MAKING STUDENT ONLINE TEAMS WORK

Joel Olson and Ray Kalinski
Purdue University Global

Online professors typically assign teams based on time zones, performance, or alphabet, but are these the best ways to position student virtual teams for success? Personality and task complexity could provide additional direction. Personality and task complexity were used as independent variables related to the dependent variable of team performance. Four hundred-fifty students starting an MBA in a proprietary online university took the Insights Discovery (ID) personality assessment. Students were randomly assigned to 138 teams. Each team had 3 deliverables, which were ranked using the Bonner Model of Task Complexity (Bonner, 1994). Performance was determined by the grade given by the professor. Teams were designated as Variable when all ID personality types were present and Dominant when 50% or more of the team members had one ID personality type. Using ID, teams were also categorized as extroverted/introverted or thinking/feeling. *T* tests and ANOVAs were used to determine statistical difference. Extroverted teams outperformed introverted teams and Variable (heterogeneous) teams outperformed Dominant (homogeneous) teams with complex tasks.

INTRODUCTION

Team projects play an important role with online classes (Palloff & Pratt, 1999; Williams & Castro, 2010). Seung (2006) highlighted the progress of virtual teams in online education. However, the virtual environment of online courses creates obstacles for compatibility and group interaction (Hewson & Hughes, 2005; McInnerney & Roberts, 2004). Carver and Kosloski (2015) pointed out that, "online teachers and course developers must find ways to encourage students to work in teams and communicate during online course" (p. 17). Professors are not always sure how to create teams that feature the collaboration, creativity and problem solving required to be successful (Goold, Crain, & Coldwell, 2008).

One way of increasing collaboration, and the probability of success with student online teams, is to look at the relationship of personality type and team performance (Hewson & Hughes, 2005; Kline & O'Grady, 2009; McInnerney & Roberts, 2004). The findings have not been consistent (Barry & Stewart, 1997; Kline, 1999; Taggar, 2000; van Vianen & de Dreu, 2001; Yeatts & Hyten, 1998). Team performance and personality have been shown to be related in some studies (MacDonnell, O'Neill, Kline, & Hambley, 2009; Potter & Balthazard, 2002; Straus, 1996; Topi, Valacich, & Roe, 2002) and inconclusive in

• **Joel Olson**, PhD, Purdue University Global. E-mail: jolson@purdueglobal.edu

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others (Beise, Carte, Vician, & Chidambaram, 2010; Chantal, Beatrice & Peoll, 2010; Driskell, Hogan, & Salas, 1998; Faizuniah & Chan, 2014; Hackman & Morris, 1975; Moreland & Levine, 1992; Rutti, Ramsey, & Li, 2012).

A previous study by this group with the same sample reviewed the relationship between personality and virtual team performance (Olson, Ringhand, Kalinsky, & Ziegler, 2015). The study did not indicate that personality was a factor in team performance. No personality type or any combination of personality types, resulting in either heterogeneous or homogeneous teams, had a statistical impact on performance. There did appear to be a statistical difference with personality type and performance of increasingly complex tasks, which resulted in this follow-up study.

Task complexity may open a window to better understand the relationship between personality type and team performance. Not all tasks are the same and some personality types may be better suited to one level of task complexity than another. Additional research exploring this relationship could lead to an increased understanding of virtual team performance. Virtual teams could then be paired by personality type and task complexity to increase performance.

LITERATURE REVIEW

Task Definition and Characteristics

While tasks are a critical part of the human experience, there has not been consensus of its definition or characteristics (Hackman, 1969). Task characteristics can include task type, time to complete tasks, and who is assigned the task (Hackman & Oldham, 1976). Early research by Hackman (1968) and later by Hackman and Oldham (1976) defined task types characterized by production, discussion, and problem-Solving (Hackman, 1968). Production was defined as the development of ideas, discussion as the identification of values that result in-group consensus, and problem solving as working to find a solution within a set of specified parameters.

Researchers have also classified tasks using multiple methods and characteristics. Bolt, Killough, and Koh (2001) considered task complexity when evaluating the relationship between performance and self-efficacy. Mohammed, Mathieu, and Bartlett (2002) included leadership when considering task type. Zigurs and Buckland (1998) used the McGrath (1984) Circumplex and classified tasks as behavior descriptions, ability requirements, task materials, and behavioral requirements. Liu and Li (2012) classified task types according to goals of input and output, process, time, and presentation. Liu and Li also reported that tasks could be measured subjectively and objectively depending on the goal of the task and output. Pieschl (2012) considered Bloom's taxonomy and suggested that task characteristics could be: remember, understand, apply, analyze, and evaluate. Salimi, (2012) also indicated that tasks can be characterized by complexity, condition, difficulty, resources, and participant ability. Technology has also complicated task complexity by solving some problems and creating new ones (Rescher, 1998). Slear, Reames, Susan, Maggard, and Connelly (2016) have done some work related to the impact of technology on tasks by identifying a connection between task clarity, task complexity, and task control in distance education.

Task Complexity

The literature abounds in models and definitions of task complexity. There are three approaches: structural, resource requirements, and interaction (Liu & Li, 2012). The structural approach has been constructed around task structure, the number, and relationship of elements involved in a task. Several researchers (Campbell, 1988; Ham, Park, & Jung, 2012; Liu & Li, 2012; Wood, 1986; Zigurs & Buckland, 1998) have used Bonner (1994) to link task complexity to task structure.

