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# **Verbalisers and Visualisers:**

## **Cognitive Styles That Are Less Than Equal**

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2007

## INTRODUCTION

The term cognitive style refers to a psychological dimension that describes the distinctive and observable ways in which individuals process information (Messick, 1984). Inherent to this definition is the premise that individuals learn differently and that these individual differences are identifiable and quantifiable. Also central to this philosophy is the belief that learning will be enhanced when there is a high level of congruence between the attributes of the individual and the characteristics of the environment. In other words, student success will be improved when educational policies and interventions respond appropriately to the different cognitive styles of college students. This is called the attribute-treatment interaction and it is seminal to the cognitive style philosophy.

Over the past thirty years numerous models of cognitive style, varying in complexity and applicability, have been developed. While these models have sparked a vast body of educational research, the results have been equivocal. The models have been widely criticized for their lack of precision and predictability. According to Kozhevnikov, Kosslyn & Sheppard (2005, p 710) “much of the previous work suffered from arbitrary distinctions and overlapping dimensions.” In spite of the criticism, several models of cognitive style survive and continue to stimulate research. Two of these models, the Field Dependent – Field Independence cognitive style and the Reflective-Impulsivity model will be reviewed briefly. Then we will discuss the Verbaliser-visualiser model on which the present research is based.

### **Field Dependent (FD) – Field Independent (FI)**

One of the earliest of these models of cognitive style is that of Witkin and his colleagues (Witkin, Moore, Goodenough, & Cox, 1977) who proposed that individuals differ in the degree to which they depend on internal or external factors to help them make decisions or to learn new material. In problem-solving situations individuals who are Field Dependent are sensitive to clues from the surrounding environment. These individuals learn best when external structure is provided and when social reinforcements are present. In contrast, individuals who are Field Independent are self-motivated. They prefer to impose their own structure on learning, and they are less sensitive to social and external factors.

Witkin’s model has stimulated a large body of research. Two recent studies using college students as subjects will serve as an illustration of the nature of this research. Hite (2004), for example, explored how the content of reading material affects the reading comprehension of students divided into FD and FI groups based on their scores on the Group Embedded Figures Test (GEFT). While there was no difference between the groups when the reading passage was social in nature, Hite found that the FI group outperformed the FD group when the reading passage was non-social. Hite explains these results in terms of the differing ability of the two groups to impose structure on the reading passage. She suggests that the social passage required less self-imposed structure because the subject matter was based on material that all students would be familiar with in their general life. When faced with new and unfamiliar materials, however, the FI

group was better able to develop and impose a structure on the material, and thus was able to outperform the FD group.

Pi-Sui-Hsu & Dwyer (2004) also are interested in factors that differentially affect the reading comprehension of FI and FD students. In this study, students were asked to read a passage under three different levels of questions: no questions, factual questions, and comprehension questions. While the higher order comprehension questions were effective in improving the reading comprehension scores for both groups, Pi-Sui-Hsu & Dwyer found that the performance of the FD group was more affected by the level of questions than was the performance of the FI groups. According to these researchers this is because FI learners are able to impose their own structure on a reading passage. In spite of the fact that the FD group may have the appropriate strategies in their repertoire, they are more likely to look externally for help in choosing the appropriate reading strategy.

### **Reflection-Impulsivity**

The reflection – impulsivity dimension is a second cognitive style model that continues to stimulate research in education. Students classified as reflectors like to take time to think and reflect before they commit to any plan of action. Impulsive students, on the other hand, prefer a more hands-on and immediate response in which they problem solve by becoming actively engaged in the task. In the Matching Familiar Figures Test (MFFT) designed by Kagan (1964) the subject is first presented with a picture of a common object. The picture is removed and the subject is asked to identify the original picture from among a group of distractor pictures. The task is timed and the error and latency scores are used to identify a reflective or impulsive cognitive style. While the MFFT has been most used with children subjects most frequently, there is also an adult form available. Three of these studies using adults are reviewed below.

Downing & Chim (2004) compared the satisfaction rates of reflector and impulsive students who enrolled in a course delivered either with an online format or in a traditional classroom format. These researchers found that students with a reflector learning style reported greater satisfaction with the online format than with the traditional classroom format leading Downing & Chim to hypothesize that this is because “in the traditional classroom setting, the additional time for reflection offered by online delivery makes this group more likely to contribute to online discussion, to report higher satisfaction levels and generally to behave more like online Extraverts” p. 265

While Downing’s research suggests that the mode of presentation is an important variable in influencing the satisfaction levels for students with a reflective learning style, other researchers have failed to find the expected relationship between a reflective or impulsive learning style and overall achievement. Lightner (1999) for example used the Matching Familiar Figures Test (MFFT) to group college students into reflective and impulsive learning style groups. Using an online presentation format, these students then learned basic Excel spreadsheets commands. For one group, a video presentation supplemented

the print commands. Lightner found no effect for cognitive style or for supplementary video presentation on the overall learning of the two groups.

