

# The influence of Spatial Orientation on Student Performance - A Methodology

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## ABSTRACT.

In earlier work, the effect of student seating positions on assessment time was documented as statistically significant. This paper reports an attempt to isolate factors involved in this anomaly. A methodology and database structure has been developed, data collected, and preliminary analysis completed.

The methodology is described and discussed, in particular those aspects that relate to the hypothesis that left or right brain dominance in students could be a factor. The model developed to investigate this hypothesis also allows for consideration of room layout, handedness (tutors and students), student age, institute type and the artistic/logical component of the topic under study. The model was tested on approximately 60 students from each of two institutes. Preliminary results show that the two institutes attract students from different population pools, based on a simple left/right brain dominance test. The implications of this result, along with plans for further data analysis, are discussed.

## 1. INTRODUCTION

In earlier work (Gibson 2002) RG found that students seated to (tutor) left of the classroom during assessments completed that assessment, on average, in shorter time than those seated (tutor) right. This was shown to be statistically valid across topic, room, student stream and

year. Informal notes gathered by JW at CCE indicated a similar effect, but for the opposite side i.e. (tutor) right of the room. At this point, a decision was made to carry out research to investigate possible explanations for this effect.

Factors under consideration to explain this behaviour included position of the door, handedness (of the tutor as well as students), topic style, and left/right brain dominance (tutor as well as students). In a discussion between the co-authors, it was noted that between us we covered virtually all of the above, including handedness and brain style dominance of the tutors. Further, we noted that as one author taught English-based subjects and the other computing oriented courses, there may be a 'natural selection' of students for each style of course based on left/right brain dominance. If so, this could be used as a basis for establishing or eliminating the other possible factors involved.

A study was planned and carried out during the second half of 2002, with participants from both WelTec and CCE.

It was decided to collect as much data from the students (and tutors) as practicable, in a format designed to allow statistical analysis covering as many factors (and interactions) as possible, as well as providing data suitable for a qualitative approach.

This paper reports in detail the methodology used, and outlines the preliminary results obtained. Plans for further data analysis and publication are discussed.

**Table 1. factors and rationale for testing.**

<b>Factor</b>	<b>Consideration</b>
Left/Right brain style dominance	Might influence seating preference
Tutor handedness	Usage of the whiteboard might affect student seating preference
Seat position front/back	Age/gender may affect seating preference
Seat position left/right	Expected to correlate with assessment time, and possibly with assessment result
Student handedness	Might influence preference
Student mark/grade	Possibility exists to derive a function correlating time with performance
Topic style (artistic to numeric)	This might identify differences between institute areas.

## 2. METHOD

In order to make effective use of the differing strengths of the two authors, a 'mixed methods' approach incorporating aspects of both quantitative and qualitative research paradigms was used for this project. This approach to research is supported in the literature (Brannen 2003).

A quantitative study was undertaken by R.G. The method selected for this part of the study was to design and build a database that would allow a statistical analysis of the hypotheses. The hypotheses under test are summarised in table 1, showing the factor assessed, and the considerations for selection of the factor.

The database was constructed using Access, to facilitate data reduction and analysis. The structure of this database is shown in fig 1.

A qualitative study was undertaken by J.W., with a view to enriching and expanding the quantitative study by incorporating the views of participants about their seating preferences. This was carried out after the data for the quantitative study had been collected, in order to avoid influencing that study. It was desirable for participants to be initially unaware of the exact nature of the seating effect being studied, and equally desirable for them to be fully informed of it for the purposes of the qualitative study. The timing of the data collection was seen as the key to meeting both these objectives.

Data for the two studies was gathered in various ways. Some data was provided directly by the participants. Two weeks prior to any of the selected assessments being undertaken, interested students in relevant courses were asked to read an information sheet discussing confidentiality issues, and to sign a release form to collect personal data. Those who completed the consent form then filled in a short questionnaire giving name, student id, date of birth, gender and handedness, and completed a short test to establish left/right brain dominance (Ward and Daley 1993).

