Field Independence/Dependence: A Hypothesized Relationship With Leadership and Academic Spheres of College Students

This study related field independence/dependence to leadership and academic realms. One hundred and twenty-two upperclass students, who were science majors, humanities majors, campus leaders, or leadership scholars, completed the Group Embedded Figures Test (GEFT) as a measure of field independence/dependence. Bennis's (1989) theory of leaders versus managers was applied to field independence/dependence to test the hypothesis that leadership scholars would be comparable to Bennis's managers and would be field independent whereas campus leaders would be comparable to Bennis's leaders and would be field dependent. Although both leader groups did not differ significantly, natural science majors were more field independent than humanities majors, no sex differences were found, and switching majors was unrelated to field independence/dependence. Finally, participants accurately rated their own analytical ability as measured by the GEFT but not their interpersonal ability. Although field independence's relation to the academic sphere has been reaffirmed, the manner in which leadership reflects cognitive style remains an unanswered question for future research.

During training, it was noticed that when pilots fly through clouds, some come out the other side upright whereas others come out the other side upside down (Witkin & Goodenough, 1981). Researchers became interested in this enigmatic phenomenon, which eventually resulted in the description of the cognitive style known as field independence/dependence. Field independence is defined as the ability to identify and evaluate information without regard to its background (Oltman, Raskin, & Witkin, 1971).

Field independence/dependence is related to cognitive and problem-solving abilities. Individuals classified as field independents can easily organize and analyze information. Although field dependents lack this inherent ability to easily organize material (Witkin, Moore, Goodenough, & Cox, 1977), they have a clear advantage with regard to social information. Research supports field dependents' superiority in attentiveness to social cues (Fitzgibbons, Goldberger, & Eagle, 1965).

Field independence/dependence has been related to academic success. The literature substantiates field independents' success in natural sciences (Bernardi, 1993; Ferguson, 1993; Paramo & Tinajero, 1990; Wapner & Demick, 1991; Witkin, Moore, Goodenough, et al., 1977; Young, Kelleher, & McRae, 1989). On the other hand, field dependents thrive in the humanities (Murphy, 1993; Wapner & Demick, 1991; Witkin, Moore, Oltman, et al., 1977).

The field independence/dependence literature relates many personal characteristics to these two cognitive styles. Moreover, the qualitative personality differences between field independent and field dependent persons may relate to leadership ability. For example, field dependents exhibit excellent interpersonal skills and may be superb leaders who are chosen often by group members. Although field independents typically do not have strong interpersonal skills, they may also be leaders; however, their strength...
lies in organizational skills. Investigating this cognitive style and the construct of leadership may produce a more integrated and inclusive understanding of field independence/dependence and leadership by teasing apart how cognitive style may explain one's choices in leadership activity.

In On Becoming a Leader, Warren Bennis (1989) argued there is a difference between leaders and managers. According to Bennis, leaders are inductive, whole brain, and flexible. Therefore, leaders foster independence within their groups. Bennis's other style describes managers who are deductive, left brain, and accomplish tasks according to detailed instructions. Although the relationship is not perfect, the characteristics Bennis used to describe leaders are similar to field dependent traits, whereas the characteristics of managers are similar to field independent traits.

The present study tested the hypothesis that Bennis's (1989) leaders are field dependent, and his managers are field independent. Our leaders are college students chosen by peers to serve in leadership positions in campus organizations. Because these individuals have evolved by group selection, they represent Bennis's leaders and should be field dependent. Our managers are leadership scholars who are students chosen by a campus committee for characteristics such as organizational skills; they should be field independent.

We also attempted to replicate three findings from the literature. First, even though sex differences are pervasive in the earlier research (Witkin, Moore, Goodenough, et al., 1977) with men demonstrating more field independence on average than women, more recent studies failed to detect such differences (Ferguson, 1993; McRae & Young, 1990; Young et al., 1989). The present study investigated whether sex differences exist in a college sample. Second, field independence has been associated with the natural sciences and field dependence with the humanities (Witkin, Moore, Goodenough, et al., 1977); this study sought to replicate this finding. Third, switching majors has been related to cognitive style (Witkin, Moore, Oltman, et al., 1977). Therefore, this study investigated whether students who have switched majors may have changed because of mismatches between their respective chosen disciplines and their individual cognitive styles.

Other hypotheses in this study led to the prediction that there is a relationship between leadership scholars and natural science majors who are both hypothesized to be field independent and between campus leaders and humanities majors who are both hypothesized to be field dependent. Finally, participants rated their own analytical and interpersonal abilities to test the hypothesis that if they are aware of their style, field independents should rate themselves higher in analytical skills and lower in interpersonal skills; the reverse should be true for field dependents.