Similar findings are reported by Huang & Chao (1998) who used the MFFT to compare the cognitive style of Chinese and American adult students. While they found that Chinese students are more likely to use a reflective style, these researchers found no differences between the groups in overall learning outcomes.

### **Visualisers – Verbalisers**

The verbaliser-visualiser cognitive style model was first developed by Paivio (1971) who proposed that the cognitive system is divided into two components: a verbal system and a visual system. The verbal system deals with linguistic information while the visual system processes and stores information as images or pictures. The two systems can function independently, but they also can process and store information simultaneously in both verbal and spatial codes. Central to this model is the recognition that individuals differ in the degree to which they depend on language or on imagery to process information. The Ways of Thinking questionnaire (Paivio, 1971) which was later updated by Richardson (1977) as the Visualiser- Verbaliser Questionnaire (VVQ) are self-report measurements in which the respondents report on their habitual way of processing different types of materials.

These questionnaires and several of the premises underlying the visualiser-verbaliser model have been criticized. The validity of the questionnaires has been challenged by Green & Schroder (1990), for example, who showed that the visual subscale is only moderately related to other visual-spatial aptitude measures. The assumption that visualisers and verbalisers exist on a single continuum where a strength in one dimension implies a corresponding weakness in the other dimension has been criticized by Antonietti & Gsiorgetti, (1998) and Green & Schroeder, (1990) who present evidence showing that the visual and verbal dimensions are independent qualities which individuals possess in various degrees. It is possible, therefore, for an individual to be strong (or weak) in both dimensions. Finally, Kozhevnikov, Kosslyn and Shephard (2005) present evidence that the visual system can be subdivided into an object visualizer dimension and a spatial visualiser dimension with object visualisers encoding and processing images holistically, while spatial visualizers generate and process images analytically.

In spite of these criticisms, the visual – verbal cognitive style dimension continues to be viewed by many researchers as a significant variable which affects program choice, and ultimately, program success. One body of research has addressed the question of whether the cognitive style of students affects their ability to learn different types of material. Casey, Winner, Hurwitz, & DaSilva, (1991) report that students with strong visual skills recall more details of figures which they had previously drawn than did students with poor visual skills. A positive correlation between students' visualizing skills and their ability to locate a position on a map was found by Schofield & Kirby (1994). Using children as subjects, Riding, Buront, Rees, & Sharratt (1995) found that those with good

visual skills learn better with pictures, while those with good verbal skills learn better with print. In a recent study Mendelson & Thorson (2004) examined the importance of cognitive style in affecting the memory of college students for newspaper articles. Using the VVQ the students were categorized into visualisers and verbalisers. The students first read a newspaper article. Later their memory for details from the article was measured. Students with high verbalizing skills were found to remember significantly more details than students with low verbalizing skills. There was no such effect between those with high and low visualizing skills. These results led the researchers to conclude that “specific styles seem to affect learning for specific learning situations” (p 484).

Another body of research supports the view that the likelihood of success is enhanced when students choose courses that match their learning style. Hansen (1995) Administered the Part VI, Spatial-Visualization (S-V), of the Guilford-Zimmerman Aptitude Survey to 95 college and university students in technical programs. Hansen found that students with a higher GPA and those who remained in the program until the senior levels were those students with higher scores on the Spatial-Visualization subtest. According to Hansen, students who enter programs where the cognitive style is compatible are more likely to do better and to stay longer than students who choose programs which are incompatible with their learning style.

Similar findings are reported by Riding & Staley (1998) who used the Cognitive Style Analysis to divide 86 first year university students into Verbaliser and Visualiser Groups. The performance of these two groups was compared in an information technology course and a management course. While the visualisers outperformed the verbalisers in IT, the reverse occurred in the management course where the verbalisers outperformed the visualisers. According to Riding & Staley “The principal medium of working was different for each area with information technology having a visual and spatial interface . . . . Management by contrast was much more verbal both in the representation of the information and in the communication of the ideas. “p 10.

