Visions of Research in Music Education

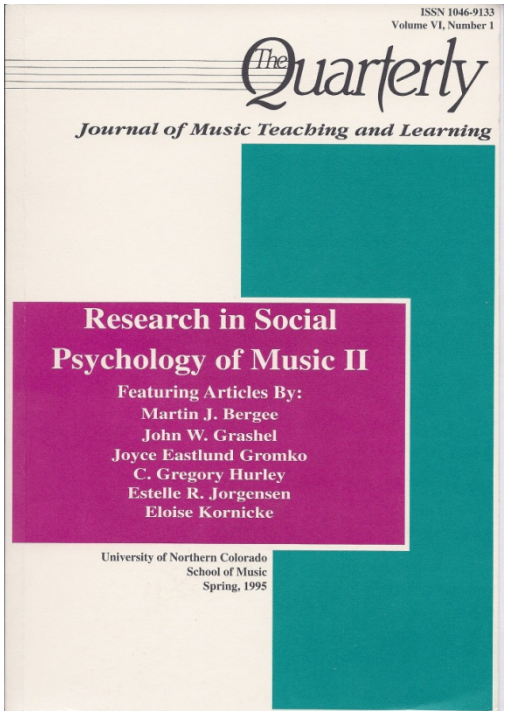
Volume 16 *Special Volume: Historical Reprint of The Quarterly Journal for Music Teaching and Learning*

Article 8

2021

An Exploratory Study of Individuall Difference Variables in Piano Sight-Reading Achievement

Eloise Kornicke
Presbyterian Church



Title: An Exploratory Study of Individual Difference Variables in Piano Sight-Reading Achievement

Author(s): Eloise Kornicke

Source: Kornicke, E. (1995, Spring). An exploratory study of individual difference variables in piano sight-reading achievement. *The Quarterly*, *6*(1), pp. 56-79. (Reprinted with permission in *Visions of Research in Music Education, 16*(6), Autumn, 2010*). Retrieved from* http://www-usr.rider.edu/~vrme/

An Exploratory Study of Individual Difference Variables in Piano Sight-Reading Achievement

By Eloise Kornicke

Director of Music, Presbyterian Church, New Providence, New Jersey

Sight-reading skill is a valuable asset for musicians in a variety of musical situations. Researchers and pedagogues alike have examined both the nature of the sight-reading task and methods for teaching the skill to students. The majority of empirical studies (e.g., Bean. 1938; Weaver, 1943a, 1943b; Ortmann, 1937; Young, 1971; Sloboda, 1974, 1976, 1978, 1981; Sloboda & Gregory, 1980; Wolf, 1976; Halpern & Bower, 1982; Salis, 1977; Beal, 1985) have focused on the task of sight-reading and/or the interaction of the task with subject characteristics (e.g., eye-hand span, pattern recognition). Few studies have examined individual difference variables (i.e., characteristics of subjects, such as intelligence, reading level, cognitive style that affect performance on a given task) as they relate to keyboard sight-reading achievement. Cognitive styles, i.e. individual variations in methods of perceiving, remembering, and thinking (Saracho, 1984; Schmidt, 1984) have been related to Jung's psychological types (Barger & Hoover, 1984), and to differences in individual learning style preferences (aural, visual, or kinesthetic) (Hyman & Rosoff, 1984).

Few studies have examined individual difference variables (...such as intelligence, reading level, cognitive style that affect performance on a given task) as they relate to keyboard sight-reading achievement.

The cognitive style, field dependence/independence (FDI), has been investigated in relation to musical behavior (e.g., Heitland, 1983; Schmidt, 1984; Schmidt & Lewis, 1987; Osborne, 1988; Ellis & McCoy, 1990; Schmidt & Stephans, 1991). As far as can be determined, FDI is the only individual difference variable that has been examined in relation to sight-reading achievement (King, 1983; Ciepluch, 1988). Although limited to wind instrumentalists, results in both studies indicated that FI students scored higher on music reading tasks regardless of instructional approach.

While empirical evidence for other relationships between sight-reading achievement and individual difference variables is scarce, there is evidence in studies outside the field of music that link these two areas. For ex-

Eloise Kornicke is Director of Music at the Presbyterian Church at New Providence, New Jersey. She received her Ph.D. from Indiana University in Piano Pedagogy/Music Education. Her research interests include sight-reading and physiology.

ample, FDI has been investigated in relation to other musical tasks (Schmidt & Lewis, 1987; Osborne, 1988), to gender differences (e.g., Fiebert, 1967; Bone & Eysenck, 1972; Doyle, 1975; McGee, 1979; Riding & Boardman, 1983), and to its interactions with instruction (Kardish, Ludoski, & Bentman, 1988; Frank, 1984; Kiewra & Frank, 1988; Strawitz, 1984; MacGregor, Shapiro, & Niemiec, 1988).

Another individual difference variable which may be related to sight-reading achievement is locus of control (LOC), which is a generalized expectancy to perceive reinforcement either as contingent upon one's own behaviors (internal control) or as the result of forces beyond one's control and due to chance, fate, or powerful others (external control) (Levenson, 1981, p. 15). LOC research suggests that when individuals perceive rewards and punishments as contingent upon personal actions (internal locus of control), behavior is different from when reinforcements seem to occur from fate or luck (external locus of control) (Phares, 1976).

Locus of control has been examined in relation to academic achievement (e.g., McGhee & Crandall, 1968; Solomon, Houlihan, Busse, & Parelius, 1971; Phares, 1976; Bar-Tal & Bar-Zohar, 1977), and in relation to stress or anxiety (Feather & Volkmer, 1988; Parkes, 1984; Richert, 1981; Duke & Nowicke, 1973). It is possible that sight-reading may be viewed by some pianists as a "high risk" performance situation, thereby causing anxiety for them (Hamann & Sobaje, 1983; Dews & Williams, 1989; Abel & Larkin, 1990; Steptoe, 1989; Nagel, Himle, & Papsforf, 1989). While these studies are not related to LOC, they do support the view that aspects of musical performance may be stressful to musicians.

Locus of control may also be related to situational aspects of the sight-reading task. In particular, ensemble situations may include aspects that favor externals, such as high structure, explicit directions, and visual feedback (Bourgeois, Levenson, & Wagner, 1980; Parent, Forward, Canter, & Mohling, 1975). Interactions between gender, LOC, and achievement were also noted in chance versus skill activities. Karabenick and Addy (1979) found that males were more willing to take risks in chance situations and that males with an external LOC orientation demonstrated more realistic choices in chance situations than females. Sight-reading seems to involve elements of chance, as individuals are being asked to read a piece of music which they have not played before. Subjects, therefore, may evaluate the task of playing a particular piece in relation to the situation, rather than in relation to their technical and sight-reading abilities.

Additionally, the relationship between FDI and LOC has been examined in achievement literature. While LOC and FDI do not appear to be linearly related, Lefcourt (1982) suggests that "locus of control and differentiation [FDI] can be used conjointly to afford better predictions than either variable might do alone in certain circumstances" (p. 72). In several studies, significant interactions have been found between LOC and FDI regarding questions related to achievement (e.g., Deever, 1968; Lefcourt & Telgadi, 1971; Schmidt & Stephans, 1991).

Personality characteristics are another set of individual difference variables that may be related to sight-reading achievement. Personality variables have been linked to LOC (Duke & Nowicke, 1973), to FDI (Schmidt and McCutcheon, 1988), and in music, to personality traits of musicians (Kemp, 1981a, 1981b, 1981c; Bell & Cresswell, 1984). Specifically, the Myers-Briggs Type Indicator (MBTI) has been used to examine music teaching behavior (Schmidt, 1989a), listeners' response to music (Lewis & Schmidt, 1991), and applied music teaching feedback (Schmidt, 1989b). Since the MBTI is designed to measure normal variations in human behavior, the measure is well suited for use in educational settings. The MBTI has been used extensively in psychological and educational research (see Myers & McCaulley, 1985; McCaulley & Natter, 1980).

The MBTI is designed to measure the four basic preferences of extraversion/introversion (EI), sensing/intuitive (SN), thinking/feeling (TF), and judgment/perception (JP). The preferences, although they may be examined independently of one another, are designed to identify an individual's psychological type

based on the interactions of the scales. The 16 possible combinations, or types, identified by Myers and McCaulley (1985) measure both what people attend to in any given situation, and to how individuals draw conclusions about their perceptions.

Research regarding type differences in achievement in reading and math (Guttinger, 1974; Myers & Myers, 1980; McCaulley & Natter, 1980) and problem solving (Yokomoto & Ware, 1980) has found that the translation of sound-symbols was easiest for individuals having a combination of introversion/intuition, and most difficult for individuals having a combination of extraversion/sensing. Since certain studies have linked language with music reading by investigating similarities between the two disciplines (e.g., Restle & Brown, 1970a, 1970b; Stern, 1975; Hahn, 1987), it follows that these findings and those for the MBTI may be related to sight-reading achievement. Other traits which may be related to sight-reading achievement include the introverts' tendency to concentrate better and to grasp concepts more easily (McCaulley & Natter, 1980), the thinking types' analytical skills, the judging types' quick decision-making ability and, finally, the openness and curiosity of the perceptive types which may contribute to their desire to sight-read new pieces.