Method

Participants

One hundred and twenty-two upperclass students (78 women, 44 men) from a small mid-Atlantic liberal arts college were drawn from four groups: science majors, humanities majors, campus leaders, and leadership scholars. Potential participants were selected to proportionally represent class year (junior and senior) and sex within the groups of science majors, humanities majors, and campus leaders. Potential students were randomly selected after meeting the criteria for representativeness and then invited to participate in the study. Participants received neither monetary compensation nor class credit. The participants were 73 seniors, 37 juniors, and 12 sophomores.

Science majors (n = 31; 58% women) included students in biology, chemistry, physics, and mathematics/computer science. Humanities majors (n = 30; 63% women) included students in English, history, philosophy/religion, communication arts, and modern languages. Campus leaders (n = 30; 60% women) included current or former officers of any established club on campus, officers of Greek organizations, and captains of sports teams. Finally, leadership scholars (n = 31; 74% women) consisted of recipients of one type of merit scholarship offered by the college. Incoming students undergo a lengthy interview process, conducted by a committee consisting of faculty and admissions personnel, to determine their leadership potential. Once at the college, merit scholars participate in a 4-year program to develop their leadership skills through organizing special events. There are only 15 merit scholars per year; consequently, sophomore scholars were invited to participate in the study to increase the size of the group. Because scholars are predominantly women, the number of men and women could not be equated.

Potential participants could be members of more than one experimental group, and therefore, the order for selecting groups was established randomly. After participants for a given group were selected, their names were eliminated from the other groups in which they might be placed. It is important to note that all four groups are not symmetrical with respect to major because both groups of leaders included students from the social sciences and students from the natural sciences and humanities.
Testing Instruments

Participants completed the Group Embedded Figures Test (GEFT: Oltman et al., 1971) to determine their cognitive style of field independence/dependence. The GEFT, a more recent version of the Embedded Figures Test (EFT), is a timed paper-and-pencil test designed for a large number of participants. Reliabilities of .82 for both sexes are noted for this instrument, and therefore, are consistent with findings on the EFT. According to the manual (Witkin, Oltman, Raskin, & Karp, 1971), adequate validity has been established with -.82 and -.63 correlations of individual EFT and individual GEFT scores for men and women undergraduates, respectively. The negative correlation results from the reversed scoring on the EFT. Scores on the GEFT range from 0 (field dependence) to 18 (field independence).

Participants also completed a 24-item questionnaire on campus experiences. It requested information on demographics such as sex, class year, original and current major, and self-reports of interpersonal and analytical abilities using a Likert scale. The scale ranged from 1 (not very good) to 5 (very good). The remaining items in this questionnaire were not included in the analyses reported in this study. These items involved school performance, career plans, favorite courses in one's major, and types of leadership positions held.

Procedure

The primary investigator contacted all participants and arranged for them to attend one of several prescheduled times that was most convenient for them. Upon arrival, participants received a packet including the GEFT and the questionnaire. Because scheduled times were open and attended by students from all groups, both packet items were appropriately coded according to their preselected group in order to later identify group membership. After the participants arrived, the researcher reiterated that the study involved two parts and explained the order of these parts. Students were assured anonymity. At this point, directions for administration of the GEFT were followed according to the manual. Afterwards, participants completed the questionnaire on campus experiences. Finally, students were debriefed and allowed to leave.

Results

The GEFT manual (Witkin et al., 1971) indicates 11.4 is the mean for college-age samples. A single sample t test indicated that the grand mean for the present sample, 13.37 (see Table 1), is significantly higher than the cited mean, t(121) = 5.42, p < .01. It is important to note that the student body may be atypical because a large proportion of entering students expect to major in the sciences. In fact, 61 out of 122 participants were natural science majors. Because people in the sciences typically score higher on the GEFT, the large number of science majors may explain the high mean. Due to the possible confound of sophomores in the leadership scholars group, the effect of class year was investigated within that group. Specifically, we compared GEFT scores of sophomores, juniors, and seniors; no significant differences were found, F(1,29) = 1.93, p > .17.

Leadership and Division of Major

Although no specific predictions were made about the relationship between kind of leader and division of major, a 4 (group) x 2 (sex) between-subjects analysis of variance (ANOVA) was performed with participant GEFT scores as the dependent variable in order to investigate the hypothesized similarity between leadership scholars and natural science majors as field independents as well as the hypothesized similarity between campus leaders and humanities majors as field dependents. Group differences were not significant, F(3, 114) = 2.27, p > .085. The means shown in Table 1 indicate that campus leaders and leadership scholars fell between humanities majors and natural science majors, but groups did not differ significantly from each other. There were no sex differences, F(1, 114) < 1, ns. Other preliminary tests also indicated there were no sex differences on GEFT scores; therefore, sex was not included in further analyses.

