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Performance of the Cognitive Holding Power Questionnaire in Queensland Schools

by

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Abstract

This paper reports results of administering the Cognitive Holding Power Questionnaire in Queensland State High Schools. The questionnaire measures First Order Cognitive Holding Power (FOCHP) and Second Order Cognitive Holding Power (SOCHP) in classroom environments. It was administered to 47 classes in 4 schools across 9 subjects with 1203 students; and the results are compared with those gained from using the instrument in TAFE with 49 classes and 706 students. The reliability of the scales, is reported and compared. Means and inter-item correlations across TAFE and school settings are compared. Relationships with such variables as teacher, subject matter, year level and school are also analysed.

1.INTRODUCTION

Cognitive Holding Power (Stevenson, 1990) is a setting (Barker, 1968, 1978) characteristic which refers to the extent to which the setting presses (Murray, 1938; Pace & Stern, 1958) learners into using first and second order cognitive procedures (Stevenson, 1986). First order procedures are those automatised procedures which enable the securement of specific goals, much like the productions of Anderson (1982) or rules of Scandura (1981). Second order procedures are those procedures which operate by utilising specific procedures in order to enable the interpretation of new situations, the solving of problems and the learning of new skills (Evans, 1991; Stevenson, 1986, 1991). They combine existing knowledge in new ways and enable far (Royer, 1979) transfer.

Settings which press learners into using first order procedures are said to have First Order Cognitive Holding Power (FOCHP). Such settings minimise the need for learners to combine and modify existing procedures for problematic tasks. It is the teacher who takes the responsibility for the second order procedures, the students' task being reduced to copying or to the simplest interpretation of information. The student may be largely unaware of the thinking strategies used in the lesson and not responsible for controlling them (cf. Rigney, 1980; Derry and Murphy, 1986). Such activities that tend to short circuit the students' use of second order procedures include copying directly from the teacher, being shown a procedure explicitly by the teacher, being told explicitly what to do, and acting on information, ideas, and judgements of the teacher. Such activities may foster the learning of the target first order skills, but not second order procedures.

Settings which press learners into using second order procedures are said to have Second Order Cognitive Holding

Power (SOCHP). These settings pose unfamiliar goals for the learner and elicit the execution of second order procedures to interpret the situation and deal with the associated problems. Such a setting promotes the use of second order procedures and impedes the learning of new tasks through only the direct application of specific procedures nominated by the teacher. Second order procedures are used to make links between the situation and existing knowledge, to generate ideas, to try out and test problem-solving strategies, to monitor the effectiveness of strategies and to check results. Selection, organisation, combination, modification, and application of sets of specific procedures would be achieved through the learners' active use of second order procedures. The trialing of novel sets of specific procedures and the monitoring of strategies for attacking the situational problems would also be accomplished by second order procedures activated as a result of the switching function of third order executive procedures (Evans 1991, Stevenson 1986, 1991).

A summary of differences in the features of settings with First and Second Order Cognitive Holding Power is given in Table 1.

(Insert Table 1 about here)

2.DEVELOPMENT OF THE INSTRUMENT

The Cognitive Holding Power Questionnaire, developed to measure First and Second Order Cognitive Holding Power has been developed and trialed in TAFE Colleges (Stevenson, 1990). Items are based on students' perceptions of teacher encouragement of activities, students feeling impelled to engage in activities and students actually undertaking activities. The activities include copying, being told, being shown, trying out ideas, finding information, finding links, checking results and questioning. In that research, it was found that the scale FOCHP had reliability, calculated as Cronbach's ‡, of 0.82-0.86; SOCHP, 0.77-0.87. Reliability was maintained across a variety of courses in different colleges.

Evidence for the validity of the instrument has been reported from studies of 27 TAFE classes of students in fitting and machining, automotive and butchery classes in three colleges (Stevenson & McKavanagh, 1991). Video-taped activites were coded, every minute, according to whether activities were initiated by the teacher or students, whether activities consisted in presentation or elicitation, the size of the

group involved in activities and the nature of the cognitive structures involved. Cognitive Holding Power was also measured. It was hypothesised that FOCHP would be associated with teacher initiation, presentation, larger groups and specific procedural knowledge (knowledge about how to do things and specific procedures); while SOCHP would be associated with student initiation, teacher interactions with single students, higher oder procedures and monitoring. Correlations of video-recorded activities with CHP are given in Table 2 (Stevenson & McKavanagh, 1991:22), and are taken as evidence for the validity of the two scales.