While systematic study of the relationship between personality and sight-reading achievement is necessary, the possible link between the two seems to be supported by data collected during interviews with pianists conducted by this researcher (Kornicke, 1989). These pianists mentioned certain personality characteristics that they believed were necessary for successful sight-reading: boldness, curiosity, love of sight-reading, and willingness to make mistakes as opposed to perfectionism.

Differences in aural imagery may be another individual difference factor contributing to sight-reading achievement. In the aforementioned interviews (Kornicke, 1989), pianists spoke of "hearing the music" before they played it and attributed success in sight-reading to that ability. Auditory imagery has been defined by Gordon (1989) as "taking place when one hears and comprehends music for which the sound is not present" (p. 3). It is one facet of "notational audiation," which is "the basis of music learning theory, and [therefore] fundamental to music achievement" (Gordon, 1989, p. 7). In addition, cognitive aspects of aural imagery have been examined by several researchers (e.g., Weber & Brown, 1986; Idson and Massaro, 1976; Gates & Bradshaw 1974).

A correlation between experience and sight-reading achievement was noted in two research studies (Bean, 1938; Eaton, 1978). Speculation as to the role of experience in sight-reading is also found in various pedagogical sources (Maier, 1963; Bishop, 1964; Last, 1972). None of these sources, however, employed the use of a detailed questionnaire in order to determine the type and range of subjects' sight-reading experience. Therefore, the aforementioned series of interviews of 14 pianists (Kornicke, 1989) were designed to obtain preliminary information regarding the role of experience in sight-reading. Factors that emerged from these interviews included the length and frequency of time spent sight-reading and the consistency of sight-reading experiences over a long period of time. In addition, experience relevant to sight-reading may include aural awareness coupled with stylistic knowledge. This knowledge may be acquired by a broad exposure to the works of various composers in different genres and from different historical periods. Systematic research is necessary in order to determine whether these factors of experience are indeed related to sight-reading achievement.

The purpose of this study was to examine several primary and secondary relationships between and among selected individual difference variables and sight-reading achievement. The primary research questions were as follows:

1. What is the best linear combination of the predictor variables and sight-reading achievement?
2. What is the best combination of predictor variables distinguishing between the extreme groups of high and low sight-reading achievers?

The secondary research questions were as follows:

1. What are the relationships between individual difference variables and sight-reading achievement controlling for gender?
2. What are the interrelationships among the sight-reading scores among the individual sight-reading selections?
3. What are the relationships between and among the individual predictor variables and individual items on the sight-reading achievement measure?
4. What are the relationships between the individual items on the Sight-Reading Experience Questionnaire and overall sight-reading experience?
5. What are the relationships among the predictor variables?

Method

Subjects

The sample for the main study was comprised of 73 volunteer subjects from four state universities located in Indiana and Illinois. The sample represented a cross section of college-level pianists and ranged in performance experience from 15 years to 51 years. The minimum level of college experience was one year of applied lessons. Due to the participation of several piano faculty members, subjects' ages ranged from 19 to 60 ($\underline{M}$=28.41). Criteria for inclusion in the study consisted of the subjects' enrollment in or completion of an undergraduate or graduate applied piano degree program.

Measure of the Dependent Variable

The researcher-constructed Sight-Reading Achievement Test (SRAT) consisted of five musical examples chosen from urtext editions of extant literature. The two-page examples, from which the title and composer were deleted, were arranged in the following order: Scriabin, Prelude Op. 13, No. 6 in b minor; Bach, Capriccio in B-Flat major; Lajos Papp, Bagatelle No. 5; Beethoven, Twelve Variations in A major; and George Perle, Etude No. 1. The criteria for selection of the pieces included the following:

- obscurity;
- a relatively fast tempo;
- inclusion of some atonal works;
- notational complexity including clef changes, multiple accidentals, and unusual pedal markings; and
- rhythmic complexity including irregular or unusual metrical groupings, and rhythms using two against three note patterns.

In order to adjudicate the taped performances of the SRAT, a 32-item Sight-Reading Performance Scale (SRPS) was developed, piloted, and revised. The purpose of using the SRAT was to increase the validity of the criterion measure by examining aspects of sight-reading that have not typically been addressed in research, such as subjects' use of dynamics, rubato, pedaling, and artistic interpretation. The importance of these aspects in sight-reading achievement is evident when one considers the typical definition of sight-reading as the ability to read and perform music at first sight without preparatory study of the piece (e.g., Wolf, 1976; Eaton, 1978; Sloboda, 1978b). In preliminary interviews conducted by this researcher (Kornicke, 1989), good sight-readers referred to a successful sight-reading performance as a Gestalt in which notes may be deliberately sacrificed in order to preserve the rhythmic continuity and style of the piece. Both dynamics and rubato were considered by these individuals to be important in order to capture the essential character of the piece. The typical scoring criteria for the keyboard sight-reading tests used in research (e.g., Fjerstad, 1969; Lowder, 1974; Eaton, 1978), however, were numbers of note and rhythm errors. In this scoring system, a sight-reading performance could be rated lower when the individual retained the essential character of the piece at the expense of omitting certain notes than when the individual sacrificed the essential character to maintain correct pitches and metronomic rhythmic precision. There was no provision for examining additional elements of sight-reading achievement.

Items for the SRPS were divided into high inference and low inference categories. High inference items referred to questions about interpretation, dynamic nuance, phrasing, appropriate pedaling, and so forth. Low inference items dealt with those aspects which can be scored as either correct or incorrect, such as note and rhythm errors. In addition, both high and low inference items were subdivided into general and specific categories. "General" was defined as relating to the per-

Table 1

Questions for the Sight-Reading Performance Scale According to Category

High inference: General

Question #

8. Appropriate tempo chosen
10. Pedaling appropriate to style of piece
12. Phrases appropriate to style
14. Appropriate use of rhythmic nuance for style of piece
16. Articulation stylistically appropriate
17. Interpretation stylistically accurate
19. Appropriate use of dynamics
20. Theme or melody was clearly articulated in appropriate style

High inference: Specific

1. Appropriate shaping of melodic line
2. Appropriate dynamic nuance in phrases
3. Appropriate rhythmic nuance in phrases
4. Notes improperly accented within melodic line
5. Appropriate vertical balance to style of piece
6. Appropriate dynamics for phrase endings
7. Appropriate durational values in phrase endings
24. Polyphonic voices articulated appropriately

Low inference: General

9. Notes omitted from right hand
11. Notes omitted from left hand
13. Notes altered in right hand
15. Notes altered in left hand
18. Performance demonstrated high degree of pitch accuracy
21. Accurate performance of rhythmic notation
22. Tempo maintained throughout piece
23. Notes properly coordinated between right and left hands

Low inference: Specific

Example 1

25. Rhythmic errors at clef changes
26. Note errors at clef changes
27. Rhythm errors at accidentals
28. Note errors at accidentals
29. Rhythm errors at wide leaps
30. Note errors at wide leaps
31. Staccato notes played evenly
32. Widely contrasted dynamic markings observed properly

Example 2

25. Rhythmic errors due to visual arrangement of notation
26. Note errors due to visual arrangement of notation
27. Rhythm errors at wide gaps in pitch
28. Note errors at wide gaps in pitch
29. Rhythm errors at textural changes
30. Note errors at textural changes
31. Durational evenness maintained
32. Note errors at accidentals

Table 1 (continued)

Example 3
25. Note errors at clef changes
26. Note errors at accidentals
27. Rhythm errors due to change in rhythmic groupings
28. Note errors due to change in rhythmic groupings
29. Rhythm errors due to visual arrangement of notation
30. Note errors due to visual arrangement of notation
31. Note errors at wide leaps
32. Pedal markings observed properly

Example 4
10. Staccato markings correctly observed for style of piece
25. Rhythm errors at irregular metrical groupings
26. Note errors at irregular metrical groupings
27. Note errors at wide intervallic leaps
28. Durational evenness of staccato maintained
29. Staccato notes inappropriately slurred
30. Tempo irregularities occurred in short sections of piece
31. Off-beat notes improperly accented
32. Clear articulation of left hand melody

Example 5
10. Staccato markings correctly observed for style of piece
24. Unevenness of dyads due to alternation of hands
25. Note errors due to multiple sharps/flats in a chord
26. Note errors at changes in rhythmic groupings
27. Widely contrasted dynamic markings correctly observed
28. Durational evenness of staccato maintained
29. Note errors due to alternation of hands on chords
30. Rhythm errors due to alternation
31. Note errors at wide gaps in pitch
32. Note errors due to changing chord size

formance as a whole, and "specific" was defined as relating to a specific section of the piece or a specific characteristic, such as note errors at clef changes. Eight questions were devised for each of the categories and subcategories. Across the five examples, subjects could receive a composite score ranging from 160 to 800 points. Table 1 outlines the categories and their respective questions.