The primary hypothesis predicted significant differences on GEFT scores between campus leaders and leadership scholars, and a planned comparison was
conducted between these two groups. Contrary to the primary hypothesis, this test failed to yield significance, $F(1, 118) < 1$, ns.

A second hypothesis predicted significant differences between natural science majors and humanities majors. A second planned comparison yielded significance, $F(1, 118) = 5.58, p < .02$. As depicted in Table 1, participants majoring in the natural sciences are significantly more field independent than those majoring in the humanities. For both planned comparisons, pooled variances were used.

Participants in both campus leader and leadership scholar groups have a major within either the humanities, natural sciences, or social sciences. Because the mean scores on the GFFT of both leadership groups fell between the humanities and natural sciences, participation in leadership activities may mediate cognitive style. We conducted an exploratory analysis to determine whether the leaders who were humanities and natural science majors were more similar to each other or were more similar to the humanities and natural science groups. A 2 (leaders) $\times$ 2 (division of major) between-subjects ANOVA was performed on the GFFT scores for leaders only.

Table 2 shows neither main effect was significant; however, there was a significant interaction, $F(1, 44) = 3.95, p < .05$. Simple effects were examined at each level of leader; neither was significant (leadership scholars, $F(1, 24) = 1.77, p > .20$; campus leaders, $F(1, 20) = 2.07, p > .17$). It might be that the analyses lack statistical power due to small sample size. Nevertheless, the means indicate that campus leaders follow the expected pattern with humanities majors scoring in the direction of field dependence and natural science majors scoring in the direction of field independence. Leadership scholars, on the other hand, showed the reverse pattern.

**Change of Major**

It was predicted that when students change their major, the change should be congruent with their cognitive style. Participants were asked to give both their original major upon entering college and their current major. Responses to both questions were recoded from major to division of major (i.e., current English major = humanities). Only 11 participants had changed to majors within the natural and social sciences, so a two-way ANOVA for original and current major was performed.

**TABLE 2**

<table>
<thead>
<tr>
<th>Leader</th>
<th>M</th>
<th>SD</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scholar</td>
<td>14.00</td>
<td>2.98</td>
<td>10</td>
<td>12.13</td>
<td>3.79</td>
<td>16</td>
</tr>
<tr>
<td>Campus</td>
<td>10.25</td>
<td>6.23</td>
<td>8</td>
<td>13.50</td>
<td>4.36</td>
<td>14</td>
</tr>
</tbody>
</table>

Note. Scores range from a low of 0 (field dependent) to a high of 18 (field independent).

**TABLE 3**

<table>
<thead>
<tr>
<th>Current major</th>
<th>Humanities</th>
<th>Natural sciences</th>
<th>Social sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>n</td>
</tr>
<tr>
<td>Humanities</td>
<td>10.54$a$</td>
<td>5.03</td>
<td>13</td>
</tr>
<tr>
<td>Natural sciences</td>
<td>18.00</td>
<td>0.00</td>
<td>1</td>
</tr>
<tr>
<td>Social sciences</td>
<td>15.33</td>
<td>1.75</td>
<td>6</td>
</tr>
</tbody>
</table>

Note. Means with the same superscript are significantly different at $p < .05$. 

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current major was not appropriate (see Table 3). Thirty-three participants had changed to humanities majors; as a result, a one-way ANOVA was performed for current humanities majors, $F(2, 30) = 6.36, p < .005$. The Tukey b procedure indicated that of students currently majoring in the humanities, those who changed from the natural sciences are more ($p < .05$) field independent than other humanities majors who had changed from a major within the humanities or within the social sciences. Because the mean is high for former natural science majors, the results indicate these students moved away from their cognitive style.

**Participants’ Ratings**

A one-way ANOVA was computed between the four groups on personal ratings of their own analytical ability (see Table 4). A significant difference was found, $F(3, 118) = 4.86, p < .003$. The Tukey b procedure determined that science majors rated themselves significantly ($p < .05$) more analytical than humanities majors and leadership scholars. Contrary to prediction, campus leaders rated themselves more analytically than leadership scholars.

Participants’ ratings of ability to interact with people were analyzed by a one-way ANOVA. No significant differences were found, $F(3, 118) < 1$, ns. The groups of leadership scholars ($M = 4.35, SD = .88$), campus leaders ($M = 4.23, SD = .82$), science majors ($M = 4.16, SD = .64$), and humanities majors ($M = 4.17, SD = .95$) were used in this analysis. The means are high, which indicates all individuals, regardless of group, perceived themselves as interacting well with other people.

**Discussion**

**Leadership**

According to the primary hypothesis, Bennis’s (1989) distinction between leaders and managers would characterize qualities of field dependents and field independents, respectively. The results do not support the hypothesis that campus leaders would conform to Bennis’s leaders and would be field dependent, or that leadership scholars would conform to Bennis’s managers and would be field independent. One interpretation is the present study failed to identify leaders and managers in the way that Bennis defined them. Perhaps defining Bennis’s managers as committee-approved leaders is problematic. Other ways of identifying managers and leaders should be explored.