Further support for the view that college students choose courses based on their cognitive style and the presumed style-demands of the program is provided by Brown and her colleagues (2006) who grouped students in an IT course into visual, verbal and bimodal groups based on their scores on the Felder-Soloman Inventory of Learning Styles (ILS) questionnaire. Of the 216 who completed the questionnaire only 11 students could be classified as verbal learners. The remaining 210 students were evenly split between the visualiser and bimodal categories, thus, supporting the view of a correlation between the cognitive style of the student and the style demands of the course.

### **Present Study**

The question of whether students in a community college exhibit distinctive cognitive styles, and the manner in which those styles impact on program selection, and program success, is of wide concern. Traditionally, colleges such as Fanshawe have been perceived of as “hands-on” institutions where students learn high-level technical skills which, in turn, transfer directly to the workforce.

While liberal arts courses have always been available, the emphasis was clearly on technology, skills-acquisition, and other job-directed programs. Recently, the mandate of these colleges has expanded to include more liberal arts courses. Articulation agreements with universities allow college students to earn credits which can be transferred to a university. Colleges have also begun to offer degree programs in applied arts or applied technology. In addition, financially-driven changes are occurring in the college system, and these changes have affected how courses are delivered. There is a clear perception, for example, that students are spending more time in lecture halls, and less time in laboratories.

How this evolution in the college system will impact on the relative success of the traditional college student is not at all clear. Antidotal evidence and informal observation suggest that many students in the college see themselves as learners who want to be shown how to do a task rather than being asked to learn through lectures and textbooks. These students clearly prefer a practical approach. In this research we will collect evidence on whether college students do, in fact, show distinctive cognitive styles, and whether those styles are correlated with success in programs.

### **Selecting Students for the Study**

Students in the college who are experiencing academic difficulties can make a self-referral for a psychoeducational assessment through the Student Success Centre. Each of these assessments includes a standardized intelligence test, typically the Wechsler Adult Intelligence Scale (WAIS-III) or the Woodcock-Johnson Tests of Cognitive Abilities (WJ III). Specific subtests, and groups of subtests, in both the WAIS-III and the WJ III measure verbal, and visual-spatial aptitudes. Those students whose test results show a significant discrepancy between their visual-spatial, and their verbal scores will be selected for this study. Verbalisers will be those who show a pattern of relative strengths in verbal skills, while those with relative strengths in the visual-spatial areas will be called Visualisers. The second step in the procedure will be to trace the program selection, and the academic performance of these two groups of students. This will allow us to address three questions: What is the relative proportion of students who can be classified as Visualisers and Verbalisers? Do these groups choose to enroll in different programs? And, finally, are the groups differentially successful in the programs in which they enroll?

## **Method**

### **Definition of Verbalisers and Visualisers**

In total there were 130 full-scale intellectual assessments conducted between January 2000 and April 2005 which were available for analysis. Of these, 85 used the WAIS-III, and 45 used the WJ III. To be selected for this study students have to demonstrate a significant discrepancy between their visual-spatial scores and their verbal scores.

A Verbaliser was defined as someone whose Verbal Comprehension Index (VCI) score on the WAIS-III was at least 11 standard scores higher than their score on the Perceptual Organization Index (POI) score.<sup>1</sup> For those students who had been administered the WJ III the verbal comprehension subtest score had to be at least 11 points higher than the spatial relations subtest.<sup>2</sup>

Conversely, a Visualiser was someone whose score on the POI was at least 11 points higher than their score on the VCI, or, in the case of the WJ III, someone whose score on the spatial relations test was at least 11 points higher than their score on the verbal comprehension subtest.

Using the WAIS-III definition, 25 students met the Verbaliser definition and 48 met the Visualiser definition. With the WJ III definition 3 were classified as Verbalisers and 11 as Visualisers.

### **Program Groupings**

On the main campus of Fanshawe College there are approximately 86 different programs grouped into 12 administrative schools. For the purposes of this research these administrative groups are further combined into four main groups which logically appeared to appeal to either a Visualiser or a Verbaliser cognitive style.

**Group 1 General Studies:** Typically this program is used by students as preparation for other programs within the college, or to meet the entrance requirements of a university. While there are clear guidelines as to the concentration of courses and the number of senior credits which must be earned, this program offers great flexibility and allows students to choose among a wide range of history, psychology, English, sociology and philosophy courses. As would be expected, course content in the majority of these courses is presented to large groups of students in the traditional lecture format.

