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Critical Thinking as Predictor of Drawing Ability

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Introduction

Much attention of late, has been given to the relationship between the quality of education and involvement in the arts. Hanna (1992), Horn and Sieder (1992), Fowler (1994, Gardiner, Knowles and Heffrey (1996), and Bezruczko (1997) have documented academic success in the presence of a strong arts program, although the specific relationship in terms of cause and effect has not as yet been determined. There may be many possible reasons for this relationship. The effect may be motivational so that good arts programs encourage students' desire to learn (Sukraw-Ebert, 1988). Quality arts programs may also train the mind to patterns of thinking which aid in the learning of other subjects, as seems to be suggested in studies such as Gardiner, Knowles, and Heffrey (1996) and Bezruczko (1997). It could be that the types of activities in which students are engaged during arts classes constitute the type of rich, stimulating environments which according to Diamond and Hopson "unmistakably influence the brain's growth and learning" (1998, pp. 107-108). There is also the possibility that intelligence, critical thinking, and the discipline of thinking in the arts are interdependent, with each benefiting from the other and each depending on the other.

The interest in critical thinking over the last decade may be an opportunity for understanding the connection between the arts and academics as critical thinking is common to all. The literature on critical thinking indicates that critical thinking abilities in one area are not transferable and do not indicate critical thinking ability in another area. However, these ideas are untested in the area of art making skills and general critical thinking. There is some empirical evidence of a correlation between achievement scores in science and general critical thinking in research conducted by Troxel and Snider (1970) and Bitner (1991). If critical thinking is a pattern of thinking, then someone who is a good, general critical thinker should be able to learn in other areas and begin to think critically in those areas once the subject specific information (rules of the game) have been introduced. Kurfiss (1988) argues that critical thinking is subject specific because "studies in artificial intelligence... have made clear that a considerable task-specific knowledge is required to solve even 'simple' problems" (p. 11). However, what if critical thinking is like a computer program (to carry on the artificial intelligence analogy) and the subject related material were the data? The program must sit dormant until the correct amount and type of data are fed into the computer for that particular program to work. Observation about results concerning transfer may be more about knowledge acquisition than thinking frames which are present (the program in the a computer), but can't be used until enough subject specific information is acquired. It may also be that, rather than subject specificity, the application of critical thinking strategies are linked to task familiarity.

This study is focused on discovering whether a relationship exists between drawing ability and general critical thinking. The study does not examine

cause and effect, as those results cannot be obtained from a correlation or regression analysis. Rather, the focus of the study is whether a relationship exists between the two main variables. The extraneous variables are controlled by including them as independent variables. A stepwise regression equation is used to statistically analyze the data. Because there are many factors effecting both variables, a regression analysis rather than a straight correlation is thought to be the more effective procedure.

Participants

The participants for the study included students from secondary introductory and advanced level art classes from grades 9-12. The participants came from three schools in suburban areas in a Midwestern state. There were a total of 137 participants in this study. Ninety-two students were from introductory art classes and 45 students were from advanced art classes. There were 64 males and 73 females which in terms of percentage of the whole is 47% males and 53% females. Students in the study were in grades 9-12; 19 students were from 9th-grade, 47 were 10th-graders, 29 were 11th-graders, and 42 were 12th-graders. In terms of percentage of the whole, the break down is 14% 9th-graders, 34% 10th-graders, 21% 11th-graders, and 31% 12th-graders.

Research Design

Three teachers from three different schools participated in the study. Each teacher taught at least one section of advanced art classes and at least one section of introductory art classes. One school contributed participants from three sections of both introductory and advanced classes. The 137 participants came from a total of ten sections. Subjects were asked to participate in the study. Those students who chose to participate in the study were asked to sign a letter indicating their agreement to participate. Because participation was voluntary, some students in each section chose not to participate, so that the final 137 participants represent varying percentages of the total number of students in each section. Students in those sections who turned in all completed materials related to the study were counted as participants in the study. Human subject data were coordinated by the cooperating teachers so that the same participant had the same number on each instrument, but the researcher had no way of identifying individual participants.

Instrumentation and Data Collection Procedures

Students were given the three instruments for the study with the same student ID number on each of these documents, so that the documents could later be correlated. Participants were asked to fill out a survey to identify independent variables (age, gender, grade, family member in the arts, years of formal training in art, the experience of private art lessons, and participation in advanced or honors Art, English, Science, and/or Math classes). They were then, on separate occasions, administered the two test instruments used in this study: The Cornell Critical Thinking Test - Z (CCTT-Z) (Ennis, R., Millman, J., & Tomko, T. 1985), and the Clark Drawing Abilities Test (CDAT) (Clark, 1989).