Our leaders may not meet the Bennis (1989) definition; however, they are active leaders. Both leader styles showed moderate scores on the GEFT suggesting that leadership may mediate cognitive style, but the post hoc analyses did not support this interpretation. Campus leaders who evolved from group selection exhibited the expected pattern with field dependents majoring in the humanities and field independents majoring in the natural sciences. Because major overrides leadership for this group, cognitive style does not appear to be mediated by leadership activities. It is not clear why leadership scholars showed the opposite pattern. It is hoped that further research will provide explanations for these enigmatic results.

**Sex Differences**

Research from the 1970s has found small sex differences on field independence, such that women are field dependent whereas men are field independent. No differences were found in the present study, which is consistent with more recent research (Ferguson, 1993; McRae & Young, 1990; Young et al., 1989). Keyes (1983) has asserted that sex differences in field independence/dependence might apply solely to Anglo-European cultures because of their socialized sexual stereotyping. Even Witkin and colleagues (Witkin, Moore, Goodenough, et al., 1977) suggested that sex differences in cognitive styles would be influenced by the nature of the society. Perhaps the reason more recent studies do not show sex differences is that, as women have moved into the workplace, sex differences have diminished (Bernardi, 1993).

An alternative interpretation of sex similarities is that our student body is atypical of college students in general due to the large proportion of first-year women and men entering the sciences. In essence, the college attracts more field independent men and women. Perhaps the preponderance of female science majors in this sample who were field independent...
has directly contributed to the lack of sex differences. Sex differences should continue to be included in future studies to determine if they do still exist for the populations at large.

Division of Major

Despite the fact this population is more field independent than published norms, the present results are consistent with the literature on division of major (Witkin, Moore, Goodenough, et al., 1977). That is, students who choose majors in the sciences tend to be field independent, whereas students who choose majors in the humanities tend to be field dependent. Future studies might include individual majors so that a more definitive understanding of how field independence/dependence expresses itself within divisions can emerge. More importantly, research is needed to move beyond the broadly defined divisions of majors to determine the critical features of cognitive style that are important to success in a major. Consequently, future studies should address instances when cognitive style is incongruent with major, such as field independent history majors.

Change of Major

Past research suggests people who switch majors change to a major congruent with their cognitive style (Witkin, Moore, Oltman, et al., 1977). However, the only significant finding in the present study found that for students who are currently majoring in the humanities, changing from a science major was associated with field independence whereas changing from either a humanities or social science major was associated with field dependence. Thus, these results fail to confirm that switching majors solely reflects cognitive style.

There are many reasons why people change majors. Roughly half of every incoming class at this college majors in biology; many of these students are on the premedical track. Sometimes students discover this discipline is not as interesting as originally perceived and prefer to major in something that is intrinsically more appealing. Additionally, some students do not perform well in the intentionally rigorous freshmen biology class, which forces them to choose another major. As a result, former biology majors change to a variety of other majors, including majors in the humanities. Changing majors, therefore, does not appear to be based only on congruence with one's cognitive style; the present results suggest this choice is multifaceted. Due to the complexity of this issue, further research should explore the choice of major to determine the impact of other factors as well as cognitive style.

Self-Ratings of Abilities

Finally, participants rated themselves on their own analytical and interpersonal abilities. It was hypothesized that if people are aware of their skills, field independents would rate themselves higher in analytical skills and lower in interpersonal skills, and the reverse would be true for field dependents. In this study, field independence was associated with rating oneself high on analytical ability. This finding suggests that people can accurately perceive their field independence.

No differences were found for interpersonal skills because all participants rated themselves high. It is not clear why individuals accurately rate their own analytical ability (field independence), but do not accurately rate their interpersonal skills (field dependence). Perhaps the rating of interpersonal skills reflects a social desirability bias because people may not want to appear as though they lack friends. The manner in which interpersonal skills was assessed is problematic; individuals were asked to rate “their ability to interact with others.” Social desirability bias clearly appears to have affected the results of this particular rating. The exploratory component in which participants rated their analytical and interpersonal abilities provides sound questions for further investigation into the possible link between one’s perception and one’s measured cognitive style.

Conclusion

This study investigated how the cognitive style of field independence/dependence is manifested in leadership ability. Field dependence has been linked to interpersonal skills (Fitzgibbons et al., 1965), and it is logical to assume that interpersonal skills are an important aspect of leadership. Even though we defined leaders in two different ways, neither leadership group scored in the direction of field dependence. However, this study reaffirms field independence/dependence’s application to the academic realm, and therefore, supports the claim that academic interests reflect cognitive style. The question remains for future research: how do different styles of leadership reflect cognitive style?

References