The resource requirement approach (Liu & Li, 2012) views task complexity in terms of resource requirements such as human information processing and cognitive demands. Liu and Li (2012) linked Braarud (2001), Wickens and McCarley (2008), and Park (2009) to this approach. Li and Wieringa (2000) emphasized physical and mental demand requirements, Bettman, Johnson, and Payne (1990) emphasized cognitive efforts, and Jacko, Salvend, and Koubeck (1995) emphasized short-term memory requirements.

Liu and Li (2012) also identified an interaction approach to task complexity. Prior knowledge and experience interact with the task. Complexity is then contingent upon the person doing the task (Gonzalez, Vanyukov, & Martin, 2005). The interaction between the person and the task can involve seeking information, understanding information requirements, uncertainty, and process (Bystrom & Jarvelin, 1995). Other researchers have understood task complexity it terms of the interaction of task components (Funke, 2010).

Task Measures

Once task characteristics have been defined and identified, task complexity can be measured. Mascha and Miller (2010) evaluated tasks using cues to determine if the task can be considered simple or difficult. If information has already been provided, the task can be determined as simple. If information is not provided, the task will be more difficult. Tasks are most often measured by difficulty and ranked from high to low (Bolt et al., 2001; Convertino, 2008; Hackman, 1968; Jacques, Garger, Brown, & Deale, 2009; Mascha & Miller, 2010; Piescahl, 2012).

Online Personality and Teams

Team effectiveness and personality have been linked (Barrick, Stewart, Neubert, & Mount, 1998; Brandstatter & Farhofer, 1997;Driskell, Hogan, & Salas, 1998; Hackman & Morris, 1975; Moreland & Levine, 1992; de Jong, Bouhuys, & Barnhoorn, 1999; O'Neil & Kline, 2008). Irani, Telg, Scherler, and Harrington (2003), found that individual personality differences may play a role in distance education students' course performance as well as how they perceive their learning experience. Tseng, Ku, Wang, and Sun (2009) suggested that personality recognition is a key factor in online collaboration and teamwork satisfaction.

Insights Discovery (ID)

ID is based on the personality type theory of Jung (1921). Jung suggested that a component of rational personality (cognitive processes) is the result of interaction between two attitudes (extroversion and introversion) and two functions (thinking and feeling). Attitudes are fundamental orientations, which shape the individual's experience and cognitive process. For example, in the extraverted attitude, external factors are the chief motivating force for judgments, perceptions, feelings, and actions. The external world of activities, things, and people are preferred. See Figure 1.

The psychological nature of introversion is the opposite, with a preference of internal or subjective factors. Introverts are characterized by a preferred orientation that highlights the internal world. This world includes thoughts, feelings, fantasies, and dreams (A. Drummond, personal communication, November 23, 2014).

Functions are also fundamental in individual experience and cognitive process. Thinking features the utilization of rational processes to link conceptually elements of both internal and external experience. Thinking is essentially impersonal and is an objective mental process of interpreting perceptions. Its goal is objective truth, independent of the personality and wishes of another person. Thinkers are at their best with the impersonal and they are most able to handle things that need to be done impersonally (A. Drummond,

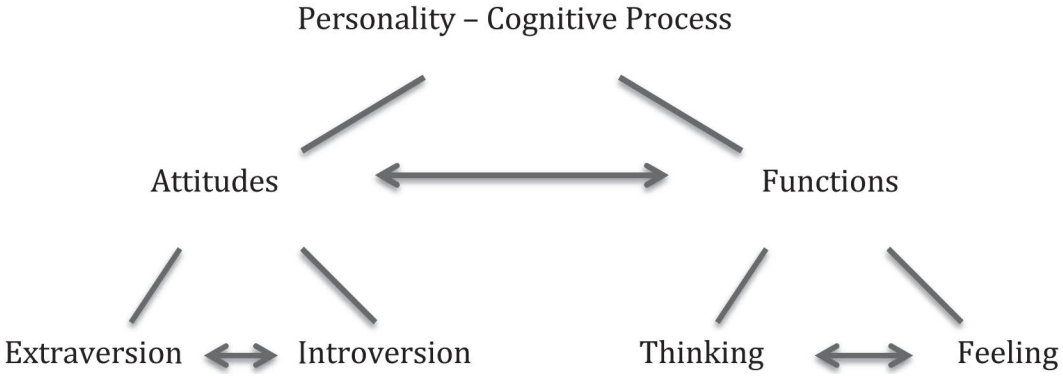

FIGURE 1
Jungian Personality (1921)

personal communication, November 23, 2014).

Feeling, while also a rational cognitive process, is much more personal and occurs on a heart level. Feelers evaluate on the basis of reflection. They use a subjective process that may be independent of external stimuli. As a cognitive process, it often serves as a filter for information that matches what is valued and wanted (A. Drummond, personal communication, November 23, 2014).