Data was also gathered indirectly while the participants were undertaking assessments pre-selected for the purposes of the study. Relevant assessments from each institution were selected on the basis that they were carried out under controlled conditions as part of the course requirements. The assessments selected also allowed students to leave on completion, rather than wait a predetermined time. During the selected assessments, the seat number for each student was noted, together with individual start and finish times. Participants were aware that these data were being gathered during the assessment. They were also asked to rank their perceptions of the difficulty of the test on a 1-5 scale, prior to handing in their work. At this stage of the study, participants were informed that the effect under study was to do with seating preferences, but not the precise nature of the effect or its perceived relationship to assessment.

The rooms were measured prior to the assessment, both front to back (from the whiteboard), and left and right (tutor view) from the centreline. For consistency, "seating position" was taken from desk centre, near side to the student. Seat positions were then numbered, to identify which students sat at which seat. This form of measurement was used to ensure flexibility in assessing angle and range of each student, as well as basic front/back and left/right data. Door position was also noted (front/centre/back, and left/centre/right).

Tutors scaled the topic style from 'numeric' to 'artistic'. For completeness, tutor information was also collected, including handedness, and the number of sessions that each tutor had in that room with those students. Assessment information relating to participants' achievement on the selected tasks was added once it was available.

After this data had been collected, the authors asked for volunteers from the participants at each institution to take part in semi-structured interviews to gather further data for the qualitative report. At this interview, participants were informed in more detail of

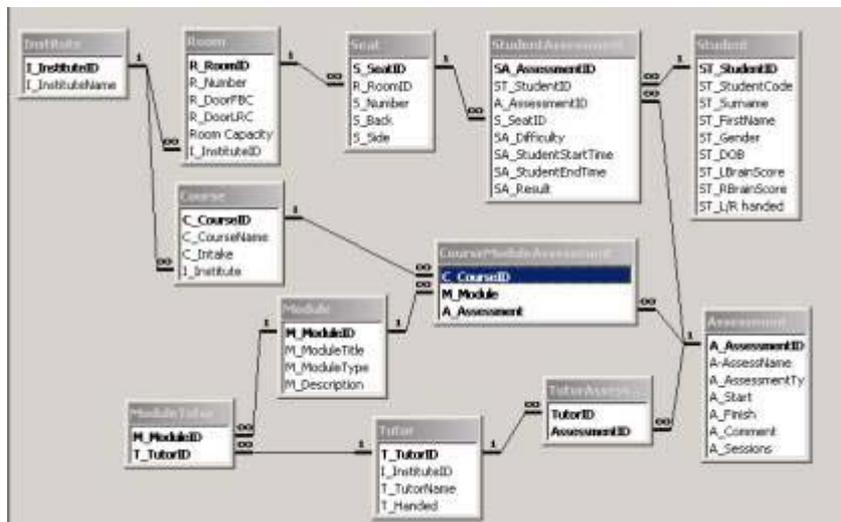


Figure 1 showing the relationships derived from the data model

the effect under study and asked to reflect on and verbalise their own awareness of their seating patterns.

### 3. RESULTS TO DATE

At this early stage of data analysis, all data has been entered into the model, and initial testing of the Left/Right brain style dominance hypothesis has been completed. Preliminary results indicate a difference between the student populations of the two institutions based on left/right brain dominance test, although there are of course anomalies within and between the two populations. Participants from Weltec have a higher frequency of left and right brain dominance, but relatively few closely balanced. Those from CCE showed a more expected pattern of frequencies, with a higher proportion of students recording balanced results.

This anomaly was based on a simplistic frequency class chart and further statistical data reduction is required to establish significant differences or trends.

### 4. DISCUSSION AND CONCLUSIONS.

This methodology appears to cover a number of factors that could explain the phenomenon discussed earlier, and the database covers the data model adequately. The database works well, and can be linked to a suitable statistical package for further analysis. In particular, polynomial modelling and multiple regression techniques are expected to be of interest.