(Insert Table 2 about here)

The reliability and validity of the instrument has been further confirmed in higher education (Clarke & Dart, 1991). In that research, First and Second Order Cognitive Holding Power scales were found to have ‡ reliabilities of 0.87 and 0.85 respectively (n=470 first and second year university students in 32 classes with 17 lecturers, in a BEd (Secondary) course). In addition, it was found that FOCHP was significantly correlated with student utilisation of surface strategies and surface approach, as measured on the Study Processes Questionairre (Biggs, 1987) ($r=0.45$, $p<0.001$; $r=0.38$, $p<0.001$, respectively); and SOCHP was significantly correlated with student use of deep strategies and deep approach ($r=0.55$, $p<0.001$; $r=0.55$, $p<0.001$, respectively).

The purpose of the research reported here is to appraise the the instrument in schools.

3.SAMPLE

The instrument was administered to 1203 students in four Brisbane State High Schools. The students were in Years 8 (n=421), 10 (n=475) and 12 (n=307), and the classes sampled were Mathematics (n=360), English (n=417), Shop A (n=93), Shop B (n=42), Manual Arts (n=91), Graphics (n=13), Chinese (n=21), Japanese (n=134) and German (n=32).

4.FINDINGS ON THE RELIABILITY OF THE INSTRUMENT IN SCHOOLS

Reliability was calculated as Cronbach's alpha. The results are given below for each dimension (47 classes with 1211 students) and compared with results gained from using the instrument in TAFE with 49 classes and 706 students.

First Order Cognitive Holding Power‡=0.84 (0.82 to 0.86

in TAFE colleges)

Second Order Cognitive Holding Power‡=0.82 (0.77 to 0.87 in TAFE colleges)

Reliability was unaltered by coding missing values as 3 on the Likert Scale.

The means and inter-item correlations for each dimension in TAFE and in schools are compared in Table 3. Results from TAFE are given with results from schools in brackets. These data indicate a high degree of consistency for the dimensions overall and for individual items, across the two types of institutions.

(Insert Table 3 about here)

5.SUBJECT AREAS AND YEAR LEVELS

Levels of First and Second Order Cognitive Holding Power were calculated for each subject area (Table 4). (The calculations were undertaken with missing values coded as 3).

(Insert Table 4 about here)

The results indicate variation in both scales across subject areas. Comparisons can be made only with caution, given the large differences in cell sizes. Nevertheless, it appears that English and Mathematic subjects may press students more into higher order thinking than languages and technology education; and that English and Chinese may press students less into developing specific procedural skills.

However, Analyses of Variance, reported later in this paper, suggest that teachers themselves, may account for a substantial part of this variance across classes.

Levels of First and Second Order Cognitive Holding Power were calculated for each year level (Table 5).

(Insert Table 5 about here)

The results indicate very similar levels of First Order Cognitive Holding Power, across year levels, with more variation for Second Order Cognitive Holding Power. The effect of year level is explored further in analyses of variance reported later.

6.ANALYSES OF VARIANCE

Analyses of variance were conducted using First and Second Order Cognitive Holding Power as Dependent Variables and School, Year, Subject and Teacher as independent variables. Because of the unequal cell sizes the GLM procedure was performed with both Type I and Type III Sums of Squares (the latter indicating the contribution of each independent variable when added last to the equation) (Table 6). In a further attempt to compensate for uneven cell sizes, the analyses were repeated for combined subject areas where all languages other than English were combined to form a language set (n=187) and Shop A, Shop B, Manual Arts and Graphics were combined to form a technology education set (n=199) (Table 7).

(Insert Tables 6 & 7 about here)

The differences between the tables are almost imperceptible. The general conclusions which can be drawn are as follows. Overall, the teacher, the subject, the school and the year level account for about 10-11% of the variance in First Order Cognitive Holding Power and Second Order Cognitive Holding Power. The only variable which accounts significantly for variance in First Order Cognitive Holding Power and Second Order Cognitive Holding Power, once all other variables have been added to the equation, is the teacher.

Using a Type I analysis, Year Level, Subject Area and School all contribute to variance in Second Order Cognitive Holding Power, but Year Level does not contribute to First Order Cognitive Holding Power. From Table 4, (as indicated previously), these appear to lower levels of Second Order Cognitive Holding Power in language and technology education classes, and, from Table 5, in Year 10 classes.

These findings are tentative and would need replication before they could be confirmed.