These attitudes and functions interact to create "attitudinal functions," and it is these interactions that create personality types (e.g., orientations to extraversion and thinking combine to create the "extraverted thinking" type). These personality types represent differences in cognitive process. ID presents this balance in terms of four colors. The colors are used entirely for ease of use and recall in learning and development environments where people struggle to remember attitudinal functions. The colors are summarized in Figure 2 (Insights, 2014). A sample ID Report can be reviewed at this site: http://hrc.co.in/wp-content/uploads/2013/06/Sample-Insights-Discovery.pdf

ID is widely used in private, nonprofit, and government organizations. ID has offices in 12 African countries, 26 European countries, eight Asian countries, and seven offices in the United States and Canada (https://www.insights.com/us/develop-your-business-using-insights-discovery/). Four million people have used ID, including employees of leading organizations (e.g., Expedia, LinkedIn, Microsoft, Philips, Allergan, AstraZeneca, and Technip) (https://www.insights.com/us/case-studies/).

ID has been registered by the British Psychological Society (BPS) and tested by their testing center (PTC). The British Psychological Society test registration is based on the European Federation of Psychologists Association's Review Model for the Description and Evaluation of tests. A test receives the British Psychological Society Certificate of Test Registration if it meets European Federation of Psychologists' Associations standards for validity, reliability, and norms. The European Federation of Psychologists' Association is used across Europe to support and encourage the harmonizing of European tests (http://ptc.bps.org.uk/test-registration-test-reviews). Test summary reviews are available (http://ptc.bps.org.uk/test-registration-test-reviews). The ID has also been presented at the 11th European Congress of Psychology.

Figure 2 gives an overview of the ID four personality types, and Figures 3 and 4 illustrate the relationship of ID type/color and cognitive process. In Figure 3, the ID attitudes (Extroversion/Introversion) are identified with the ID left/right circle halves, with Blue and Green as

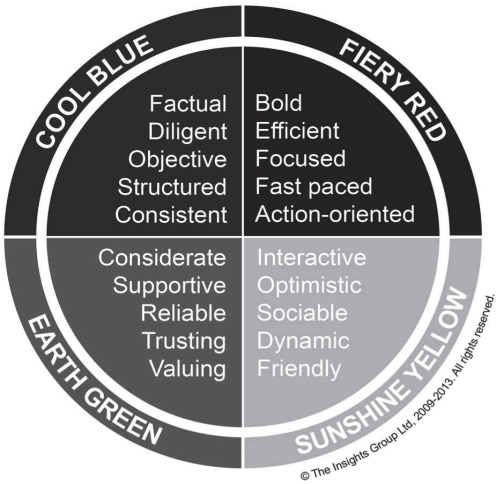

FIGURE 2
ID Four Personality Types

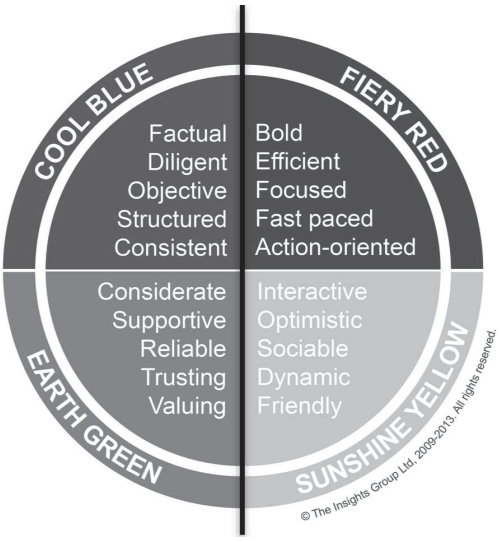

FIGURE 3
Linking ID Attitude to Cognitive Process
(Extroversion/Introversion)

the introverted cognitive process and Red and Yellow as the extroverted cognitive process. In Figure 4, the ID functions (Thinking/Feeling) are identified with the ID upper/lower circle halves, with Blue and Red as the thinking cognitive process and Green and Yellow as the feeling cognitive process.

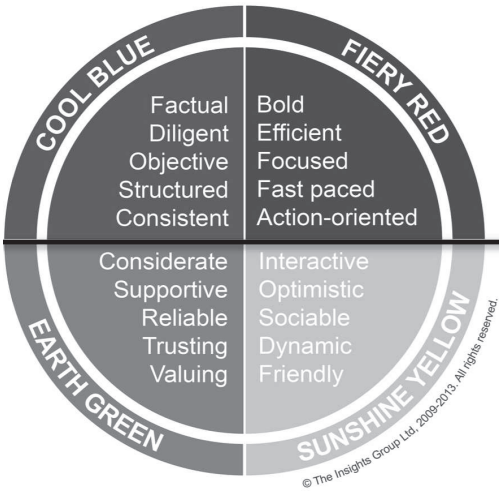

FIGURE 4
Linking ID Function to Cognitive Process
(Thinking/Feeling)

Personality Type Bias and Team Performance on Complex Tasks

Bias can impact team performance (Convertino, 2008). A review of the research indicates that groups that are similar or homogeneous share common beliefs and are therefore more biased, while groups that have a diverse composition are less biased. Groups that are not homogeneous tend to perform at a higher level. However, increased diversity could also reduce team performance if there was insufficient time to build common ground (Convertino, 2008).

This bias could be related to group process (Kerr & Tindale, 2004). Views from the minority are less likely to be considered, even when the view is critical. Gigone and Hastier (1996) referred to this phenomenon as a common knowledge effect. Biases prevent teams from the benefit of different skills and knowledge. When increased diversity leads to increased shared perspective and knowledge,

teams can improve their performance (van Knippenberg & Schippers, 2007).