Both tests were timed. Teachers were allowed great latitude in deciding when they would administer the tests to the participants in each section of their classes to be less intrusive in the curriculum of cooperating teachers. Some teachers administered the CDAT first and others administered the CCTT first. Some teachers administered both tests within one week and others administered the tests several weeks apart. Since the CDAT contained four drawing assignments at 15 minutes each and the classes were all 50 minutes, the drawing tests were administered over a two day period. The CCTT was a 50 minute test administered in one class periods.

The Schools

School A is a suburban high school with a total 9-12 population of about 1,500 students. The introductory art classes average about 32 students, and the advanced classes average about 15 students per class. One advanced and one introductory class were used for this study. The community in which School A was located contained a minority population which made up about 12% of the total population.

School B is a small suburban high school with a total 9-12 population of about 900 students. The introductory art classes average about 26 students and the advanced classes average about six students per class. The community in which School B was located contained a minority population which made up about 12% of the total population. One advanced and one introductory class were used for this study.

School C, like school B, is a small suburban high school with a total 9-12 population of about 960 students. The Art II classes average about 25 students and the Advanced classes (Art III/IV) average about 15 students per class. Three Art II classes were used in this study and three Art III/IV classes were used. The community in which School C was located contained a minority population which made up 12.6% of the total population.

Results

Results indicate that a statistically significant relationship exists between the dependent variable (the Clark Drawing Abilities Test) and the Cornell Critical thinking Test (CCTT) ($p < .05$). Three independent variables were found to function as predictors for the dependent variable (CDAT) when a stepwise regression analysis was applied (see Table 2). These independent variables were participation in advanced or honors Art classes (HRT), experience of private lessons (PVTRT), and scores on the Cornell Critical Thinking Test (CCTT).

Table 1**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	12	15.43	1.28	2.70	0.002
Error	124	58.96	0.47		
C Total	136	74.40			
Root MSE	0.69		R-square	0.20	
Dep Mean	3.17		ADJ R-SQ	0.13	
C.V.	21.68				

Table 2**Summary of Stepwise Procedure for Dependent Variable CDAT**

Variable Step	Number Entered	Number Removed	Partial R**2	Model R**2	C(p)	F	Prob>F
1 HRT	1		0.109	0.109	6.340	16.589	0.0001
2 PVTRT	2		0.041	0.151	1.906	6.4865	0.00
3 CCTT	3		0.029	0.180	-0.699	4.774	0.03

Note. Variable HRT indicates students enrolled in advanced or honors Art classes. Variable PVTRT indicates the participation or experience of private art classes. Variable CCTT is the Cornell Critical Thinking Test.

Table 3 **Correlation Analysis**
 Pearson Correlation Coefficients / Prob> |RI| under Ho: Rho=0 / N = 137

	CDAT	CDAT	SCH	AGE	GEN	GR	FMRT	RTCLS	PVTRT	HRT	APE	APM	APS	CCTT
CDAT														
SCH	-0.08													
AGE	0.18*	-0.02												
GEN	0.21*	-0.03	0.16											
GR	0.21*	-0.03	0.16	0.86**	0.09	0.45**	0.17*	0.06	0.54**	0.17*	0.16	0.23**	0.15	
FMRT				0.04	0.12	0.11	0.15	0.06	0.23**	0.26**	0.21**	0.11	0.07	
RTCLS				-0.01	0.53**	0.16	0.65**	0.26**	0.21**	0.33**	0.27**	0.27**	0.27**	
PVTRT				0.03	0.04	0.04	-0.02	0.09	0.02	0.01	-0.07			
HRT				0.12	0.70**	0.27**	0.06	-0.16	0.20*					
APE				0.16	0.08	0.11	0.01	0.27**	0.27**	0.43**	0.40**			
APM				0.23**	0.17*	0.27**	0.56**	0.55**	0.19*					
AMS														0.19*

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*r<.05 **r<.01
 CDAT=Clark Drawing Abilities Test SCH=school AGE=age GEN=gender FR=grade
 FMRT=family involvement in the arts RTCLS=the number of art classes since sixth grade
 PVTRT=the experience of private art lessons HRT=AP or Honors art classes APE=AP or Honors English
 APM=AP or Honors MATH APS=AP or Honors Science CCTT=Cornell Critical Thinking Test

Many of the independent variables were found to intercorrelate (see Table 3). The most interesting of the intercorrelations was the AP or honors classes, which all significantly intercorrelated with each other. This fits into the observations made by Yochim (1967) and Clark and Zimmerman (1984) that the artistically talented student is not the academic malcontent and social outcast, but rather is quite socially and academically capable. Indeed, all of the advanced classes intercorrelate, suggesting that students who take one AP (Advanced Placement, advanced, or honors) class are likely to take all or many available AP or advanced classes. This fits in well with the Hurwitz (1983) notion of a "clustering of aptitudes" (p. 17) with talent in art being the "tip of the iceberg" (p. 17). This is to say that artistic talent is a complex cluster of aptitudes or mental abilities of which artistic ability is one manifestation. Artistic talent is probably dependent on many abilities especially in the light of the fact that all of the independent variables in this study account for only 13% of the variability of the scores on the dependent variable. It also fits with Clark's hypothesis that intelligence and drawing ability are related.