7.CONCLUSIONS

The results of the study add weight to the reliability of the Cognitive Holding Power Questionnaire and provide evidence of its ability to differentiate among different classes in school settings. The results suggest that teachers have a major role in creating First and Second Order Cognitive Holding Power, and that there are interactions between the effects of teachers and the nature of the subject area.

There is also some evidence that levels of press vary across Year Levels.

The Cognitive Holding Power Questionnaire seems to be useful in identifying relative emphases on different kinds of cognitive processes which students feel are required of them in different settings. Thus the Questionnaire has potential for assisting teachers in schools in focusing their attention on the kinds of cognitive structure they are seeking to develop, and adjusting their teaching accordingly.

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Table 1:Contrasting Features of Settings with First and Second Order Cognitive Holding Power

Character-
isticsFirst Order Cognitive
Holding Power (FOCHP)Second Order Cognitive
Holding Power (SOCHP)Press from
Setting Presses students into
following instructions or
procedures, provided by the
teacher, e.g. copying, doing
as told, doing as shown,
relying on the teacher for
ideasPresses students into working
things out for themselves,
tackling problems, exploring,
e.g. finding links, finding
out information, checking
results, trying out ideasExamples
of Teacher
ActivitiesDemonstrating, telling,
providing information,
generating ideas,
instructing, designing tasks
for student practice,
showing links, checking
resultsPosing new and problematic
tasks, encouraging students
to explore and tackle

unfamiliar tasks and
situations, acting as a
referent as requested,
encouraging students to find
links and check their own
results against existing
knowledgeExamples
of Student
ActivitiesCopying the teacher,
following instructions,
relying on the teacher for
new ideas and procedures,
executing plans provided by
the teacher, relying on the
teacher for links and for
checking on the results,
passively accepting new
information and procedures,
accepting results of
activitiesInterpreting new situations,
making plans, solving new
problems, making links
between existing and new
knowledge, generating ideas,
trying out new ideas and
procedures, checking the
results of new procedures
against existing knowledge,
monitoring own activitiesCognitive
ActivityEncoding new propositional
knowledge
Encoding new specific
proceduresUse of second order
procedures for making plans,
problem-solving and
monitoring
Use of propositional
knowledge for interpretation
of problems, monitoring new
procedures, and assessing

progress toward goals
Active reconstruction of
propositional knowledge
Second order procedures
operating on specific
procedures

Table 2: Correlations of Cognitive holding Power with
Observed Teacher and Student Variables
(Stevenson & McKavanagh, 1991:22)

Variable FOCHPSOCHPAction - Presenting (P) 0.42*-0.40*Action - Eliciting (E)-0.56** 0.36 Action - Teacher initiating (L)-0.12-0.59** Action - Student initiating (S)-0.05 0.60***Group size -Whole group (V)-0.05-0.42* Group size -Small groups (F)-0.32 0.01 Group size -Teacher with one student (O) 0.32 0.52**Content - Information (T)-0.44*-0.38 Content - Knowledge about how to do something
(A) 0.39* 0.14Content - Specific procedures (Y) 0.28 0.11Content - Higher order procedures (G)-0.48* 0.12Content - Monitoring (M) 0.25 0.38*

Table 3:Means and inter-item correlations for the CHPQ. TAFE results with school results in brackets (Items in each dimension clustered according to sub-scales)

Item
MeanFOCHP
Corr.
Item
MeanSOCHP
Corr. 9 3.2 (3.3).54 (.48)15 3.4 (3.2).39 (.38) 6 3.0 (3.0).66 (.54) 4 3.2 (3.0).36 (.28)20 3.1 (3.1).64 (.63)27 3.1 (3.1).35 (.34)26 3.3 (3.4).48 (.50) 3 3.5 (3.4).44 (.40)17 3.2 (3.2).58 (.53)22 3.2 (3.0).53 (.51)30 3.2 (3.2).57 (.54)13 3.4 (3.2).49 (.54)18 3.0 (2.9).49 (.47)29 3.2 (3.1).46 (.47)16 3.5 (3.8).39 (.39)12 3.2 (3.0).50 (.49)24 3.2 (3.3).61 (.61) 7 3.4 (3.2).44 (.46) 5 3.0 (3.2).51 (.52)21 3.4 (3.4).39 (.43) 8 3.1 (3.1).46 (.51) 1 3.3 (3.0).52 (.49)28 3.0 (2.9).47 (.44)11 3.3 (3.1).50 (.51)23 3.0 (3.0).30 (.20) 2 3.1 (3.0).55 (.49)19 3.3 (3.2).43 (.52)

