**Power calculation**

This is a power calculation for sample size required to observe differences in learning outcomes between interactive visualisation control and experimental game groups.

# Calculation

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Minimum meaningful improvement** | | | **Sensitivity** | | **Required n participants** | |
| **Control group mean** | **Standard deviation** | **Experimental group mean** | **Power** | **Alpha** | **Per group** | **Total** |
| 13.84 | +/- 1.77 | 14.84 | 80% | 0.05 | 49 | 98 |
| 0.01 | 73 | 146 |
| 0.001 | 107 | 214 |
| 90% | 0.05 | 66 | 132 |
| 0.01 | 93 | 186 |
| 95% | 0.05 | 81 | 162 |
| 0.01 | 112 | 224 |

# Priors (Pilot test data)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **Score on assessment** | | | |
| **Study** | ***N of participants*** | **Mean** | **SD** | **Min** | **Max** |
| Pilot testing of assessment | 6 | 13.84 | 1.77 | 11.27 | 15.6 |

# Description of variables

Main outcome measure

|  |  |  |
| --- | --- | --- |
| **Outcome measure** | **Score range** | **Score meaning** |
| Intended learning outcome MCQ | 0 - 24 | Each point of score represents learning outcome(s) that the participant successfully learned. Detailed in full in the ILO document. |

Other variables in calculation

|  |  |  |
| --- | --- | --- |
| **Variable to estimate** | **How it was estimated** | **Notes** |
| Control group mean | Estimated from pilot testing data | Pilot test results reflect baseline performance (i.e., no period of learning before assessment) and so control/experimental means are assumed to be higher. *This may affect SD estimation (see below)*. |
| Experimental group mean | Minimum meaningful improvement | The minimum meaningful improvement to warrant spending extra resources gamifying an interactive visualisation is estimated at an average improvement of half a point. This would mean that half the learners who use the game learn an additional learning outcome compared with interactive visualisation controls. |
| Standard deviation | Estimated from pilot testing data | Modelling accounts for a SD of 1.77 |
| Accepted alpha / power levels | Minimum of a = 0.05 / p = 80% |  |