The judges for the SRAT were doctoral level students who had a completed Masters degree in piano performance. Judges were given a copy of the SRPS in advance and were given a training session using pilot tapes. Among three judges, the inter-judge reliability for the main study was determined to be .99 using the Cronbach's Alpha formula. The high inter-judge reliability contributed to the validity of the measure and supports the view of Abeles (1975) that musical aspects, in addition to note and rhythm errors, can be assessed with a high degree of reliability. Such an examination offers an understanding of the components of sight-reading that is not possible when only note and rhythm errors are scored (e.g., Eaton, 1978; Fjerstad, 1969; Lowder, 1973; Salis, 1977).

Procedure

Two-hour appointments were made for each of the 73 volunteer subjects who participated in the main study. The tests were administered individually in the following order: SRAT, Sight-Reading Experience Ques-

Table 2

Pearson Correlations Among Aural Imagery, Locus of Control, MBTI, FDI, and Sight-Reading Experience (SR-EXP)

	SR-EXP	AUR	LOC	EI	SN	TF	JP
AUR	.28*						
LOC	-.07	-.03					
EI	-.13	.07	-.38**				
SN	.15	.06	.23*	-.06			
TF	-.01	-.14	.26**	.01	.05		
JP	.26*	-.07	-.02	-.08	.45**	.27**	
FDI	.08	.18	-.05	-.06	.20	-.32**	-.03

N=73

* Significant beyond the .05 level
** Significant beyond the .01 level

Key to abbreviations used in Table 2:

AUR	Aural Imagery Test composite score
LOC	Locus of Control
EI	Extraversion/Introversion
SN	Sensing/Intuition
TF	Thinking/Feeling
JP	Judging/Perception
FDI	Field Dependence/Independence
SR-EXP	Sight-Reading Experience

tionnaire (SREQ), Aural Imagery Test (AIT), Locus of Control (LOC), Myers-Briggs Type Indicator (MBTI) and Hidden Figures (FDI).

The Sight-Reading Experience Questionnaire (SREQ), generated from information obtained in the preliminary interviews (Kornicke, 1989) was divided into three sections: pre-college experience, college experience, and knowledge of musical style. The questions pertaining to musical style asked subjects to estimate how many cumulative pieces they had sight-read and how many pieces they had performed for each of 53 composers. Each question from the SREQ was initially examined as a discrete variable. On the basis of a significant correlations between the SREQ and SRAT, the discrete variables relating to sight-reading experience were collapsed into a single variable, sight-reading experience.

The Aural Imagery Test (AIT) (Pagan, 1970) was originally designed to present chords visually and aurally by use of slides and a sound projector. Greater consistency of administration was achieved in the present study by using a audio-visual tape of the chords. The sounds were aurally generated using an acoustic piano rather then a chord organ as originally specified, since the subjects in the present study were piano majors. Except for these alterations, the directions specified by Pagan (1970) were followed.

The 46-item Locus of Control Test (LOC) was adapted by Schmidt and Stephans (1991)

Table 3

Stepwise Multiple Regression Summary with Sight-reading Achievement Scores as the Criterion Variable

Variable	MR	r	r^2	Change in r2	F	p
AUR	.39	.42	.15		12.01	<.001
SR-EXP	.48	.41	.23	.08	10.29	<.001
FDI	.57	.34	.33	.10	10.91	<.001

N=71

Note. MR=multiple R; r^2=cumulative r; r=simple correlation

from two locus of control scales: the Rotter Internal-External Control Scale (Phares, 1976), and the James Internal-External Locus of Control Scale (cited in Lefcourt 1982). Possible scores ranged from a low of 46, indicating a relatively external locus of control, to a high of 230, indicating a relatively internal locus of control.

Personality variables were measured using Form F (166 items) of the Myers-Briggs Type Indicator (MBTI) (Myers & McCaulley, 1985). The test was administered and scored according to published directions.

The cognitive style of field dependence/independence (FDI) was measured through use of the Hidden Figures Test (HFT) (French, Eckstrom, & Price, 1962). The task was to identify which of five simple geometric figures was embedded in each complex geometric figure. The possible range of scores was from 0 to 32 with low scores indicating relative field dependence and high scores indicating relative field independence.

Results

Pearson correlations were computed and a stepwise multiple regression analysis was subsequently performed in order to indicate the best linear combination of LOC, FDI, the MBTI variables, SR-EXP and AI as predictors of sight-reading achievement. Pearson correlations among the predictor variables are presented in Table 2.

LOC was negatively correlated with EI (r= .-37), indicating that extroverts in the present sample tend to have external attributions of their successes or failures. Conversely, LOC was positively correlated with SN (r=.23), and TF (r=.26), indicating a slight tendency for intuitive and feeling types to have an internal locus of control. The highest correlation among the personality variables was JP, which correlated with SN (r=.45). The significant correlation between SN and JP has occasionally been found in previous MBTI research (see Myers & McCaulley, 1985). A low negative correlation was found between TF and FDI (r=-.32), indicating that thinking types tended to be slightly more field dependent than feeling types.

Moderately significant correlations were also found between aural imagery and the SRAT. Because of the relatively high significant correlations between Part 1 and Part 2 of the Aural Imagery Test (r=.63), the combined score (AURAL) was used in subsequent analysis. A low significant correlation of .34 was found between FDI and SRAT. Aural imagery was not significantly correlated with LOC, FDI, or any of the personality variables.

A low significant correlation of .34 was found between FDI and SRAT. FDI was not correlated with sight-reading experience. Sight-reading experience was significantly correlated with JP at .26, however, indicating a link between perception and greater amounts of experience.

Non-significant correlations were found between LOC and SRAT, SR-EXP, AURAL, and FDI. With the exception of SN and JP,

Table 4

Discriminant Analysis for Sight-reading Group Membership

Variable	F	Wilks'	p
SR-EXP	11.25	.80	<.01
FDI	8.51	.72	<.01
AUR	6.81	.68	<.01
TF	5.46	.66	<.01

N=49

correlations among personality variables were low. Non-significant correlations were found between EI and SRAT, SR-EXP, AURAL, and FDI. Similar non-significant correlations were found for TF. For SN, non-significant correlations were found with SRAT, AURAL, and FDI. Non-significant correlations were also found between JP and SRAT, AURAL, LOC, and FDI. Thus, personality variables were relatively discrete.

Results of the multiple regression analysis are shown in Table 3.

The strongest predictor of sight-reading achievement was aural imagery, accounting for 15 percent of the variance. The second variable to enter the equation was sight-reading experience, accounting for an additional 8 percent of the variance. Finally, the third variable to enter the equation was field dependence/independence, accounting for an additional 10 percent of the variance. A total of 32 percent of the variance is explained by these three variables. Personality variables as measured by the MBTI and locus of control were non-significant predictors of sight-reading achievement.

A discriminant analysis was carried out in order to distinguish between the groups receiving the highest and lowest scores on the SRAT. The sample was partitioned into three groups consisting of high, medium, and low sight-reading scores for the purpose of predicting group membership of the two extreme (high or low) scoring groups. Table 4 presents the results for the prediction of sight-reading group membership. The best predictors, in order, were sight-reading experience, field independence, aural imagery, and thinking/feeling.

Sight-reading experience accounted for 37 percent of the discriminant function, with field independence accounting for an additional 25 percent. The third variable to enter the equation was aural imagery, accounting for 22 percent of the discriminant function. The final variable to enter the equation was the MBTI thinking type, accounting for 15 percent of the discriminant function.

The secondary objectives of this study were also examined. Correlation coefficients between sight-reading achievement and the variables of AURAL, LOC, MBTI, FDI, and SRAT for male subjects, female subjects, and for the total sample are presented in Table 5.

The combined score for aural imagery was correlated with SRAT for female subjects at .39. The correlation for male subjects and aural imagery was slightly higher (r=.45), accounting for 20 percent of the shared variance. Aural imagery was correlated with SRAT for the entire sample at .41. Sight-reading experience was positively correlated with achievement for males at .36, for females at .44, and for the total sample at .41. LOC was negatively correlated with sight-reading achievement for males, indicating that males with a relatively external locus of control tended to receive higher scores on the SRAT. LOC was not significantly correlated with SRAT for the sub-group of females or the en-

Table 5

Pearson Correlations for Aural Imagery, Sight-Reading Experience, Locus of Control, MBTI, FDI, and Sight-Reading Achievement Among Male/Female and Total Sample

	Male (n=29)	Female (n=44)	Total (n=73)
Aural Imagery Test			
Part 1	.49**	.47**	.48**
Part 2	.44**	.26	.35**
Combined score	.45**	.39**	.41**
Sight-Reading Experience	.36**	.44*	.41**
Locus of Control (LOC)	-.34**	-.01	-.17
Myers-Briggs			
EI	.19	.10	.13
SN	.05	.11	.10
TF	-.26	.07	-.11
JP	.08	.22	.10
Hidden Figures (FDI)	.52**	.15	.34**

