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A Preliminary Report on the Effect of Cognitive Style Upon the Quality of New System Development Projects
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Abstract

This paper reports the results of a preliminary study which attempts to determine whether or not a system developer’s cognitive style will have an impact upon the quality of a system developed by the developer in question. Two groups of system development projects are compared; the projects are all the result of development teams’ efforts. One group of project teams (the control group) was assembled without regard to the cognitive style of the team members, the other teams were assembled following the application of a thinking mode identification tool (the Herrmann Brain Dominance Instrument).

Introduction

Over time the idea of cognitive style has been discussed as it applies to managers, decision makers and other users of information systems. The basic assumption, supported by several clinical studies, is that a decision makers’ ability to utilize information is directly related to the dominant hemisphere of the brain (Eagly and Chaiken, McKenney and Keen, Turban and Aronson, Vazquez and Lunce.,). However, this assumption is based upon a rather superficial examination of the physiology, and it concludes that the brain consists of two half brains and therefore the simplistic left brain/right brain dichotomy adequately describes the differences between these two brain halves. However, closer scrutiny of the brain reveals that this organ consists of four structures rather than just two. “These four paired structures consist of the two cerebral hemispheres and the two halves of the limbic system. These are paired structures connected together by what is called commissures. The two cerebral hemispheres are connected together by the Corpus Callosum and the two halves of the limbic system are connected together by the Hippocampal Commissure” (Herrmann Institute, FAQ).

Investigations conducted by the Herrmann Institute suggest that cognitive styles can be categorized and that these classifications can be useful in making managerial decisions. These categories go beyond traditional the qualitative-quantitative dichotomy and describe four thinking modes: rational, experimental, organizational, and feeling. The purpose of this study is to report of the results of a preliminary investigation of the effect of these Herrmann modes of cognitive style upon the quality of the analysis and design of an information system supporting a specific business application.

Study Theory and Method

Due to the difficulty and expense involved in using executives as experimental subjects, mature university students are often used as subjects in the early stages of many studies in order to establish the validity of the methodology (Jarvenpaa, et al). For the purpose of this preliminary study two groups of business students, primarily juniors and seniors, agreed to serve as subjects; there task was to serve as surrogates for experienced systems developers. They were all information systems majors and were enrolled in a required Systems Analysis and Design course. The goal of this course is to introduce the student to analytical thinking, problem formulation and problem solving in a business environment. In several previous works, scholars have questioned the underlying cognitive style of students who enroll in computer related courses.

The underlying assumption is that the predominately left brained or quantitative thinkers were better suited for the generation of computer programs, and that the more right brain dominant individuals were more likely to be found in disciplines such as the Liberal Arts. “The organizing principle of the brain and the physiology of the brain both proclaim a condition for wholeness. The brain is physically constructed so that specialized areas of processing can collaborate with other areas of specialization. We are not single individuals, but rather a coalition. The organizing principle explains how the naturally occurring iteration among different modes (or styles) of thinking is affected by dominance and preference” (Herrmann Institute, FAQ).

Systems analysts have been expected to fulfill a great many roles. Among the roles that they have been asked to adopt are those of change agent, innovator, mediator, problem finder, problem solver and business analyst. Each of these roles may require a different set of paradigms in order to be successfully accomplished to provide a sense of rewarding accomplishment for the role player. With so many diverse roles to be fulfilled, it is reasonable to ask several questions. Where do these systems analysts come from? How are they developed? How are they educated? Are the students currently being taught to develop the systems of the Twenty-first Century going to be happy and productive as systems analysts?

Function within organizations has changed as new technologies have emerged. It is no longer acceptable for the I.S. Department to sequester itself and periodically release new versions of old solutions into the production arena,
With the pervasive spread of personal computers and end user computing, with the development of more information centers of increasing sophistication, with the dramatic availability of internet access, and with the recognition of information as a true and legitimate resource within the organization that must support the organization's basic strategies, the position of the I.S. department within the organization has changed. This change that dictates that educators must be aware both of the change and that perhaps different cognitive styles may become more appropriate to solving systems problems in the future.