Another significant intercorrelation noted in the correlation analysis in Table 3 which is consistent with the literature on critical thinking was APE (Advanced or honors English) with the Cornell Critical Thinking Test (CCTT) ($r = .40$). This is expected since the items on the test are language based. The review of literature highlights a relationship between critical thinking and language ability (Thompson & Melancon, 1987) and that reading level correlates to scores on tests for critical thinking (Raburn & Van Schuyver, 1984). Language development correlates to development of problem solving strategies. Ellis and Siegler (1994) also found that students learned better and were more capable of transferring learning to new situations when they verbalized about their observations rather than having someone tell them the information. Drawing also involves participants in that type of self-discovery.

Ennis, Millman, and Tomko (1985), Frisby (1991), Adiseshiah (1977), Miller (1990), and Phillips, Uprichard, and Johnson (1974) all indicate a relationship between age and critical thinking ability although Frisby's meta-analysis showed some contradictory information. This study did not find such a relationship although the age range was so small (14-19 with a mean age of 16.4) that it might be considered, for the CCTT (Cornell Critical Thinking Test) variable, to be homogeneous. It may, however, be interesting to note that in the correlation analysis there is significant intercorrelation between GR (grade level) and the CCTT ($p > .07$) which indicates that critical thinking ability is more a function of learning than simply getting older.

Meier (1939) discussed the importance of encouragement, nurturing, and modeling in the development of artistically talented individuals. Artistically talented people are influenced by a number of factors which are inherited, acquired, and learned. The presence of a close friend or mentor to encourage the developing talent is necessary. The findings in this study were not consistent with this observation showing no statistically significant intercorrelation with this variable. There was, however, a very small number of students ($n = 11$) reporting artistic involvement of family members which may have been the reason for this

lack of significant correlation in this study. The questionnaire may also have been worded to be more specific about a mentoring relationship.

According to the literature, art talent does not seem to be bound by age or gender. Clark (1989b) observed that there was no correlation between age and the CDAT. The correlation analysis shows an intercorrelation between age and the CDAT, but age also intercorrelates with RTCLS (number of art classes taken since 6th grade) and HRT (AP or honors Art class). Younger students have taken fewer art classes and are less likely to be enrolled in advanced or honors Art classes because of the prerequisites requiring that introductory art classes be taken. The significance of age is probably thus mitigated by the fact that mainly older students have advanced training in art. There was no statistically significant intercorrelation between any of the other variables and gender.

Discussion

This study, being a correlation study, does not address cause and effect. What part general critical thinking has on drawing ability, or to what extent drawing ability effects the development of drawing ability, is not known. What is known from this study is that there is a relationship between general critical thinking and drawing ability, and general critical thinking is a statistically significant predictor of drawing ability. It must also be stressed that general critical thinking along with all of the independent variables contributed only 13% of the variance in the drawing scores. It is certain that there are other factors beyond the scope of this study that contribute to artistic talent, of which general critical thinking is but one. Other factors may be socioeconomic status, IQ tests of spatial understanding, and scores on math, science and reading measures (as opposed to reports of taking advanced classes in those subjects).

Future studies should be conducted to expand and clarify the information gained through this research. Since few students scored at or above the 50th percentile on the CCTT-Z, a similar study might be conducted using the CCTT-X to ascertain whether the degree of difficulty may have affected the scores on that independent variable in relation to the dependent variable. The CCTT-Z is a test designed for college students, adults, and academically gifted high school students, whereas the CCTT-X is designed for fourth to 12th grade students. The CCTT-Z was used because gifted high school students were a focus of this study, but there were many average students that were participants in this study.

Another study is suggested that would focus on the degree to which drawing ability influences general critical thinking. This study would use the measure of critical thinking as the dependent variable and the test for drawing ability would be used as one of many independent variables. It is also suggested that fewer dichotomous variables be used. Continuous variables will net more meaningful data.

Finally, there need to be more studies to account for more of the variability on the CDAT as the independent variables account for only 13% of the variability in the scores on that dependent variable. Diamond and Hobson (1998) have

found that minds are better developed in richer environments suggesting the effect that socioeconomic status might play on brain growth and development. Researchers Clark and Zimmerman (1984) and Yochim (1967) have indicated a relationship between IQ and artistic talent. Therefore, it is suggested that socioeconomic status and IQ might be included in a future study as independent variables.

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