* Significant at the .05 level
** Significant at the .01 level

Table 6

Pearson Correlations Among the Five Pieces of the SRAT

	Ex 1	Ex 2	Ex 3	Ex 4
Example 2	.86**			
Example 3	.82**	.90**		
Example 4	.79**	.85**	.87**	
Example 5	.77**	.80**	.85**	.83**

** Significant at the .001 level

Key to examples in Table 6:

Example 1 Scriabin, Prelude Op. 13, No. 6
Example 2 Bach, Capriccio
Example 3 Lajos Papp, Bagatelle No. 5
Example 4 Beethoven, Twelve Variations
Example 5 George Perle, Etude No. 1

Table 7

Pearson Correlations Among the Independent Variables and Individual Items on the SRAT (N=73)

	LOC	FDI	EI	SN	JP	TF	SR-EXP
I1	-.23*	.32**	.19*	.14	.09	-.10	.42**
I2	-.23*	.34**	.22*	.10	.11	-.07	.45**
I3	-.19*	.31**	.14	.11	.10	-.08	.46**
I4	-.27**	.30**	.23*	.11	.07	-.15	.43**
I5	-.23*	.28**	.14	.08	.10	-.17	.42**
I6	-.18*	.34**	.14	.12	.09	-.11	.43**
I7	-.21*	.35**	.12	.16	.13	-.11	.43**
I8	-.10	.10	.09	.13	.14	-.01	.39**
I9	-.01	.35**	.07	.03	.04	-.09	.22**
I11	.04	.44**	.05	.07	.06	-.13	.21*
I12	-.22*	.31**	.14	09	.06	-.13	.44**
I13	-.15	.39**	.16	.00	.01	-.12	.24**
I14	-.16	.33**	.11	.10	.12	-.06	.45**
I15	-.18*	.39**	.13	-.02	.00	-.21*	.25**
I16	-.24*	.28**	.12	.06	.09	-.11	.38**
I17	-.19*	.24**	.13	.11	.13	-.07	.42**
I18	-.23*	.41**	.16	-.02	.03	-.24**	.26**
I19	-.22*	.38**	.16	.10	.07	-.05	.46**
I20	-.27**	.35**	.17	.07	.09	-.15	.41**
I21	-.12	.31**	.08	.19	.21*	-.06	.37**
I22	-.05	.18	.02	.22*	.14	-.03	.38**
I23	-.11	.35**	.13	.09	.13	-.07	.25**

Table 7 (continued)

* Significant at the .05 level
** Significant at the .01 level

Key to abbreviations used in Table 7:

I1	Appropriate shaping of melodic line
I2	Approproate dynamic nuance within phrases
I3	Appropriate rhythmic nuance within phrases
I4	Notes improperly accented within melodic line
I5	Appropriate vertical balance to style of piece
I6	Appropriate dynamics for phrase endings
I7	Appropriate durational values in phrase endings
I8	Appropriate tempo chosen
I9	Notes omitted from right hand
I11	Notes omitted from left hand
I12	Phrases appropriate to style
I13	Notes altered in right hand
I14	Appropriate use of rhythmic nuance
I15	Notes altered in left hand
I16	Articulation stylistically appropriate
I17	Interpretation stylistically accurate
I18	Performance demonstrated high degree of pitch accuracy
I19	Appropriate use of dynamics
I20	Theme or melody was clearly articulated in appropriate style
I21	Accurate performance of rhythmic notation
I22	Tempo maintained throughout piece
I23	Notes properly coordinated between right and left hands
LOC	Locus of Control
FDI	Field Dependence/Independence
EI	Extraversion/Introversion
SN	Sensing/Intuition
JP	Judging/Perception

tire sample. None of the MBTI variables was correlated with the SRAT. For male subjects, FDI was highly correlated with the SRAT, accounting for 27 percent of shared variance. The positive correlation indicated that males who are relatively field independent achieved higher scores on the SRAT. FDI was not correlated with the SRAT for females.

Table 6 presents correlations among achievement scores for the five musical selections comprising the SRAT.

All the pieces were highly correlated with one another, indicating that sight-reading achievement was consistent across the five selections. The lowest correlation (r=.77) was found between example one, a contemporary work by Scriabin, and example five, a contemporary work by George Perle. The highest correlation was found between example two, a Baroque work by Bach, and example three, a contemporary work by Lajos Papp.

Table 7 presents correlations among the independent continuous variables and twenty-two individual items which were used across all five sight-reading excerpts in the SRAT.

These included items one through 23 with the omission of item 10. Sight-reading experience (SR-EXP) was significantly correlated with all items. Positive correlations for SR-EXP ranged from a low of .21 (item 11) to a high of .46 (items 3, 19), indicating a strong relationship between high scores on subjects' choice of interpretive nuances and sight-reading experience. The lowest correlations

Table 8

Pearson Correlations for Continuous Sight-Reading Experience Variables and SRAT Total Score

	Item #	r
Pre-College experience:		
Age subject began lessons	1	-.07
Age sight-reading included in lessons	2	.01
Age subject sight-read on own initiative	3	.25**
Number of pieces sight-read per week	4	.37**
How often subject sight-read	5	.33**
Range of sight-reading experience	6	.32**
Number of pieces across range of experience	6	.31**
College experience:		
Current sight-reading involvement	8	.38**
Number of pieces sight-read per week	9	.37**
Range of sight-reading experience	10	.13
Number of pieces across range of experience	10	.21*
Subject's rating of sight-reading ability	11	.49**
Subject's rating of like/dislike interest in sight-reading	12	.40**
Composite number of pieces sight-read	14	.50**
Composite number of pieces performed	14	.16
Composite sight-reading experience (SR-EXP)		.41**

N=73

between SR-EXP and sight-reading achievement were found among items related to pitch accuracy.

FDI was significantly correlated with all items except item 8 and item 22, which were concerned with tempo. For the significant items, relative FI was associated with higher performance ratings. The highest correlations were found between items relating to pitch accuracy and relative FI (items 11, 18, 13, 15). The lowest correlation was found between FI and accurate stylistic interpretation (r=.24).

Negative significant correlations were found between LOC and items 1-7, 12, and 15-20. The negative correlation coefficients indicate a slight tendency for individuals with an external locus of control to achieve the higher scores on the SRAT items. The highest negative correlations, ranging from r=-.27 to r=-.24, were found among items related to articulation (items 4, 16, 20). Shaping melodic lines, proper dynamic nuances, and pitch accuracy were correlated at -.24.

There were few significant correlations between the MBTI personality variables and individual sight-reading items. Introversion was moderately correlated with shaping of melodic lines (r=.19), dynamic nuance (r=.21), and notes improperly accented (r=.23). Thinking was moderately correlated with notes altered in left hand (r=-.21) and pitch accuracy) (r=-.24). Intuition was positively correlated with tempo maintenance (r=.24).

Correlations for the continuous independent variables of the Sight-Reading Experience Questionnaire (SREQ) and the composite Sight-Reading Achievement Test (SRAT) were statistically significant for all but two

Table 9

Descriptive Statistics for Continuous Variables in Sight-Reading Experience Questionnaire (N=73)

Variable	Item #	Mean	SD	Range
Pre-college experience				
Age subject began lessons	1	6.84	2.45	12
Age subject sight-read on own initiative	3	7.46	5.74	21
Number of pieces sight-read per week	4	2.58	1.38	4
Frequency of sight-reading experience	5	2.88	1.47	4
Range of sight-reading experience	6	13.15	5.09	20
Number of pieces across range of experience	6	20.60	20.53	99
College experience:				
Current sight-reading involvement	8	3.45	1.31	4
Range of sight-reading experience	10	13.38	4.41	24
Number of pieces sight-read across range of experience	10	12.37	14.00	63
Subjects' rating of sight-reading ability	11	2.84	1.19	4
Liking for sight-reading	12	3.61	1.20	4
Composite number of pieces sight-read	14	105.84	37.28	186
Composite number of pieces performed	14	94.35	87.83	797

items, as shown in Table 8.

Subsequently, twelve continuous variables as outlined in Table 8 were equally weighted using z scores and collapsed into one variable, a composite of sight-reading experience (SR-EXP). Subject data for the composite were operationally defined as the mean z for these items. Composite number of pieces performed (PFST) was excluded because it was not significantly correlated with number of pieces sight-read or any of the college experience variables with the exception of subjects' rating of interest in sight-reading (r=.21). The significant correlation computed for SR-EXP and SRAT was .41, indicating practical significance with 16 percent of the

Table 10

Frequencies for Categorical Variables in Sight-Reading Experience Questionnaire

Variable	Item #	N	%
Pre-College experience:			
Sight-reading included in lessons	2		
Yes		23	31.50
No		5	68.50
Subject sight-read on own initiative	3		
Yes		53	72.60
No		20	27.40
Teacher encouraged sight-reading on subject's own time	7		
Yes		37	50.70
No		36	49.30

N=73

variance shared between experience and sight-reading achievement.

A low positive correlation (r=.25) was found between SRAT and the age subjects sight-read on their own initiative. Significant correlations were also found between individual subjects' ratings of their own sight-reading ability and achievement (r=.49), with 24 percent of the variance shared between their self-report of liking for sight-reading and sight-reading achievement. Finally, subjects' rating of like/dislike interest in sight-reading was correlated with achievement at .40.

