   2.072   0.0427 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1935 on 58 degrees of freedom
## Multiple R-squared:  0.07108,    Adjusted R-squared:  0.03905
## F-statistic: 2.219 on 2 and 58 DF,  p-value: 0.1179
```

Plane geometry/trigonometry is predicted by spatial perception accuracy (p=0.042).

GT - abstract reasoning & spatial perception broken down by difficulty of questions

Level 1 GT

```
##
## Call:
## lm(formula = GT1 ~ bin_absrea + bin_spaper, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.55801 -0.11771  0.09919  0.16928  0.23936
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.78141    0.13765   5.677 4.62e-07 ***
## bin_absrea  -0.02271    0.02085  -1.089    0.281
## bin_spaper   0.03504    0.02315   1.514    0.136
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2062 on 58 degrees of freedom
## Multiple R-squared:  0.04808,    Adjusted R-squared:  0.01526
## F-statistic: 1.465 on 2 and 58 DF,  p-value: 0.2395
```

Level 2 GT

```
##
## Call:
## lm(formula = GT2 ~ bin_absrea + bin_spaper, data = finalDF3)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.4940 -0.2071  0.0496  0.2146  0.3365
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.546035   0.158602   3.443  0.00107 **
## bin_absrea  -0.002242   0.024027  -0.093  0.92598
## bin_spaper   0.041394   0.026677   1.552  0.12618
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2376 on 58 degrees of freedom
## Multiple R-squared:  0.04067,    Adjusted R-squared:  0.007585
## F-statistic: 1.229 on 2 and 58 DF,  p-value: 0.3
```

Level 3 GT

```
##
## Call:
## lm(formula = GT3 ~ bin_absrea + bin_spaper, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.63073 -0.22101  0.00768  0.18847  0.48637
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.08762    0.17620   0.497    0.621
## bin_absrea   0.02131    0.02669   0.798    0.428
## bin_spaper   0.06921    0.02964   2.335    0.023 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2639 on 58 degrees of freedom
## Multiple R-squared:  0.1096, Adjusted R-squared:  0.07888
## F-statistic: 3.569 on 2 and 58 DF,  p-value: 0.03453
```

Level 4 GT

```
##
## Call:
## lm(formula = GT4 ~ bin_absrea + bin_spaper, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.43989 -0.23576 -0.06781  0.18219  0.56011
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.14581    0.18459  -0.790   0.4328
## bin_absrea   0.01334    0.02796   0.477   0.6351
## bin_spaper   0.08205    0.03105   2.643   0.0106 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2765 on 58 degrees of freedom
## Multiple R-squared:  0.1219, Adjusted R-squared:  0.09163
## F-statistic: 4.026 on 2 and 58 DF,  p-value: 0.02305
```

Level 5 GT

```
##
```

```
## Call:
## lm(formula = GT5 ~ bin_absrea + bin_spaper, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.33351 -0.16541  0.01778  0.15160  0.50125
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.18381    0.13745  -1.337  0.18634
## bin_absrea   0.01632    0.02082   0.784  0.43646
## bin_spaper   0.06691    0.02312   2.894  0.00535 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2059 on 58 degrees of freedom
## Multiple R-squared:  0.1512, Adjusted R-squared:  0.1219
## F-statistic: 5.166 on 2 and 58 DF,  p-value: 0.008614
```

Difficult questions level 3-5 of plane geometry/trigonometry is predicted by spatial perception accuracy.

AG - abstract reasoning & spatial perception

```
##
## Call:
## lm(formula = AGscore ~ bin_absrea + bin_spaper, data = AG_DF2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.37201 -0.15112  0.01555  0.12378  0.29466
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.480461   0.111596   4.305 6.51e-05 ***
## bin_absrea  0.004212   0.016906   0.249    0.804
## bin_spaper  0.024232   0.018771   1.291    0.202
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1672 on 58 degrees of freedom
## Multiple R-squared:  0.03234,    Adjusted R-squared:  -0.00103
## F-statistic: 0.9691 on 2 and 58 DF,  p-value: 0.3855
```

Algebra/coordinate geometry is not predicted by abstract reasoning or spatial perception.

AG - abstract reasoning & spatial perception broken down by difficulty of questions

Level 1 AG