RESEARCH METHOD

Hypotheses

H1: Teams dominated by Extroverts (ID Fiery Red and Sunshine Yellow) tend to outperform teams dominated with Introverts (ID Cool Blue and Earth Green) on complex tasks.

H2: Teams dominated by Thinking members (ID Fiery Red and Cool Blue) tend to outperform teams dominated by Feeling members (ID Earth Green and Sunshine Yellow) on complex tasks.

H3: Teams dominated by Fiery Red ID types tend to outperform teams dominated by Sunshine Yellow ID, Earth Green ID, or Cool Blue ID on complex tasks.

H4: Teams with a lower bias (Variable teams with all four ID types) tend to outperform teams with a higher bias (teams with one Dominant ID type) with complex tasks.

Research Approach

The study used a general mixed method linking qualitative and quantitative methods. Each researcher received training in understanding ID. Qualitative data were collected as researchers were paired to assess student ID types and categorized student teams as Dominant or Variable (Table 2). ID types and team categorization did not proceed until there was full consensus. In the event consensus could not be reached, a research group member who was ID certified served as the final arbitrator. Those student teams that did not have a complete clear record of ID types for each student were excluded from the study. Quantitative data were collected from the numerical scores of student team assignments, which were then reviewed descriptively by *t* tests and ANOVA.

Measuring the Operationalization of Complexity

This study framed task complexity from the Bonner structural perspective. Bonner (1994) utilized a task model involving input, processing, and output. Twenty factors are then included and organized by information and clarity of information for each of the task model components of output, processing, and output (see Figure 5).

The study involved three tasks of varying complexity. In Week 1, each team wrote a 600-word memo describing each member, using their ID type and previous work experience to introduce the team to the class. The memo addressed team challenges and strengths (see Appendix A).

In Week 5, each team completed the course Market Simulation that ran in each of the previous weeks. In addition to completing the last Market Simulation Unit, in Week 5 teams were ranked with a Cumulative Balanced Scorecard based on their team performance, including the Market Simulation variables of total demand, stocks out, emergency loan, bankruptcy, net income, ending cash flow, retained earnings, and balanced scorecard (see Appendix B).

In Week 6, each team prepared a 16-slide PowerPoint presentation. The presentation addressed appropriate next steps for their simulated business at the end of the simulation. The presentation analyzed the previous four quarters (each week was identified as a business quarter) and completed a tactical plan, pro forma financial statements, and business plan through the 6th quarter (see Appendix C).

Based on the Bonner Task Complexity Model, Week 5 (ranked 3) was the most complex, followed by the Week 6 assignment, with the Week 1 assignment (ranked 1) being the least complex (see Table 1).

Task Complexity	Input	Amount	Number of Alternatives Number of Cues Cue Redundancy
		Clarity	Cue Specification Cue Measurement Match Between Presented Cues Presentation Format
	Processing	Amount	Number of Alternatives Number of Cues Number of Procedures
		Clarity	Procedure Specification Procedure Interdependence Sign of Input-Output Relations Magnitude of Input-Output Relations Cue Consistency Functional Form of Process
	Output	Amount	Number of Goals Number of Solutions
		Clarity	Goal Specification Presence of Criteria for Testing Solutions

Source: Bonner (1994).

FIGURE 5
Bonner's Model of Task Complexity

TABLE 1
Assignment Task Complexity Ranking

		Unit 1 Task Memo	*Unit 6 Task PowerPoint (PPT)*	*Unit 5 Task Market Simulation*
Input	Amount	1	2	3
	Clarity	1	2	3
Process	Amount	1	2	3
	Clarity	1	2	3
Output	Amount	1	2	3
	Clarity	1	2	3

Source: Bonner (1994 p. 215).

Measuring the Operationalization of Team Composition in Terms of Personality

Nominal data were utilized to categorize teams. Teams where the majority of team members had one ID type were categorized as Dominant. Those teams where there was at least one team member from each ID type where categorized as Variable. As a result, Variable teams were the most heterogeneous with the lowest bias (see Table 2).

Sample

The sample for this study consisted of students from the initial course of an MBA program course at a proprietary university. The initial sample included 71 classes and 1,800 student-learning teams. The sample was delimited

TABLE 2
Team Personality Types and Bias Definition

Team Type	*Definition*	*Bias*
Dominant	50% of members with the same personality; all other personalities at less than 50%	High
Variable	All personalities were present	Low

Source: Olson et al. (2015).

TABLE 3
Extroversion (Red/Yellow ID) Compared To Introversion (Blue/Green ID) Team Personality by Task

	Task #1 (Memo)		*Task #2 (Mkt Sim)*		*Task #3 (Team PPT)*	
	Extra Version	*Intro Version*	*Extra Version*	*Intro Version*	*Extra Version*	*Intro Version*
Mean team scores	93.06	92.53	92.55	89.83	91.19	91.71
Variance	38.29	59.92	36.76	27.28	41.94	32.98
Observations	27	57	27	57	27	57
Pooled variance	53.06		30.29		35.82	
df	82		82		82	
$P(T <= t)$ one-tail	0.378		0.019		0.355	

by only including teams that met the following criteria: (a) 4–6 students on the team, (b) all team members completing the course, and (c) all team members providing accurate ID type classification. These delimitations reduced the final sample size to 138 learning teams.

Performance

Faculty grades were used to assess performance. Scores were grouped by assignment based on the level of task complexity and compared for difference by personality type. Dominant and variable team performance was compared by assignment task complexity.