Problem solving is a creative activity. Simon described problem solving as a three step process which begins with the gathering of intelligence (the study of the problem space), design (the generation of a set of alternative solutions to the problem previously analyzed), and choice (the ability to recommend a viable alternative from the previously defined solution set). Several studies have indicated that creative activities are typically more successfully accomplished by individuals who are predominantly right brained (McKenney & Keen). However, it is well established that the human brain is highly specialized. Herrmann’s “whole brain theory allocates the brain's specialized modes into one or more of these four physiological structures. Since dominance can only occur between paired structures, we now have the basis of a much more sophisticated and useful model comprising not only the left and right modes, but also the cerebral and limbic modes. Extensive data speaks loudly that there is an equal number of people whose mental preferences are primarily cerebral or limbic as those that are primarily left or right. Therefore, the four quadrant whole brain model allows us to differentiate between not only the more popular notions of left brain/right brain, but also the more sophisticated notions of cognitive/intellectual which describes the cerebral preference, and visceral, structured, and emotional which describes the limbic preferences” (Herrmann Institute).

Several instruments have been developed to measure the hemisphere dominance, or estimator of the cognitive style of an individual. Perhaps the two best known are the Myers-Briggs Type Indicator and the Herrmann Brain Dominance Instrument (HBDI). For this study, approximately 100 students were subjected to the Herrmann Participant Survey. The Herrmann Participant Survey provides a profile of brain hemisphere dominance or an indication of the subjects preferences for a particular type of mental activity. Preferences to type of mental activity have been shown to correlate to competence in the performance of some activity. Herrmann stated in "what people like [to do], they tend to do better" (p. 76).

Two issues were to be investigated: [1] Are the personality types currently being attracted to the information systems major primarily left brain hemisphere dominant, as determined by the administration of the HBDI? If so, these students are more technically oriented and less creative in their cognitive styles, and thus they might be more comfortable cloistered with their terminal than having to interact with the user community in the creative act of problem solving; and [2] Could a consideration of cognitive styles of students involved in the development of analysis projects improve the overall quality of the projects. Over several previous semesters, a variety of approaches have been utilized to create student project teams. During this experiment, teams of students were composed based upon a distribution of specific types of brain dominance to each of the groups.

A panel of experts composed of information systems faculty and industry representatives were utilized to evaluate the overall quality of the students projects (a structured specification (developed per Kowal) of a hypothetical retailer) compared to projects submitted by teams organized without consideration of the students' brain hemisphere dominance. The results of this report might indicate an opportunity for an improvement in the way in which systems should be developed in response to user needs. They might also provide some insights into how educators might better prepare our students for the pragmatic world of business in the future.

The control group of students, whose project teams were composed without consideration of the students’ cognitive style, provided a sample size n = 53. The mean numeric score on projects of the control group was 86.59028 with a standard deviation of 5.614. The sample size of the experimental group was n = 62. The mean score for this group was 87.3663 with a standard deviation of 5.379.

<table>
<thead>
<tr>
<th>Comparatives</th>
<th>Test Group (TG)</th>
<th>Control Group (CG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size (n)</td>
<td>62</td>
<td>53</td>
</tr>
<tr>
<td>Average Grade (µ)</td>
<td>87.4</td>
<td>86.6</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>5.4</td>
<td>5.6</td>
</tr>
</tbody>
</table>

was not significantly different from that of the control group (this hypothesis is stated below). We were unable to reject the null at the 95% confidence level (i.e. \( \alpha = .05 \)).

\[ H_0: \mu_{(Test \ Group)} = \mu_{(Control \ Group)} \]
\[ H_A: \mu_{(\text{Test Group})} \neq \mu_{(\text{Control Group})} \]

Failing to reject the primary hypothesis, the variance between groups was compared. The null hypothesis (stated below) in this case is that the distribution about the mean of the control group and the experimental group are equal.

\[ H_0: \sigma_{(\text{Test Group})} = \sigma_{(\text{Control Group})} \]
\[ H_A: \sigma_{(\text{Test Group})} \neq \sigma_{(\text{Control Group})} \]

At alpha of .05, utilizing an F-test of group variances, again, we failed to reject the null. That is we are 95% confident that there is not a statistically significant variance in the distribution of grades when the two groups are compared.

**Conclusions and Study Limitations**

The failure to find statistically significant results does not imply that the Herrmann Personality Survey should not be used to help structure the learning experience. Nor should it indicate that this stream of research should not be continued. It does suggest that future experiments should be more rigorously structured and the evaluation criteria for the student projects should be made less subjective, if possible. The more we know of how our students learn, the better job we will be able to do as educators.

Of course, what we learn in a classroom environment can be translated to the business world. Had this experiment produced statistically significant results, it might have been appropriate to infer that cognitive style might play an extremely important role in insuring the quality of new systems development. Although the results were not statistically significant, this experiment provided some insights into the way in which undergraduates perform. Some who were selected as team managers, due to a particular evaluation of their Herrmann profiles, performed extremely well.

**References**