```
##
## Call:
## lm(formula = AG1 ~ bin_absrea + bin_spaper, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.93163 -0.18262  0.09455  0.23438  0.42655
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.35510    0.21392   1.660   0.1023
## bin_absrea   0.01309    0.03241   0.404   0.6878
## bin_spaper   0.08300    0.03598   2.307   0.0247 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3204 on 58 degrees of freedom
## Multiple R-squared:  0.09534,    Adjusted R-squared:  0.06414
## F-statistic: 3.056 on 2 and 58 DF,  p-value: 0.05472
```

Level 2 AG

```
##
## Call:
## lm(formula = AG2 ~ bin_absrea + bin_spaper, data = finalDF3)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.8110 -0.2023  0.1890  0.2714  0.3556
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.84088    0.21637   3.886 0.000264 ***
## bin_absrea   0.01315    0.03278   0.401 0.689846
## bin_spaper  -0.04122    0.03639  -1.133 0.262042
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3241 on 58 degrees of freedom
## Multiple R-squared:  0.02215,    Adjusted R-squared:  -0.01157
## F-statistic: 0.6568 on 2 and 58 DF,  p-value: 0.5223
```

Level 3 AG

```
##
## Call:
## lm(formula = AG3 ~ bin_absrea + bin_spaper, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.51651 -0.14286  0.03434  0.17586  0.37119
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.30137    0.15033   2.005   0.0497 *
## bin_absrea   0.02690    0.02277   1.181   0.2424
## bin_spaper   0.04151    0.02529   1.642   0.1061
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2252 on 58 degrees of freedom
## Multiple R-squared:  0.08059,    Adjusted R-squared:  0.04888
## F-statistic: 2.542 on 2 and 58 DF,  p-value: 0.08746
```

Level 4 AG

```
##
## Call:
## lm(formula = AG4 ~ bin_absrea + bin_spaper, data = finalDF3)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.4777 -0.1073 -0.0331  0.2141  0.6091
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.35318    0.19593   1.803   0.0767 .
## bin_absrea  -0.02451    0.02968  -0.826   0.4123
## bin_spaper   0.03710    0.03296   1.126   0.2649
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2935 on 58 degrees of freedom
## Multiple R-squared:  0.0275, Adjusted R-squared:  -0.006039
## F-statistic: 0.8199 on 2 and 58 DF,  p-value: 0.4455
```

Level 5 AG

```
##
```

```
## Call:
## lm(formula = AG5 ~ bin_absrea + bin_spaper, data = finalDF3)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.2829 -0.1594 -0.1083  0.2682  0.8118
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.340451   0.177155   1.922   0.0596 .
## bin_absrea  -0.043652   0.026838  -1.627   0.1093
## bin_spaper   0.007435   0.029798   0.250   0.8038
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2653 on 58 degrees of freedom
## Multiple R-squared:  0.04373,    Adjusted R-squared:  0.01075
## F-statistic: 1.326 on 2 and 58 DF,  p-value: 0.2734
```

Overall algebra/coordinate geometry is not predicted by abstract reasoning or spatial perception. But level 1 algebra/coordinate geometry is predicted by spatial perception.

AG - abstract reasoning & spatial perception & flexible thinking

```
##
## Call:
## lm(formula = AGscore ~ bin_absrea + bin_spaper + bin_flexthin,
##     data = AG_DF2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.39426 -0.14305  0.01244  0.12100  0.31039
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.436758   0.123297   3.542 0.000799 ***
## bin_absrea   0.005031   0.016976   0.296 0.768024
## bin_spaper   0.020910   0.019225   1.088 0.281344
## bin_flexthin 0.012660   0.015013   0.843 0.402602
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1676 on 57 degrees of freedom
## Multiple R-squared:  0.04426,    Adjusted R-squared:  -0.006041
## F-statistic: 0.8799 on 3 and 57 DF,  p-value: 0.457
```

Algebra/coordinate geometry is not predicted by abstract reasoning, spatial perception or flexible thinking.

AG - abstract reasoning & spatial perception & flexible thinking broken down by difficulty of questions

Level 1 AG