The results so far extracted appear to confirm the informal observation made by JW at CCE. There is a difference in left/right brain dominance between the two populations. This finding cannot be linked with any certainty to the observed seating/assessment effect, but does have significance in its own right. It forms a sound basis for further statistical investigations relating to the hypotheses under study, none of which can yet be eliminated as possible factors accounting for the original observed effect. Any further results found through the statistical analysis will have increased validity as a consequence of this initial finding. Each of the remaining possible factors in the hypotheses will be analysed, including interactions. RG is continuing the analysis of the data, and the results will be fully reported at a later date.

Data collection for the qualitative study is currently underway. A preliminary analysis of the data has identified some trends in the reasons given by participants for their seating preferences. The metacognitive skills of the interviewees have generated interesting comments, and provided an insight into both seating preferences and the reasons for these. In particular, there is strong evidence expressed by the students involved in this aspect of the study, that their feelings of 'rightness' or 'comfort', and consequently their performance on assessments, are affected by whether or not they are able to sit in their preferred position in the room. Analysis of the qualitative data is continuing, and the results of this study will also be reported later this year (2003).

Once these two reports are complete, a combined paper will be prepared. This paper will draw on the findings of each study in order to propose an

explanation of the original effect, together with a discussion of some of the implications and applications which may arise from the research. It is intended that this paper will be available by the end of the year.

The methodology reported in this paper looks likely to produce worthwhile insights into classroom seating preferences. The degree to which these are catered for may well have a bearing on student achievement - certainly a valuable outcome for the educational community.

## REFERENCES

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# Flight Simulation vs. Real Aviation: 3D Flight Simulation Technologies

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## ABSTRACT

This paper will look at the ICT technologies used in flight simulator software, with the aim to identify and briefly discuss the technology involved in this area, potential benefits, and to determine positive and negative impacts by looking at various relevant authors and reference material to be found in publications

in books, journals, articles and the Internet. Consequently, the scope of the report will be limited to the following specific areas:

The Flight Simulation vs. Real World Environment

Flight Simulator software: Microsoft Flight Simulator

Virtual Airlines, Air Traffic Control and Virtual Reality hardware

My methodology will attempt to highlight the technologies, as well as relevant positive and negative aspects as mentioned in the reference material; and in the conclusion to offer some thoughts in summary.

## 1. INTRODUCTION

The technological advances and growth of personal desktop computer Flight Simulation software, online Virtual Airlines and Air Virtual Traffic Control, as well as affordable 3D Virtual Reality hardware, have led to some interesting developments in the area of Aviation and Flight Training. This has resulted in the Aviation Sector, Airlines and Flight Schools looking at this technology as an effective training tool, and perhaps as a new method to log instrument flying hours for student pilots.

This paper will be looking specifically at some emerging personal Flight Simulation technologies: Software, Virtual Airlines, and 3D

Virtual Reality hardware that are currently being adopted by virtual pilots and real pilots. This will compare the Virtual Airspace with the real world to determine how accurate and useful the technology has become in this area. (I.e. Graphical rendering quality and accuracy of the virtual world and airports, as well as the technical accuracy of aircraft behaviour and systems)

## 2. HOW APPLICABLE IS FLIGHT SIMULATION TO REAL WORLD AVIATION?

Flight Simulators have become so realistic that they offer would-be pilots as well real pilots the opportunity to learn almost every aspect of flying from how to handle aircraft to Instrument Flying Systems, GPS navigation, Air Traffic Control procedures, weather reporting; and with real world scenery it is possible to realistically fly actual routes in real time. The flight simulator that is considered to be the benchmark in this area is Microsoft Flight Simulator.

In 1978 Bruce Artwick, together with Stu Moment, founded a software company by the name of subLOGIC and started developing graphics programs for the 6800, 6502, 8080 and other processors. In 1979 Bruce decided to take the model from his original thesis further and developed the first flight simulator program for the Apple-II (based on the 6502 processor). This followed a version ported for the Radio Shack TRS-80. Both versions were constructed in their respective