Table 4:Cognitive Holding Power in Different Subject Areas (Meeans with Standard Deviations in brackets)

SubjectSOCHPFOCHPn Chinese

Graphics

Shop A

Japanese

Manual Arts

Shop B

German

Mathematics

English 2.64 (0.65)

2.96 (0.43)

3.02 (0.54)

3.03 (0.58)

3.05 (0.55)

3.12 (0.50)

3.17 (0.62)

3.19 (0.54)

3.20 (0.54) 3.05 (0.79)

3.45 (0.37)

3.33 (0.61)

3.30 (0.63)

3.20 (0.61)

3.60 (0.48)

3.16 (0.59)

3.20 (0.54)

3.07 (0.57) 21

13

93

134

91

42

32

417

360 TOTAL 3.14 (0.55) 3.19 (0.61) 1203

Table 5:Cognitive Holding Power in Different Year Levels (Means with Standard Deviation in brackets)

Year Level SOCHP FOCHP n 8

10

12 3.14 (0.59)

3.09 (0.53)

3.20 (0.51) 3.21 (0.63)

3.19 (0.61)

3.17 (0.60) 421

475

307 TOTAL 3.14 (0.55) 3.19 (0.61) 1203

Table 6:Analysis of Variance of First and Second Order Cognitive Holding Power (9 subjects treated separately)

Dependent Variable: SOCHP

Sum of Mean
Source DF Squares Square F Value Pr>F

Model5239.000.752.620.00
Error1150328.630.29
Corrected Total1202367.63

R-Square CV Root MSE SOCHP Mean
0.1117.040.533.14

Type I Mean
Source DF SS Square F Value Pr>F

SCHL33.681.234.300.01
YEAR21.930.963.370.03
SUBJ813.591.705.950.00
TCH3919.800.511.780.00

Type III Mean
Source DF SS Square F Value Pr>F

SCHL30.670.220.780.51
YEAR00.00
SUBJ30.420.140.490.69
TCH3919.800.511.780.00

Dependent Variable: FOCHP

Sum of Mean
Source DF Squares Square F Value Pr>F

Model5246.960.902.580.00
Error1150403.150.35
Corrected Total1202450.11

R-Square CV Root MSE SOCHP Mean
0.1018.550.593.19

Type I Mean
Source DF SS Square F Value Pr>F

SCHL34.091.363.890.00
YEAR20.230.110.320.72
SUBJ817.262.166.150.00
TCH3925.390.651.860.00

Type III Mean
Source DF SS Square F Value Pr>F

SCHL30.450.150.4300.73
YEAR00.00
SUBJ30.750.250.710.54
TCH3925.390.651.860.00

Table 7:Analysis of Variance of First and Second Order Cognitive Holding Power (4 combined sets of subjects: English, Mathematics, Languages, Technology Education)

Dependent Variable: SOCHP

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Model	5	138.97	0.76	2.68	0.00
Error	1151	328.66	0.29		
Corrected Total	1202	367.63			

R-Square	CV	Root MSE	SOCHP Mean
0.11	17.03	0.53	3.14

Source	DF	Type I SS	Mean Square	F Value	Pr>F
SCHL	3	3.68	1.23	4.30	0.01
YEAR	2	1.93	0.96	3.37	0.03
SUBJ	3	6.20	2.07	7.24	0.00
TCH	4	327.16	0.63	2.21	0.00

Source	DF	Type III SS	Mean Square	F Value	Pr>F
SCHL	3	0.67	0.22	0.78	0.51
YEAR	0	0.00			
SUBJ	2	0.39	0.20	0.69	0.50
TCH	4	327.16	0.63	2.21	0.00

Dependent Variable: FOCHP

Sum of Mean

Source DF Squares Square F Value Pr>F

Model5146.410.912.590.00
Error1151403.700.35
Corrected Total1202450.11

R-Square CV Root MSE SOCHP Mean
0.1018.560.593.19

Type I Mean
Source DF SS Square F Value Pr>F

SCHL34.091.363.890.00
YEAR20.230.110.320.72
SUBJ310.903.63 10.360.00
TCH4331.190.732.070.00

Type III Mean
Source DF SS Square F Value Pr>F

SCHL30.450.150.430 0.73
YEAR00.00
SUBJ20.190.100.280.76
TCH4331.190.732.070.00