RESULTS

Hypothesis 1

H1: Teams dominated by Extroverts (ID Fiery Red and Sunshine Yellow) tend to outperform teams dominated with Introverts (ID Cool Blue and Earth Green) on complex tasks.

As shown in Table 3, the "*t* Test: Two Sample Assuming Equal Variance" procedure was used to evaluate hypothesis 1. No statistically significant difference was found in comparing team scores for tasks #1 (Team Memo) and #3 (Team Presentation). However, a statistically significant difference was found in comparing team scores for task #2 (Market Simulation) at a 95% confidence level. Teams where the majority of members had an Attitude of Extroversion outperformed teams where the majority of members had an Attitude of Introversion. Hypothesis $H1_0$ is not supported for the less complex Tasks #1 and #3, but is supported for the more complex Task #2 at the 95% confidence level.

Hypothesis 2

H2: Teams dominated by Thinking members (ID Fiery Red and Cool Blue) tend

TABLE 4
Thinking (Red/Blue ID) Compared To Feeling (Green/Yellow ID) Team, Personality by Task

	Task #1 (Memo)		*Task #2 (Mkt Sim)*		*Task #3 (Team PPT)*	
	Thinking	*Feeling*	*Thinking*	*Feeling*	*Thinking*	*Feeling*
Mean team scores	92.72	92.66	90.63	90.88	91.71	91.15
Variance	48.89	63.35	32.80	29.82	32.88	42.92
Observations	59	25	59	25	59	25
Pooled variance	53.125		31.930		35.817	
df	82		82		82	
$P(T <= t)$ one-tail	0.486		0.426		0.347	
$P(T <= t)$ two-tail	0.972		0.853		0.693	

to outperform teams dominated by Feeling members (ID Earth Green and Sunshine Yellow) on complex tasks.

The "*t* Test: Two Sample Assuming Equal Variance" procedure was again used to evaluate hypotheses $H2_0$. Table 4 shows that no statistically significant difference was found in comparing each set of task scores. Hypothesis $H2_0$ is not supported for any of the three tasks.

Hypothesis 3

H3: Teams dominated by Fiery Red ID types tend to outperform teams dominated by Sunshine Yellow ID, Earth Green ID, or Cool Blue ID on complex tasks.

To assess $H3_0$, a one-way analysis of variance (ANOVA) procedure was applied to each set of task scores. There was no statistically significant difference between any of the personality styles for any of the tasks (see Tables 5a, 5b, 5c, and the summary in Table 5d). Hypothesis $H3_0$ is not supported for any of the three tasks.

Hypothesis 4

H4: Teams with a lower bias (Variable teams with all four ID types) tend to outperform teams with a higher bias (teams with one Dominant ID type) with complex tasks.

The "*t* Test: Two Sample Assuming Equal Variance" procedure was also used to evaluate hypotheses $H4_0$. Table 6 shows that no statistically significant difference was found in comparing each set of task scores at the two-tail p-value level. There was no statistically significant difference in team performance between teams with lower bias (teams with all four personality type) and teams with higher bias (teams with one dominant personality type).

However, teams with higher bias (teams with one dominant personality type) outperformed teams with lower bias (teams with all four personality types) on Task #2 (Market Simulation) using a one-tail *p* value ($p = 0.037$). Hypothesis $H4_0$ is not supported for Tasks #1 and #3, but it is supported for Task #2 using a one-tail test of significance.

DISCUSSION

A previous study by this group examined the relationship between virtual team performance and ID personality type. The findings did not indicate a relationship between virtual team performance and ID personality type (Olsen et al., 2015). There was no statistically significant difference in the performance of any per-

TABLE 5A
ANOVA: Comparison of Personality Type Using Task #1 (Team Memo) Scores

Personality Type	*Count*	*Sum*	*Mean Team Scores*	*Variance*
Red	20	1,853.58	92.67	38.269
Blue	39	3,616.85	92.73	55.488
Green	18	1,657.38	92.07	73.042
Yellow	7	659.08	94.15	42.834

Team Performance	*Sum of Squares*	*df*	*Mean Square*	*F*	*Significance*
Between groups	21.867	3	7.289	0.135	0.939
Within groups	4,334.409	80	54.180		

TABLE 5B
ANOVA: Comparison of Personality Type Using Task #2 (Market Simulation) Scores

Personality Type	*Count*	*Sum*	*Mean Team Scores*	*Variance*
Red	20	1,862.93	93.15	39.326
Blue	39	3,484.11	89.36	25.351
Green	18	1,636.03	90.89	31.448
Yellow	7	635.944	90.85	30.184

Team Performance	*Sum of Squares*	*df*	*Mean Square*	*F*	*Significance*
Between groups	193.086	3	64.363	2.122	0.104
Within groups	2,426.270	80	30.328		

TABLE 5C
ANOVA: Comparison of Personality Type Using Task #3 (Team PowerPoint) Scores

Personality Type	*Count*	*Sum*	*Mean Team Scores*	*Variance*
Red	20	1,854.30	92.71	31.994
Blue	39	3,556.65	91.19	33.384
Green	18	1,670.84	92.82	32.111
Yellow	7	607.805	86.82	50.490