**Group 2 Human and Community Services:** The majority of programs in this group lead directly to employment in various fields of human service. Included are such programs as Developmental Social Worker, Early Childhood Education, Child and Youth Worker,

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<sup>1</sup> According to Table B.1 in the WAIS-III scoring manual a difference of 10.47 for the 18-19 group, and a difference of 9.71 for the 20-24 group between standard scores on the VCI and POI are significant at the .05 level. Thus, a difference of at least 11 standard scores was needed for entry into one of the experimental groups.

<sup>2</sup> In establishing the groups using the WJ III, a logical choice would have been to use the two CHC factors, first, comprehension-knowledge based on verbal comprehension and general information, and second, visual-spatial thinking based on spatial relations and picture recognition. Typically, the counselors who use the WJ III administer only the standard battery which includes verbal comprehension and spatial relations subtests. In order to maximize the size of our groups, therefore, we decided to use the two single subtests when creating the two cognitive groups from the WJ III scores.

and Police Foundations. Field placements and other on-the-site experiences are typical to most of the programs in this group.

**Group 3 Technology and Sciences:** This group is an amalgamation of programs which have the word design, technology or science in their program name. Building Technology, Art & Design, Health Sciences, and Motive Power Technology are examples of programs included in this group.

**Group 4 Other:** This grouping includes the programs which do not fit easily into one of the other groups, or they are programs that include courses which appear to appeal to both Verbal and Visual styles. For example, Media & Communication includes programs such as television journalism which would be most suited to an individual with a Verbaliser style. At the same time Media & Communication also includes courses on multi-media design which, we hypothesized, would appeal to students with a Visualiser cognitive style. Other programs such as Tourism & Hospitality and Business Studies present similar challenges.

### **Success in Program**

We defined success in two ways: first, by determining whether the student had either graduated or was making progress toward a diploma, and second, by examining the student's cumulative grade point average (GPA) in the program.

#### 1) Graduation.

In this research, only the outcome of the first program in which the student enrolled is considered. A student is classified as being successful if s/he earned a certificate or diploma, or if the student was registered as a student in good standing when the data for this study was collected. With this definition, students who changed programs prior to earning a certificate or diploma, or who withdrew all registration from the college for two consecutive semesters were classified as early leavers and thus, as being unsuccessful.

#### 2) Grade Point Average (GPA)

Fanshawe College uses a traditional 6 level grade point system (i.e., A+ = 5, A = 4, B = 3, C = 2, D = 1, F = 0). The college transcript for each participant in the study was printed. The cumulative GPA was recorded at the point where the student graduated, or at the point where the student left the study because they were unsuccessful. For students who were making satisfactory progress toward a diploma or certificate a record was made of their most recent cumulative GPA.

## Results and Discussion

### ***Finding 1: THE PROPORTION OF VISUALISERS AMONG THE STUDENTS IN THIS STUDY IS SIGNIFICANTLY GREATER THAN THE PROPORTION OF VERBALISERS***

Of the 87 students in the study, 28 (i.e., 32.2%) demonstrated a Verbaliser style, whereas 59 (i.e., 67.8%) had a Visualiser style. A chi square test showed the difference in the size of the groups to be statistically significant ( $\chi^2(1, N = 87) = 11.046, p < .001$ ). The fact that Visualisers significantly outnumber Verbalisers has been found by other researchers, particularly when the subjects were students in specialized programs. Brown et al. (2006), for example, were forced to abandon one portion of their research because they could not find enough Verbalisers to make comparable groups among students in an IT program. Out of a group of 106 university students, these researchers found only 11 students who demonstrated a clear Verbaliser style. Additional support for the position that the number of Visualisers and Verbalisers are not equally distributed among a student population is reported by Felder & Spurlin (2005) who found a high proportion of visual learners among a group of electrical engineering students.

While the students in the study may not be representative of all college students, these results do provide support for the view that students who choose to enroll in community colleges are more likely to have a Visualiser learning style than a Verbaliser style. The next results to be reported expand on this foundation by suggesting that Visualisers and Verbalisers tend to choose programs that lead to different career paths, and that Visualisers are generally less successful than are Verbalisers in persisting in those programs.