Descriptive statistics were computed for all items in the Sight-Reading Experience Questionnaire (SREQ). Means and standard deviations for the continuous variables are presented in Table 9.

The mean age for beginning lessons was 6.84 years. The mean age at which subjects reported beginning sight-reading on their own was 7.46 years. Only 53 of the 73 subjects in the main study, however, reported having sight-read on their own during pre-college years. There was wide variability in the number of pieces subjects reported sight-reading per week and among the types of sight-reading experiences in which they participated (SD=20.53 for both items).

The mean for current sight-reading involvement was 3.45, on a five-point scale, indicating a moderate involvement by subjects in sight-reading activities. Range of sight-reading experience was comprised of six Likert scales in which subjects indicated their involvement among various types of sight-reading experiences. These included: piano solo, piano duet, accompanying solo instruments/ensembles, or accompanying solo voice/choral ensembles. Scoring ranged from a possible 6 to 30 points for the item. The means for range of experience for both pre-college and college experience were 13.15 and 13.38 respectively, indicating a rather low level of sight-reading involvement for the sample as a whole. There was a wide distribution of pieces sight-read per week with a mean of 6.35 and a relatively large standard deviation of 10.38. The scores were markedly skewed (sk=3.39), indicating that the majority of subjects tended to sight-read very few pieces. The number of pieces reported ranged from 0 to 50. Seventy-seven percent of the sample reported having sight-read five pieces or fewer per week. The dispersion of the number of pieces sight-read

Table 11

Descriptive Statistics for Aural Imagery Test, MBTI, Locus of Control, FDI, and Sight-Reading Achievement

Variable	Mean	SD	Skewness
Aural Imagery Test			
Part 1	22.43	3.89	-.63
Part 2	42.80	5.68	-.48
Combined score	65.11	8.54	-.30
Locus of Control (LOC)	142.13	15.68	-.23
Myers-Briggs			
EI	104.91	25.50	-.40
SN	109.86	24.25	-.41
TF	104.12	23.69	-.53
JP	97.93	27.62	.48
Hidden Figures (FDI)	10.04	5.77	.67
Sight-Reading Test (SRAT)			
Example 1	236.45	61.21	.56
Example 2	242.98	66.43	.94
Example 3	231.68	62.12	1.03
Example 4	255.58	67.32	.63
Example 5	235.50	64.11	.88
Total score	1202.21	299.87	.87

N=73

(M=105.84, SD=37.28) per composer was not as wide as the number of pieces performed (M=94.35, SD=87.83). In addition, subjects rated how well they liked to sight-read (M=3.61), and they rated their ability to sight-read (M=2.84), indicating that subjects rated their interest in sight-reading higher than they rated their ability to sight-read.

Data for the categorical variables from the SREQ are presented in Table 10.

Sixty-eight percent of the subjects reported that sight-reading was not included in lessons. By contrast, 72 percent of the subjects reported sight-reading on their own initiative. Fifty percent of the subjects reported that pre-college teachers encouraged them to sight-read on their own initiative.

Descriptive statistics for the measures of Aural Imagery (AI), the Myers-Briggs Type Indicator (MBTI), Locus of Control (LOC), Field Dependence/Independence (FDI), and composite and individual items from the Sight-Reading Achievement Test (SRAT) are presented in Table 11.

The distributions were not markedly skewed (sk < ± 1.00), indicating normal distribution. The highest skewness was reported for Example 3 of the SRAT (sk=1.03), indicating a slightly positive skew. This may be attributable to the difficulty of the piece. Example 3 was a contemporary atonal selection with some rhythmic complexity, and a linear arrangement of notes requiring a high degree of coordination between the right and left hands. Mean scores for the five examples in the SRAT were within a relatively narrow range (i.e., m=235.50 to m=255.58). The variances were also within a relatively narrow range (i.e., SD^2=61.21 to 64.11). Standard deviations for the MBTI personality

scales ranged from 23.69 to 25.50, indicating wide variability in the sample used for this study.

Discussion

Results of this study indicate that selected individual difference variables served as significant predictors of sight-reading achievement. Significant relationships were found when the composite measure of sight-reading was used as a criterion variable, and also when individual sight-reading items were examined. Sight-reading achievement was investigated at different levels of analysis, and the strength of the observed correlations varied accordingly.

The results of the multiple regression analysis are perhaps not surprising. The relationship of aural imagery to music reading is logical since music involves the conversion of printed notation into sound. It would appear that individuals who could more easily form a mental image of the sound from printed notation would have an advantage in sight-reading musical scores. Significant components of sight-reading experience in the present study included not only quantity, frequency, and range of experiences (i. e., piano solo, accompanying vocal solos/choral ensembles), but also factors of attitude and initiative toward sight-reading. Another interesting factor in the results for sight-reading experience was the clear distinction found between performing pieces and sight-reading them. Composite number of pieces performed was not significantly correlated with sight-reading achievement (r=.16), indicating that sight-reading involves skills that are not likely transferred from the sole act of practicing and/or performing literature. This information calls into question the assumption that learning a large number of pieces will contribute to sight-reading skill. The study's findings that FIs tend to score higher on sight-reading achievement are compatible with the results of previous studies (King, 1983; Ciepluch, 1988). In addition, by examining FDI in relation to other predictor variables rather than in isolation, the relative importance of FDI as a predictor of sight-reading achievement was determined.

In contrast to the analysis for the entire sample, the MBTI variable of Thinking/Feeling (TF) entered the discriminant equation for high/low sight-reading achievers. The finding that high-achieving sight-readers were relatively thinking (T) appears to be the first documentation of a relationship between personality and sight-reading achievement, and seems to be compatible with previous research on the TF scale. In particular, the thinking type's analytical, business-like approach to mastering material may help to analyze aspects of the music more quickly. In addition, since thinking types do not have the same preference for working in groups as feeling types (McCaulley & Natter, 1980), thinking types may be more willing to spend time alone developing sight-reading skills. Several good sight-readers (Kornicke, 1989) did report that they regularly enjoyed checking out large numbers of scores from the library and reading through all of the pieces. While sight-reading may also be practiced in group settings, the additional effort required to arrange rehearsal times could limit the feeling types' number of opportunities to engage in sight-reading activities.

Gender differences in sight-reading achievement were found for aural imagery, sight-reading experience, FDI, and LOC. The correlation for AI was stronger for males, and conversely, the relationship between sight-reading experience and achievement was stronger for females. FI was found to be significantly related with higher achievement on the SRAT for males but not for females. Although a One-way ANOVA for sight-reading achievement by gender indicated that there was no significant difference between SRAT scores for males versus females, an interaction between FDI and gender did emerge as a factor in sight-reading achievement.

The findings of this study regarding FDI are similar to those of other research studies (e.g., Riding and Boardman, 1983; Provost, 1981; Travis, McKenzie, Wiley, & Kahn, 1988) which have found gender differences in modes of instruction. The suggestion by Travis, et al., (1988) that women may develop a different achievement schema may be relevant. With regard to sight-reading, it is possible that for males the degree of field independence appears to function to a

greater extent in sight-reading achievement. In addition, males may be relying more on the development of aural imagery skills than do females. The stronger correlation between experience and sight-reading achievement for females would seem to support findings that indicate females may draw upon a more flexible global processing style, involving an intercorrelation of various components such as visual and verbal aspects, environmental and contextual cues, personal variables, and learning styles. Some of these factors are found in the experience variable, which incorporates attitudes, range of experience, and interest.

The interaction effect between males, external LOC and sight-reading achievement appears upon first examination to be contrary to previous literature on LOC, which has found greater academic achievement to be linked to internal locus of control (e.g., Findley & Cooper, 1983; Crump, Hickson, & Laman, 1985). One explanation may lie in the LOC literature dealing with the interaction of person and environment. In particular, internals are seen to adapt better in situations that maximally allow them to control their own behavior while externals adapt better to situations that impose control on them (Baron & Ganz, 1972; Baron, Cowan, Ganz, & McDonald, 1974; Lefcourt, 1983). Sight-reading may favor externals because the task can involve external controls such as a conductor or other performers which require the sight-reader to continue playing; a risk factor in a "test" situation such as a jury exam; and an element of chance because the performer has not practiced the music in advance.

While the reasons underlying this finding for males but not for females is not readily apparent, it may be related to previous research on situational factors and LOC. Males may be more willing to take risks in chance situations than females (Karabenick & Addy, 1979). In addition, since females may develop an attributional pattern which is closely related to their cognitive abilities (Shute, Howard, & Steyart, 1984), it is possible that some type of interaction between cognitive abilities and/or spatial abilities and LOC is involved (e.g., McGee, 1979; Sherman, 1967).