Team Performance	*Sum of Squares*	*df*	*Mean Square*	*F*	*Significance*
Between groups	217.276	3	72.425	2.126	0.103
Within groups	2,725.313	80	34.066		

sonality ID type, or grouping of ID personality types on virtual team performance. Further, there was no statistically significant difference based on ID personality type bias. That is, heterogeneous teams and homogenous teams demonstrated no significant difference in team performance. However, while completing this study, the research group did notice differences in ID personality type team performance related to task complexity. This study was

TABLE 5D
Summary of ANOVA on Team Scores for Task Type

Team Performance	*Sum of Squares*	*df*	*Mean Square*	*F*	*Significance*
Task #1 (Memo)					
Between Groups	21.867	3	7.289	0.135	0.939
Within Groups	4,334.409	80	54.180		
Task #2 (Market Simulation)					
Between Groups	193.086	3	64.363	2.122	0.104
Within Groups	2,426.270	80	30.328		
Task #3 (Team PowerPoint)					
Between Groups	217.276	3	72.425	2.126	0.103
Within Groups	2,725.313	80	34.066		

TABLE 6
Lower Bias Compared to Higher Bias Team Personality by Task

	Task #1 (Memo)		*Task #2 (Mkt Sim)*		*Task #3 (Team PPT)*	
	Lower Bias	*Higher Bias*	*Lower Bias*	*Higher Bias*	*Lower Bias*	*Higher Bias*
Mean team scores	90.90	92.70	88.03	90.70	90.80	91.54
Variance	32.01	52.49	53.91	31.56	59.85	35.45
Observations	20	84	20	84	20	84
Pooled variance	48.671		35.723		39.997	
df	102		102		102	
$P(T <= t)$ one-tail	0.151		0.037		0.318	
$P(T <= t)$ two-tail	0.301		0.075		0.636	

completed to investigate the relationship of task complexity, ID personality type, attitudinal preferences of extroversion/introversion and functional preferences of thinking/feeling to virtual team performance.

These subsequent findings suggest that personality types with the attitude of extroversion will do better on complex tasks than personality types with the attitude of introversion. Biased teams (teams with 50% or more of the team consisting of one personality type) also were more effective with complex tasks than unbiased teams. However, personality types with the function of thinking or feeling showed no performance difference related to task complexity and there was no variation in the performance of complex tasks related to any one personality type. Each personality type did equally as well with complex tasks.

One would expect that the lean virtual environment would favor teams with the attitude of introversion, given the restrictions of the communication medium for extroverted interaction; however, the study indicated that teams with the attitude of extroversion did better with complex tasks than teams with the attitude of introversion. Perhaps the extroverted team members mitigated the increased potential for withdrawal in a virtual environment with their preference for the external world of things, people, and activities. Extroverts worked against the potential isolation of virtual communication mediums, which increased their performance compared to introverted teams

that may have followed the isolating flow of the communication medium. Teams with a dominance of introverted team members were reinforced in their preferences for the internal world by communication mediums that supported that preference and may have avoided interaction, the result being reduced interaction and diminished performance on complex tasks. Workman, Kahnweiler, and Bommer, (2003) did observe that team members preferring group interaction demonstrated more commitment to virtual teamwork.

One would also expect unbiased teams would perform better on complex tasks than biased teams, given the additional perspective and processing; however, this was not substantiated by the study. Time pressure could have been a mitigating factor. Each team had one week to complete each assignment. Teams with a similar personality type and approach in its attitudes and functions could be more time-efficient, resulting in better performance with complex tasks. Unbiased teams may not have had sufficient time to take advantage of their diversity.

Task complexity may open new windows of understanding related to the impact of personality on performance. Some researchers have suggested that personality could be demonstrated to be a factor in virtual team performance (Barrick et al., 1998; Brandstatter & Farhofer, 1997; de Jong et al., 1999; Hackman & Morris, 1975; Moreland & Levine, 1992; O'Neil & Kline, 2008), while other researchers have suggested that there is no correlation between team effectiveness and personality (Beise et al., 2010; Chantal et al., 2010; Faizuniah & Chan, 2014; Hackman & Morris, 1975; Moreland & Levine, 1992; Rutti et al., 2012). Like these researchers, our initial study did not suggest a relationship between personality type and performance; however, the subsequent study did suggest a relationship between task complexity and personality. The frame of task complexity may explain these varying results related to personality and team performance.

Some researchers have reported no clear relationship between the attitudes of extroversion and functions of thinking/feeling and team performance (Kim, Lee, Lee, Huang, & Makany, 2011; Liu & Li, 2012). Like Hayes and Allison (1998), this study pointed toward a relationship of attitudes and functions with team performance. While this study did not indicate a relationship between the functions of thinking/feeling with team performance, there was some performance difference on complex tasks related to the attitudes of extroversion/introversion. Hayes and Allison (1998) linked the functions of thinking/feeling to differentiation of global and local thinking. Individuals using local functions prefer data (facts), while individuals using global functions prefer using knowledge (meaning). This study did indicate a difference between attitudes and functions related to the performance of complex tasks; however, the difference was not with the functions of thinking/feeling. The difference was with the attitudes of extroversion/introversion.