```
##
## Call:
## lm(formula = AG1 ~ bin_absrea + bin_spaper + bin_flexthin, data = finalDF3)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.9241 -0.1735  0.0918  0.2357  0.4232
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.31438    0.23747   1.324   0.1908
## bin_absrea    0.01385    0.03270   0.424   0.6734
## bin_spaper    0.07991    0.03703   2.158   0.0352 *
## bin_flexthin  0.01179    0.02892   0.408   0.6849
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3227 on 57 degrees of freedom
## Multiple R-squared:  0.09797,    Adjusted R-squared:  0.05049
## F-statistic: 2.064 on 3 and 57 DF,  p-value: 0.1152
```

Level 2 AG

```
##
## Call:
## lm(formula = AG2 ~ bin_absrea + bin_spaper + bin_flexthin, data = finalDF3)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.8171 -0.2163  0.1577  0.2766  0.3589
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.76666    0.23940   3.202  0.00223 **
## bin_absrea    0.01454    0.03296   0.441  0.66084
## bin_spaper   -0.04686    0.03733  -1.255  0.21448
## bin_flexthin  0.02150    0.02915   0.738  0.46375
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3254 on 57 degrees of freedom
```

```
## Multiple R-squared:  0.03139,    Adjusted R-squared:  -0.01959
## F-statistic: 0.6158 on 3 and 57 DF,  p-value: 0.6076
```

Level 3 AG

```
##
## Call:
## lm(formula = AG3 ~ bin_absrea + bin_spaper + bin_flexthin, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.47846 -0.14512  0.00586  0.17897  0.39066
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.24098    0.16604   1.451    0.152
## bin_absrea    0.02803    0.02286   1.226    0.225
## bin_spaper    0.03692    0.02589   1.426    0.159
## bin_flexthin  0.01749    0.02022   0.865    0.391
##
## Residual standard error: 0.2257 on 57 degrees of freedom
## Multiple R-squared:  0.09251,    Adjusted R-squared:  0.04474
## F-statistic: 1.937 on 3 and 57 DF,  p-value: 0.1339
```

Level 4 AG

```
##
## Call:
## lm(formula = AG4 ~ bin_absrea + bin_spaper + bin_flexthin, data = finalDF3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.47793 -0.10717 -0.03335  0.21325  0.60956
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.3540621  0.2178221   1.625    0.110
## bin_absrea   -0.0245267  0.0299909  -0.818    0.417
## bin_spaper    0.0371663  0.0339647   1.094    0.278
## bin_flexthin -0.0002563  0.0265232  -0.010    0.992
##
## Residual standard error: 0.296 on 57 degrees of freedom
## Multiple R-squared:  0.0275, Adjusted R-squared:  -0.02369
## F-statistic: 0.5372 on 3 and 57 DF,  p-value: 0.6587
```

Level 5 AG

```
##
```

```
## Call:
## lm(formula = AG5 ~ bin_absrea + bin_spaper + bin_flexthin, data = finalDF3)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.3070 -0.1712 -0.1101  0.2392  0.8412
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.289291   0.196285   1.474    0.146
## bin_absrea   -0.042693   0.027026  -1.580    0.120
## bin_spaper    0.003547   0.030606   0.116    0.908
## bin_flexthin  0.014820   0.023901   0.620    0.538
##
## Residual standard error: 0.2668 on 57 degrees of freedom
## Multiple R-squared:  0.05014,    Adjusted R-squared:  0.0001434
## F-statistic: 1.003 on 3 and 57 DF,  p-value: 0.3983
```

Algebra/coordinate geometry is not predicted by abstract reasoning, spatial perception or flexible thinking. But level 1 algebra/coordinate geometry is predicted by spatial perception.

Summary

1. Overall math score is predicted by spatial perception.
2. Elementary algebra score is predicted by spatial perception. It is not predicted by abstract reasoning even when broken down by question difficulty.
3. Plane geometry/trigonometry score is predicted by spatial perception. Specifically, level 3-5 difficulty, of plane geometry/trigonometry is predicted by spatial perception.
4. Intermediate algebra/coordinate geometry is predicted by spatial perception (univariate analysis).
   Intermediate algebra/coordinate geometry is not predicted by abstract reasoning, spatial perception or flexible thinking (multivariate analysis).
   But level 1 algebra/coordinate geometry is predicted by spatial perception.