Correlations between and among the individual predictor variables and individual items on the sight-reading achievement measure indicate that items pertaining to interpretation appear to be related more strongly to SR-EXP, while items having to do with note and rhythmic notation are more strongly related to FDI. Since FDI by definition pertains to the skill of being able to disembed simple patterns from more complex ones, and since the task of sight-reading involves differentiating field-salient aspects from non-salient aspects within a musical score, it appears logical that relative FI would be useful in disembedding those aspects. In contrast, experience variables appear to be most related to the more global elements of sight-reading that are related to understanding of style.

The significant negative correlations between LOC and sight-reading achievement were primarily items concerned with interpretive details rather than note accuracy. The explanation for the negative LOC correlations seems to correspond to the earlier discussion regarding situational differences in LOC (e.g., Karabenick and Addy, 1979). The items correlated with LOC are related to decisions which require risk-choices at the given moment in order to be performed properly, such as choices about shaping lines, dynamic nuance, durational values, phrasing, and articulation. LOC was not related to the majority of the items regarding accuracy of pitches, nor was it related to the majority of the rhythm items. It would seem that interpreting rhythm and maintaining a tempo involves separate skills (e.g., Boyle, 1968; Gregory, 1972; Kelso, Southard, & Goodman, 1979; Shaffer, 1966; Revak, 1987). Therefore, risk-taking externals who perceive themselves to be in a chance situation might make more accurate decisions about interpretation, but that skill would not necessarily contribute to the execution of their choices rhythmically.

Relatively few sight-reading items of the SRPS were significantly related to the MBTI personality variables. Three items concerning interpretation were correlated with introversion. It seems possible that traits of the introvert, such as concern with the inner world of concepts and the tendency to be contemplative, would allow them to evaluate stylistic aspects of the music with which they

have interacted and then apply the ideas to new musical situations (i.e., in sight-reading music). Maintaining the tempo throughout the piece was related to intuition. The intuitives' tendency to use insight to analyze meaning, relationships, and possibilities (Myers & McCaulley, 1985) would seem to be useful in enabling them to make logical decisions about tempo maintenance. Perception (P) was correlated with accuracy in performing rhythmic notation. Since musical compositions generally incorporate a number of rhythmical and melodic patterns in various permutations, the perceptives' ability to adapt quickly to the changing patterns of the music appears to be useful in sight-reading. Thinking (T) was correlated with notes altered in the left hand and overall pitch accuracy. The traits of employing analytical thought and objectivity would seem useful in analyzing pitch relationships within musical compositions, and hence judgments about alterations of pitch.

Descriptive statistics from the Sight-Reading Experience Questionnaire (SREQ) indicate that there was wide variability among subjects regarding type and quantity of sight-reading experience. The range of 0 to 50 for pieces sight-read per week indicates a lack of uniformity regarding sight-reading involvement among subjects. Interestingly, the majority of subjects reported sight-reading on their own initiative, and less than half reported sight-reading as having been included in lessons. It would appear then, for this sample, that subjects' interest in sight-reading may be intrinsic, rather than being predicated on the extrinsic encouragement of teachers in formal instructional settings.

The modest association between sight-reading achievement and beginning sight-reading at a relatively older age is notable. While the mean age for subjects' sight-reading on their own initiative was 7.46, the range was 16 years, with the youngest being five and the oldest 21 when they began to sight-read. This finding is not necessarily in line with the pedagogical literature, which encourages teachers to introduce sight-reading at the very first lessons (Last, 1972; Maier, 1963; and Johnstone, no date). Part of the explanation may be found in the complex nature of sight-reading skill, which seems to require the subjects' use of higher levels of formal thinking in order to recognize structures and patterns in the music and to evaluate essential components of style quickly. Given this complexity, it would seem logical that older subjects could use their sight-reading experiences cumulatively in a more efficient and perhaps beneficial way than young children, who may not be able to transfer elements from one sight-reading experience to the next (e. g., see learning theorists Piaget, 1952a, 1952b; Gagne, 1979, 1985; Bruner, 1960). The advantage of early sight-reading, however, may not necessarily be that students are learning to see patterns, but rather that they are establishing good habits. Later at the appropriate developmental stages, these habits may enhance sight-reading achievement (e.g., Asmus, 1986; Gordon, 1989; and Kendall, 1988).

Other results of this study suggest that subjects' interest in sight-reading is related to sight-reading experience. There were moderate correlations between subjects' ratings of ability and self-reported interest in sight-reading, and between subjects' ratings of ability and achievement as measured by the SRAT. Support for a relationship between attitude and achievement has been noted in the literature (Greenberg, 1970; Vander Ark, Nolin, & Newman, 1980; Asmus, 1986; Austin, 1988). Although it is not possible to determine the causal relationships between attitude and achievement in sight-reading from the current study, it appears that interest may be part of a logical progression leading to sight-reading achievement in the following manner: subjects' interest could contribute to their desire to engage in sight-reading activities, which would increase their overall experience level. The greater experience level could lead to greater familiarity with style, a suggestion that is supported by the correlation between composite number of pieces sight-read among 53 composers and sight-reading achievement. Finally, higher achievement in sight-reading could increase the subject's enjoyment of participating in sight-reading experiences, as suggested by Asmus (1986).

Implications for Educators

1. The importance of range of sight-reading experience for pre-college years suggests the value of introducing a wide range of styles during the earlier years of piano instruction.

2. The finding that greater sight-reading achievement was related to a relatively late age of beginning sight-reading offers evidence that while young children do learn to read music, they may be processing the information differently from adults, according to their developmental stage. Therefore, children's early understanding of notation may not be contributing to their skill at sight-reading as much as some pedagogues have thought.

3. The finding that part of sight-reading involvement is related to subjects' interest in sight-reading and self-ratings of sight-reading ability is a further indication that achievement in musical endeavors such as sight-reading is not solely predicated on learning the rudiments of the skill, but on individual differences in motivation, self-concept, attitude and so forth.

4. The finding that number of pieces performed was not related to sight-reading achievement supports indirectly the view of some pedagogues (e.g., Rowley, no date; Broughton, 1956) that sight-reading must be developed independently from performance, and may encourage teachers to place more emphasis on the development of sight-reading skills separately from the study of piano literature. In addition, the finding that subjects' sight-reading scores were largely consistent across styles suggests that teachers may need to modify their view of the sight-reading process and the relationships among style, genre, time periods, and technical demands in sight-reading achievement.

5. The importance of aural imagery in sight-reading may help to explain why some students can play music by ear but cannot read notation fluently. For these students, their aural awareness is possibly more developed than their aural imaging of the printed page. Perhaps there should be more focus on teaching aural imagery as a separate skill from ear training. A program linking visual notation to aural sound could be developed commencing with dyads, and simple melodic patterns, and progressing to more complex patterns with the use of key signatures.

6. The significant relationship of FDI to sight-reading achievement may have implications for teachers. Perhaps the findings in education and music education literature (e.g., Strawitz, 1984; Carbo, 1984; Schmidt & Lewis, 1987; MacGregor, Shapiro, and Niemiec, 1988; Osborne, 1988) which has investigated methods of instruction for FD students could be applied to piano instruction. For example, the Hidden Figures Test could be administered to those students who find sight-reading difficult, in order to determine if they are FD. The teacher could then develop a program of drill sequences for recognizing notes, chords, and melodic/rhythmic patterns. By focusing the student's attention on such details, the FD student could conceivably become more proficient at disembedding patterns from the musical score.

7. The gender interaction between LOC and sight-reading achievement may indicate that the situation or context of the task performance is a factor in sight-reading achievement. While a number of teachers advocate ensemble playing as a means of learning sight-reading skills, there may be some students who would receive greater benefit by practicing sight-reading alone. Therefore, different types of experiences could be offered, such as a group setting for external LOC individuals who seem to respond to risk situations, individual assignments for internals who like to work alone, or duet assignments to appeal to MBTI feeling types who prefer group learning situations.

8. From this study, it seems that the individuals who are relatively introverted, intuitive, thinking, and perceiving may have particular advantage in some piano sight-reading tasks. It follows that instructors could provide sensing students with a number of drills to enhance sight-reading achievement. In addition, instructors could point out the value of curiosity to judging types, and could explore ways to increase students' curiosity about sight-reading new pieces. Feeling types could be placed in group or duet situations so that sight-reading can be carried out within the context of interpersonal interaction.

Recommendations

This study was exploratory in nature. Consequently, the majority of findings are preliminary and in need of further research in order to increase generalizability. The resulting methodological applications that can be shared from this research effort could potentially benefit a great many students. Perhaps such concentrated efforts to enhance the learning process of students will enable time to realize their highest potential in this vital yet often elusive facet of musical performance.

References

Abel, J., & Larkin, K. T. (1990). Anticipation of performance among musicians: Physiological arousal, confidence, and state-anxiety. *Psychology of Music, 18*, 171-182.

Abeles, H. F. (1975). Student perceptions of characteristics of effective applied music instructors. *Journal of Research in Music Education, 23*(2), 147-154.

Asmus, E.P. (1986). Student beliefs about the causes of success and failure in music: A study of achievement motivation. *Journal of Research in Music Education, 34*(4), 262-278.