Our previous study did not find any performance difference between biased and unbiased groups (reference redacted for peer review), which did not support Convertino's (2008) findings suggesting a relationship between bias (diversity of personality type) and virtual team performance. This study did indicate a correlation based on task complexity between personality type, team bias, and performance; however, the findings did not support Convertino's (2008) findings. Instead of bias (homogeneity) leading to decreased performance, in this study bias led to increased performance on complex tasks. While bias did affect the performance of complex tasks, it was the high-bias homogenous teams that outperformed the low-bias heterogeneous teams on complex tasks. Diversity appeared to be a detriment. The study did not assess the decision-making of homogeneous groups (Gigone & Hastier, 1996; Tolcott, Marvin, & Lehner, 1989; van Knippenberg & Schippers, 2007) or the bias of group processing in homogeneous groups (Kerr & Tindale, 2004), the study could only

report that increased bias led to increased performance with complex tasks.

RECOMMENDATIONS

So how should professors assign teams to position them for success? This study would suggest that time pressure and task complexity drive team assignments. When teams have very short time horizons, biased teams would likely outperform unbiased teams. With complex tasks, teams with a dominance of extroverted members would likely outperform teams with a dominance of introverted members. While ID personality type is a factor in team performance, it needs to be intentionally linked to task complexity and time pressure. The leading independent variables are bias and the attitude of extroversion/introversion. ID personality type does not appear to be a factor.

In online environments, by observing student behavior through introduction and discussion board threads, professors could make some assessments related to student attitude (extroverted/introverted), function (thinking/feeling), and ID personality type. When making team assignments, those assessments could then be paired with task complexity and time pressure to position teams for success. Wade, Cameron, Morgan, and Williams (2016) conclude that understanding how to best work with others toward a common goal and how to structure group work in online educational settings are critical components in developing students who are competitive in today's workplace market.

LIMITATIONS

The study may have been improved if either the resource or interaction approach to task complexity had been used instead of the structural approach used in the study. This study used a structural frame to assess task complexity with an emphasis on the task itself, and the number and kind of elements involved in a task (Bonner, 1994; Campbell, 1988; Ham et al., 2012; Wood, 1986; Zigurs & Buckland, 1998). The resource and interaction approach may have given more pronounced differences with the performance of complex tasks given their emphasis on the human resource requirements and processes for a task.

The resource approach categorizes task complexity by the human resources needed to complete the task, human resources such as information processing and cognitive processes. The interaction approach also centers on the person doing the task, but the emphasis is on interaction instead of human resources (Braarud, 2001; Bettman et al, 1990; Jacko et al., 1995; Li & Wieringa, 2000; Park, 2009; Wickens & McCarley, 2008). The interaction approach does not focus on the human resource requirements related to experience, knowledge, and training, but focuses on human resource requirements related to interaction. Not what is known, but how knowledge emerges through interaction (Bystrom & Jarvelin, 1995; Gonzales et al., 2005). Both the resource and interaction approaches to task complexity would link more closely to the independent variable of personality type with its attitudes of extroversion/introversion and functions of thinking/feeling than the structure approach used in the study.

As always, improved sampling would have been beneficial. While the sample was taken over a 2-year period, the sample was taken from one course early in an online propriety MBA program. A strengthened sample would have included a class toward the end of the MBA program. Technology adaptation is a factor that should be considered in an early online course that could be mitigated with a course added to the sample toward the end of the MBA.

Although the ID describes 64 personality types, this study was limited to the four that subjects self-disclosed in a team assignment used in the study. The full strength of the ID was not put into play, which may have yielded more granular findings. Using only four of the 64 types may have masked differences between personality types.

Grade inflation may have also been a limitation and should be addressed in subsequent similar studies. The initial study did not indicate performance difference, partly because so many students were given an A. There was not sufficient grade variation to indicate difference. This study did find difference in the context of grade inflation on the criteria of task complexity. While this did have value, grade inflation may have hidden more significant differences.

Time pressure is also a variable of importance that should be included in subsequent studies. ID types, their attitudes, functions and degree of bias could perform differently based on time pressure. Bias simplifies team processes, which would be beneficial in time urgent situations. Unbiased teams will likely require more time to capitalize on the additional perspectives and approaches represented by different ID types, attitudes, and functions. This would have value to help online groups develop the time management skills required for professional workforce settings (Morgan, Williams, Cameron, & Wade, 2014).

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APPENDIX A

Week 1: Team Memo Assignment

Taken directly from the proprietary online MBA course used in the study.

Team Memo for 30 points

Use your Team Discussion Board to introduce each team member and to exchange information about particular strengths, fields of study, and work experience. Your Team Discussion Board can be accessed from the Team Area Unit (below Unit 6).

Your team should then collaboratively pull this information together into a memo addressed to the instructor and the class (approximately 500–600 words), introducing your team and reviewing your team strengths and challenges. Include an assessment of your team style using Insights information. Post the memo to the main threaded discussion titled Team Memo Discussion.

Use this area to post the completed memo with all of your team information. Make sure to include team introductions, team strengths and challenges, and an assessment of your team style by using the Insights information.

To the left is an image of an Insights Wheel. You may find the Insights Wheel helpful for creating effective teams throughout your graduate program. Click here for a downloadable copy of the Insights Wheel.

Team assignment information is available on the Main Threaded Discussion in Unit 2 labeled Team Discussion, and your team has a private Team Threaded Discussion area under Team Area. You will use this team throughout the course and this private area for other collaborations.

Make sure to post the completed memo to the Unit 2 Team Discussion Thread by Sunday evening.