### ***Finding 2: VISUALISERS TEND TO ENROLL IN DIFFERENT PROGRAMS THAN DO VERBALISERS***

Table 1  
The percentage of Visualisers and Verbalisers who enrolled in the four major groups of programs

	Technology	General Arts	Human/Social Services	Other
Visualisers	50.8%	8.5%	15.3%	25.4%
Verbalisers	28.6%	21.4%	28.6%	21.4%

Table 1 shows the relative percentage of Visualisers and Verbalisers who chose to enroll in the four major groupings of programs offered in the college. While the differences between the groups in program selection are not large enough to reach statistical significance [ $\chi^2(3, N = 87) = 6.526, p < .09$ ] the trend is pronounced. While almost 51% of the Visualisers chose technological programs, less than 29% of the

Verbalisers chose to enroll in technological programs. Conversely, in comparison to the Visualisers, the Verbalisers were much more likely to enroll in General Arts (21.4% vs. 8.5%) and in Human and Social Services (28.6% vs. 15.3%).

This trend is consistent with the results of a series of studies examining the relationship between the individual's cognitive style and the profession or courses in which the individual engages. In an early study, Baken (1969) using hemisphericity to measure cognitive style, found that students in sciences, mathematics and engineering demonstrated different cognitive styles than did students enrolled in literature and humanities programs. In a second study also using hemisphericity measurements, Dabbs (1980) found that English students demonstrated increased blood flow to the verbal areas of the brain while students in architecture showed increased flow to the spatial areas. Galin & Ornstein (1974) were able to demonstrate that lawyers and ceramists use different types of brain activity depending on the task in which they were engaged. Finally, in a study comparing the spatial skills of students with different career orientations, Eisenberg & McGinty (1977) found that students taking a calculus course had significantly better spatial skills than did a group of elementary teachers or business students, who were enrolled in a general mathematics course.

A final piece of research that has found an interaction between the nature of the program and the cognitive style of the students is that of Zhang and RiCharde (1997). They administered the Learning-Thinking Style Inventory to 243 male college students who were taking a variety of programs. Students in liberal arts programs scored significantly better than engineering and science students on an auditory measure, while engineering students outperformed the liberal arts students on the kinesthetic measure.

Using a variety of measures and a range of subject groups the findings of the studies reviewed above are consistent with the outcome of the present study which shows that students choose to enroll in courses which they believe match their learning style. Those with strengths in the visual-spatial areas are attracted to technological studies while students with relatively strong verbal skills enroll in courses in Human Services and in General Arts which they see as depending more on oral communication, and print language skills and less on kinesthetic and visual-spatial aptitudes.

***Finding 3: VERBALISERS ARE MORE LIKELY TO COMPLETE THEIR PROGRAM THAN ARE VISUALISERS.***

**Table 2**  
**The course completion rate and the GPA of the Visualiser and Verbaliser groups in the first program in which they enrolled**

	<b>Visualisers</b>	<b>Verbalisers</b>
<b>Course completion</b>	<b>42.4%</b>	<b>75.0%</b>
<b>GPA</b>	<b>2.29</b>	<b>2.63</b>

As can be seen in Table 2, 75% of the Verbalisers completed the first program in which they registered. This is in contrast to the Visualisers where only 42.4% were successful in completing their first program. A chi-square test ( $1, N = 87$ ) = 8.11,  $p < .01$  showed this to be a significant difference. There was not, however, a large difference in the grade point average between the two groups. On average the Verbalisers earned a GPA of 2.63 while the Visualisers earned an average of 2.29. The differences between these means did not reach statistical significance ( $t = 1.247, df = 85, p < .216$ ).

The fact that Verbalisers consistently outperform Visualisers, regardless of the course or program, is supported by other research. Carthey (1993), for example, compared the performance of left hemisphere students with right hemisphere students in three business courses: Principles of Management, Principles of Economics, and Business Law. He found that the left hemisphere students outperformed the right hemisphere students in all courses. Carthey hypothesized that the left hemisphere students were more analytic and were better on multiple choice examinations (i.e., the most common form of evaluation) than the other students. Zang and RiCharde (1997) in the study described above propose that colleges rely heavily on print language for transmitting and evaluating information, and because of this, they disadvantage students with strong visual-spatial aptitudes and weaker language aptitudes.

The fact that there was not a significant difference in the GPA between the two groups, even while there was a significant difference in the course completion rate, raises the possibility that the Visualisers left programs for reasons other than the specter of imminent academic failure. Could it be that there is a discrepancy between what the student expects from a program and what the student actually experiences in the program? If the student expects a “hands-on” approach to learning and instead, encounters a heavy textbook and lecture approach, the student may become dissatisfied and withdraw. This raises the likelihood that there are other important variables – in addition to cognitive style – that affect a student’s persistence and success. In an era in which improving the rate of course completion is seen as a high priority in community colleges, there is an ongoing need for more research on the variables that affect a student’s likelihood of graduation.

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