Austin, J. R. (1988). The effect of music contest format on self-concept, motivation, achievement, and attitude of elementary band students. *Journal of Research in Music Education, 36*(2), 95-107.

Bar-Tal, D., & Bar Zohar, Y. (1977). The relationship between perception of locus control and academic achievement. *Contemporary Educational Psychology, 2*, 181-199.

Barger, R. R., & Hoover, R. L. (1984). Psychological type and the matching of cognitive styles. *Theory Into Practice, 23*(1), 56-63.

Baron, R. M., & Ganz, R. L. (1972). Effects of locus of control and type of feedback on the task performance of lower-class black children. *Journal of Personality and Social Psychology, 21*, 124-130.

Baron, R. M., Cowan, G., Ganz, R. L., & McDonald, M. (1974). Interaction of locus of control and type of performance feedback: Considerations of external validity. *Journal of Personality and Social Psychology, 20*(2), 285-292.

Beal, A. L. (1985). The skill of recognizing musical structures. *Memory and Cognition, 13*(5), 405-412.

Bean, K. L. (1938). An experimental approach to the reading of music. *Psychological Monographs, 50*, Whole number 226.

Bell, C. R., & Cresswell, A. (1984). Personality differences among musical instrumentalists. *Psychology of Music, 12*(2), 83-93.

Bishop, D. (1964). Sight reading in the piano class. *Clavier, 1*(2), 48-51.

Bone, R. N., & Eysenck, H. J. (1972). Extraversion, field dependence and the Stroop Test. *Perceptual and Motor Skills, 34*, 873-874.

Bourgeois, A., Levenson, H., & Wagner, C. (1980). Success on a biofeedback task: Effects of congruence-incongruence between locus of control and psychological differentiation. *Journal of Personality Assessment, 44*(5), 487-491.

Boyle, J. D. (1968). The effect of prescribed rhythmical movements on the ability to sight read music. *Dissertation Abstracts International, 29*, 2290A.

Broughton, J. (1956). *Success in Piano Teaching.* New York: Vantage Press.

Bruner, J. (1960). *The Process of Education.* New York: Alfred A. Knopf.

Carbo, M. (1984). Research in learning style and reading: implications for instruction. *Theory Into Practice, 23*(1), 72-76.

Ciepluch, G. M. (1988). Sightreading achievement in instrumental music performance, learning gifts, and academic achievement: A correlation study. *Dissertation Abstracts International, 49*, 1398A. (University Microfilms No. #8810008).

Crump, B. R., Hickson, J. H., & Laman, A. (1985). Relationship of locus of control to achievement and self-concept in education majors. *Psychological Reports, 57*, 1055-1060.

Deever, S. G. (1968). Ratings of task oriented expectancy for success as a function of internal control and field independence. *Dissertation Abstracts International, 29*, 365B.

Dews, C. L. & Williams, M. S. (1989). Student musicians' personality styles, stresses, and coping patterns. *Psychology of Music, 17*, 37-47.

Doyle, J. A. (1975). Field independence and self actualization. *Psychological Reports, 36*, 363-366.

Duke, M. P., & Nowicki, S. (1973). Personality correlates of the Nowicki-Strickland locus of control scale for adults. *Psychological Reports, 33*, 267-270.

Eaton, J. (1978). A correlation study of keyboard sight-reading facility with previous training, note-reading, psychomotor, and memorization skills. (Doctoral dissertation, Indiana University). *Dissertation Abstracts International, 39*, 4109A.

Ellis, M. C., & McCoy, C. W. (1990). Field dependence/independence in college nonmusic majors and their ability to discern form in music. *Journal of Research in Music Education, 38*(4), 302-310.

Feather, N. T., & Volkmer, R. E. (1988). Preference for situations involving effort, time pressure, and feedback in relation to Type A behavior, locus of control and test anxiety. *Journal of Personality and Social Psychology, 55*(2), 266-271.

Fiebert, M. (1967). Sex differences in cognitive style. *Perceptual and Motor Skills, 24*, 1277-1278.

Findley, M. J., & Cooper, H. M. (1883). Locus of control and academic achievement: A literature review. *Journal of Personality and Social Psychology, 44*(2), 419-427.

Fjerstad, C. D., (1969). A comparison of tachistoscipic and metronomic training for developing sight-reading of harmonic notation within class piano instruction. (Doctoral dissertation, Indiana University). *Dissertation Abstracts International, 30,* 1194A.

Frank, B. M. (1984). Effect of field independence-dependence and study technique on learning from a lecture. *American Educational Research Journal, 21*(3), 669-678.

French, J. W., Echstrom, R. B., & Price, L. A. (1962). *Manual for Kit of Reference Tests for Cognitive Factors.* Princeton: NJ: Educational Testing Service.

Gagne, R. M. (1979). *Principles of Instructional Design.* New York: Holt, Rinehart and Winston.

Gagne, R. M. (1985). *The Conditions of Learning and Theory of Instruction.* New York: Holt, Rinehart and Winston.

Gates, A., & Bradshaw, J. L. (1974). Effects of auditory feedback on a musical performance task. *Perception and Psychophysics, 16*(1), 105-109.

Gordon, E. E. (1989). *Learning Sequences in Music: Skill, Content, and Patterns.* Chicago: GIA Publications.

Greenburg, M. (1970). Musical achievement and self-concept. *Journal of Research in Music Education, 18,* 57-64.

Gregory, T. B. (1972). The effect of rhythmic notation variables on sight-reading errors. *Journal of Research In Music Education, 20*(4), 462-468.

Guttinger, H. I. (1974). Patterns of perceiving: Factors which affect individualized reading instruction at the high school level. Paper presented at the American Educational Research Association Annual Meeting, Chicago, Ill. (Available from the Center for Applications of Psychological Type, Gainesville, Fl.)

Hahn, L. (1987). Music reading and language reading: Correlations in processes and instruction. *Journal of Research in Music Education, 4*(1), 41-47.

Halpern, A. R., & Bower, G. H. (1982). Musical expertise and melodic notation. *American Journal of Psychology, 95*(1), 31-50.

Hamann, D. L., & Sobaje, M. (1983). Anxiety and the college musician: A study of performance conditions and subject variables. *Psychology of Music, 11*(1), 37-50.

Heitland, K. W. (1983). Cognitive styles and musical aptitudes: An exploratory study. *Dissertation Abstracts International, 43*(8), 2534A.

Hyman, R., & Rosoff, B. (1984). Matching learning and teaching styles: The jug and what's in it. *Theory Into Practice, 23*(1), 36-43.

Idson, W. L., & Massaro, D. W. (1976). Cross-octave masking of single tones and musical sequences: The effects of structure on auditory recognition. *Perception and Psychophysics, 19*(2), 155-175.

Johnstone, J. A. (no date). *The Art of Teaching Piano Playing.* London: W. M. Reeves, Ltd.

Karabenick, S. A., & Addy, M. M. (1979). Locus of control and sex differences in skill and chance risk-taking conditions. *The Journal of General Psychology, 100,* 215-228.

Kardash, C. M., Lukowski, L., & Bentmann, L. (1988). Effects of cognitive style and immediate testing on learning from a lecture. *Journal of Educational Research, 81*(6), 360-364.

Kelso, J. A., Southard, D. L., & Goodman, D. (1979). On the coordination of two-handed movements. *Journal of Experimental Psychology: Human Perception and Performance, 5*(2), 229-238.

Kemp, A. (1981a). The personality structure of the musician: I. Identifying a profile of traits for the performer. *Psychology of Music, 9*(2), 69-75.

Kemp, A. (1981b). The personality structure of the musician: II. Identifying a profile of traits for the composer. *Psychology of Music, 9*(2), 69-75.

Kemp, A. (1981c). Personality differences between the players of string, woodwind, brass, and keyboard instruments, and singers. *Council for Research in Music Education, 66-67,* 33-38.

Kendall, M. J. (1988). Two instructional approaches to the development of aural and instrumental performance skills. *Journal of Research in Music Education, 30*(4), 205-219.

Kiewra, K.A., & Frank, B.M. (1988). Encoding and external-storage effects of personal lecture notes, skeletal notes, and detailed notes for field-independence and field-dependent learners. *Journal of Educational Research, 81* (3), 143-148.

King, D. (1983). Field dependence/field independence and achievement in music reading. *Dissertation Abstracts International, 44,* 1320A.

Kornicke, E. (1989). [Achievement in sight-reading: Interviews with pianists]. Unpublished raw data.

Last, J. (1972). *The Young Pianist* (2nd ed.). London: Oxford University Press.

Lefcourt, H. M. (Ed.). (1982). *Locus of Control: Current Trends in Theory and Research* (2nd ed.). Hillsdale, New Jersey: Lawrence Erlbaum Associates, Pub.

Lefcourt, H. M. (Ed.). (1983). *Research with the Locus of Control Construct: Vol. 2. Developments and Social Problems.* New York: Academic Press.

Lefcourt, H. M., & Telgadi, M. (1971). Perceived locus of control and field dependence as pre-

dictors of cognitive activity. *Journal of Consulting and Clinical Psychology, 37,* 53-56.

Levenson, H. (1981). Differentiating among internality, powerful others, and chance. In H. M. Lefcourt (Ed.). *Research with the Locus of Control Construct: Vol. 1. Assessment Methods* (pp. 15-61). New York: Academic Press.

Lewis, B. E., & Schmidt, C. P. (1991). Listeners' response to music as a function of personality type. *Journal of Research in Music Education, 39*(4), 311-321.

Lowder, J. (1973). An experimental study of a keyboard sightreading test administered to freshman secondary piano students at the Ohio State University. *Contributions to Music Education, 3,* 97-105.

Lowder, J. F. (1974). Evaluation of a sight-reading test administered to freshman piano classes. *Journal of Research in Music Education, 3,* 97-105.

MacGregor, S. K., Shapiro, J. Z., & Niemiec, R. (1988). Effects of a computer-augmented learning environment on math achievement for students with differing cognitive style. *Journal of Educational Computing Research, 4*(4), 453-465.

Maier, G. (1963). *The Piano Teacher's Companion.* New York: Mills Music, Inc.

McCaulley, M. H., & Natter, F. L. (1980). *Psychological (Myers-Briggs) Type Differences in Education.* Gainesville, Fl: Center for Applications of Psychological Type, Inc.

McGee, M. G. (1979). Human spatial abilities: Psychometric studies and environmental, genetic, hormonal, and neurological influences. *Psychological Bulletin, 86,* 889-918.

McGhee, P. E., & Crandall, V. C. (1968). Beliefs in internal-external control of reinforcement and academic performance. *Child Development, 39,* 91-102.

Myers, I. B., & McCaulley, M. H. (1985). *Manual: A guide to the Development and use of the Myers-Briggs Type Indicator.* Palo Alto, Calif.: Consulting Psychologists Press.

Myers, I. B., and Myers, P. B. (1980). *Gifts Differing.* Palo Alto, Calif.: Consulting Psychologists Press, Inc.

Nagel, J. J., Himle, D. P., & Papsforf, J. D. (1989). Cognitive-behavioural treatment of musical performance anxiety. *Psychology of Music, 17,* 12-21.

Ortmann, O. (1937). Span of vision on note-reading. *Music Educator's National Conference Yearbook,* 88-93.

Osborne, A. M. (1988). The interaction of field dependence/independence, instructional methodology and achievement in harmonic dictation skills. *Dissertation Abstracts International, 49*(10), 2959A.

Pagan, K. A. (1970). An experiment in the measurement of certain aspects of score reading ability. (Doctoral dissertation, Indiana University). *Dissertation Abstracts International, 31,* 1313A.

Parent, M., Forward, J., Canter, R., & Mohling, J. (1975). Interactive effects of teaching strategy and personal locus of control on student performance and satisfaction. *Journal of Educational Psychology, 67,* 764-769.

Parkes, J. R. (1984). Locus of control, cognitive appraisal, and coping in stressful episodes. *Journal of Personality and Social Psychology, 46*(3), 655-668.

Phares, E. J. (1976). *Locus of Control in Personality.* Morristown, N.J.: General Learning Press.

Piaget, J. (1952a). *The Language and Thought of the Child.* London: Routledge & Kegan Paul.

Piaget, J. (1952b). *The Origins of Intelligence in Children.* New York: International Universities Press.

Provost, G. L. (1981). Teaching strategies, modes of evaluation, and field-dependence factor. *Perceptual and Motor Skills, 52,* 163-173.

Restle, F., & Brown, E. R. (1970a). Serial pattern learning. *Journal of Experimental Psychology, 83,* 120-125.

Restle, F., & Brown, E. R. (1970b). Serial pattern learning: Pretraining of runs and trills. *Psychonomic Science, 19*(6), 321-322.

Revak, C. A. (1987). Relationship among selected psychomotor abilities and music reading achievement of beginning woodwind instrumentalists. Unpublished thesis proposal. Indiana University, Bloomington, Indiana.

Richert, A. J. (1981). Sex differences in relation to locus of control and reported anxiety. *Psychological Reports, 49,* 971-974.

Riding, R. J., & Boardman, D. J. (1983). The relationship between sex and learning style and graphicacy in 14-year-old children. *Educational Review, 35*(1), 69-78.

Rowley, A. (no date). *Do's and Don'ts For Musicians.* London: Edwin Ashdown, Ltd.

Salis, D. (1977). The identification and assessment of cognitive variables associated with reading of advanced music at the piano. (Doctoral dissertation, University of Pittsburgh). *Dissertation Abstracts International, 38,* 7239A.

Saracho, O. N. (1984). Young children's academic achievement as a function of their cognitive styles. *Journal of Research and Development in Education, 18*(1), 44-50.

Schmidt, C. (1984). The relationship among aspects of cognitive style and language-bound/language-optional perception to musicians' performance in aural discrimination tasks. *Journal of Research in Music Education, 32*(3), 159-168.

Schmidt, C. P. (1989a). Applied music teaching behavior as a function of selected personality variables. *Journal of Research in Music Education, 37*(4), 258-271.

Schmidt, C. P. (1989b). Individual differences in perception of applied music teaching feed-

back. *Psychology of Music, 17,* 110-122.
Schmidt, C., & Lewis, B. E. (1987). Field dependence/independence, movement-based instruction and fourth graders' achievement in selected musical tasks. *Psychology of Music, 15*(2), 117-127.
Schmidt, C. P., & McCutcheon, J. W. (1988). Re-examination of relations between the Myers-Briggs Type Indicator and field dependence-independence. *Perceptual and Motor Skills, 67,* 691-695.
Schmidt, C. P., & Stephans, R. (1991). Locus of control and field dependence as factors in students' evaluations of applied music instruction. *Perceptual and Motor Skills, 73,* 131-136.
Shaffer, P. W. (1966). Functional similarity of imagining to perceiving: Individual differences in vividness of imagery. *Perceptual and Motor Skills, 25,* 744.
Sherman, J. A., (1967). Problem of sex differences in space perception and aspects of intellectual functioning. *Psychological Review, 74,* 290-299.
Shute, G. E., Howard, M. M., & Steyaert, J. P. (1984). The relationships among cognitive development, locus of control, and gender. *Journal of Research in Personality, 18,* 335-341.
Sloboda, J. A. (1974). The eye-hand span: An approach to the study of sight-reading. *Psychology of Music, 2,* 4-10.
Sloboda, J. A. (1976a). Visual perception of musical notation: registering pitch symbols in memory. *Quarterly Journal of Experimental Psychology, 28,* 1-16.
Sloboda, J. A. (1978a). Perception of contour in music reading. *Perception, 6,* 323-331.
Sloboda, J.A. (1978b). The psychology of music reading. *Psychology of Music, 6* (2), 3-20.
Sloboda, J. A., & Gregory, A. H. (1980). The psychological reality of musical segments. *Canadian Journal Psychological Review, 34*(3), 274-280.
Slododa, J. A. (1981). The uses of space in music notation. *Visible Language, 15,* 86-110.
Solomon, D., Houlihan, K. A., Busse, T. V., & Parelius, R. J. (1971). Parent behavior and child academic achievement, achievement striving and related personality characteristics. *Genetic Psychology Monographs, 83,* 173-273.
Steptoe, A. (1989). Stress, coping and stage fright in professional musicians. *Psychology of Music, 17,* 3-11.
Stern, J. F. (1975). The application of language reading skills to the teaching of music reading in elementary schools. *Counsel for Research in Music Education, 41,* 45-53.
Strawitz, B. M. (1984). Cognitive style and the acquisition and transfer of the ability to control variables. *Journal of Research in Science Teaching, 21*(2), 133-141.
Travis, C. B., McKenzie, B. J., Wiley, D. L., & Kahn, A. S. (1988). Sex and achievement domain: Cognitive patterns of success and failure. *Sex Roles, 19*(7, 8), 509-525.
Vander Ark, S. D., Nolin, W. H., & Newman, I. (1980). Relationship between musical attitudes, self-esteem, social status, and grade level of elementary children. *Bulletin of the Council for Research in Music Education, 62,* 31-41.
Weaver, H. E. (1943a). A survey of visual processes in reading differently constructed musical selections. *Psychological Monographs, 55,* 1-30.
Weaver, H. E. (1943b). Memory span and visual pauses in reading rhythms and melodies. *Psychological Monographs, 55,* 33-50.
Weber, R. J., & Brown, S. (1986). Musical imagery. *Music Perception, 3*(4), 411-426.
Wolf, T. (1976). A cognitive model of musical sight-reading. *Journal of Psycholinguistic Research, 5*(22), 143-171.
Yokomoto, C. F., & Ware, J. R. (1980). Improving problem solving performance using the MBTI. *Proceedings of the 1982 American Society of Engineering Annual Conference,* pp.163-167). (Available from the Center for Applications of Psychological Type, Gainesville Fl)
Young, L. J. (1971). A study of the eye movements of successful and unsuccessful piano sight readers while piano sight-reading. (Doctoral dissertation, Indiana University). *Dissertation Abstracts International, 32,* 5834A.