Team Tools:

- Your team also has a team-specific area in Doc Sharing, an email group list, and a private synchronous chat area, if you choose to use them.
- Teams sometimes use an instant-messaging service, such as AIM or chat.
- Part of your simulation grade is based on team participation. Setting up a specific time each week to check in may be helpful.

The final grade was determined by how well the Team Memo met the grading criteria and individual participation in the team assignment based on Team DB posts.

APPENDIX B

Week 5

Taken directly from the proprietary online MBA course used in the study. The Marketplace Simulation used in the course is from Marketplace Live, http://www.marketplace-simulation.com/. The following Marketplace Simulation Student Instructions and Executive briefings are taken from the course and provided by Marketplace Live.

The Week 5 Team Project is the completion of a Market Simulation that runs throughout the term. The Simulation has 4 quarters. The team's final performance at the end of Week 5 in the fourth quarter determines the team score for this assignment. Each individual's Week 5 Team Project score is based on peer evaluations and the team's success in the business simulation. At the end of simulation there is a "Cumulative Balanced Scorecard" for each team based on their simulation performance (Total Demand, Stock Outs, Emergency Loan, Bankruptcy, Net Income, Ending Cash Flow, Retained Earnings, Balanced Scorecard). Points for the team project are awarded by ranked finish. The team with the highest Cumulative Balanced Scorecard is awarded 75 points, second 68, third, 64, and fourth 60. 75 points are also awarded for involvement based on peer reviews and time logged into the simulation. A perfect score would be 150 points.

What follows are the student directions. The Executive Briefings are the directions that the faculty member provides for each learner group at the start of the quarter.

Marketplace Simulation Student Instructions

Student sign up:

What you need: The Game ID and your "team" number from your professor. You are a team of one for this simulation. You will have an Advisory Board to work with. You will receive your student license number prior to beginning your Unit 2 assignments. The license number will be emailed to your student.kaplan.edu email address.

Executive Briefings With Students

In ground-based simulations, faculty meets with each student for a reflective briefing. It is important to incorporate this personal touch into our simulation experience. This personal touch is very rewarding. It is nice to see the students develop. You start to take a personal interest in each student, and the students love it.

Executive Briefing for Quarter 1

This is a very interesting quarter for the students. They have almost 2,000,000 in their pockets and a sense that anything is possible. And, they are right. However, they have to start making choices that will affect them for the rest of the exercise.

The most important decision the students have to make in Quarter 1 is their initial strategic direction. They will have several opportunities to change this direction, but there is a tendency to stay with their first strategy throughout the game.

There are many strategies that the students can formulate. Fortunately, most of them can be successful if pursued smartly and aggressively. Thus, the big worry is not which of the many directions to take, but the rationale for taking any direction. Have the students thought through their options and considered the major implications and tradeoffs of each choice? Do they have a vision for how their firm will successfully compete in the marketplace? Most of the major strategic choices are highlighted in the strategic direction area within the software.

During your Quarter 1 executive briefing, probe to make sure the students have considered the following factors in their decision:

1. Size of market for each market segment. Workhorse segment is the largest in terms of numbers. The Mercedes segment looks like a good size segment but this is deceiving because it is very difficult to satisfy their needs until the firm can offer several new R&D features in Quarter 5. The Traveler segment is moderate in size.
2. Profit potential of each market. Workhorse segment offers the greatest profit potential because it will typically result in large production runs, which drive down production cost, thus improving gross margins. The Mercedes would appear to have attractive profit margins, but the sales volumes are fairly small in the early quarters, thus production costs are very high. The Mercedes segment will not be profitable until new R&D goes on the market in Quarter 5 or later. The Traveler segment is also volume sensitive, but not as bad as Mercedes. This segment should be paired with a large volume segment in order to drive down production costs, thus improving gross margins.
3. Size of geographic markets. The largest markets will generate the largest amount of demand, all other things being equal.
4. Propensity of competitors to enter the market. The largest geographic markets and the Workhorse segment will attract the largest number of competitors. Since this is not hard for the students to forecast, some teams will avoid these markets. You might point out to these teams

that competition is not always bad. Each additional competitor brings more attention to the product category and can actually improve overall demand. To be the only competitor in a geographic market or segment, can be bad news. There is a threshold of marketing that must be done to generate interest in the product. One competitor may not be able to stimulate the market sufficiently to make a good profit.

5. Cost to enter the market. The biggest geographic markets will cost the most to enter, but they have the biggest market demand. The small markets might be cheap, but they may not bring in enough demand to drive production costs down to the point that it is profitable. Small markets can be profitable if added to large markets. The large markets are needed to bring production costs down.
6. Cost to compete. The high-end of the market (Mercedes and Travelers) are expensive to serve. They require more expensive components and R&D. The market will favor teams that can deliver superior performance. It will be unmerciful to those that try to get by with minimum technology.

Executive Briefing for Quarter 2

This will be the toughest quarter for the students. They have to make a lot of difficult decisions with very little information. The anxiety level should be at its peak. You need to be encouraging, cautious and demanding. Encourage the students to try different ideas, to experiment with different advertisements, prices, manufacturing settings. They can learn a great deal from the market.

Encourage the students to be cautious. The students should use Quarter 2 to learn what the market wants and then use this knowledge in Quarter 3 to more aggressively pursue their objectives. They should walk before they try to run. They will be much smarter in Quarter 3 than they are in Quarter 2. They will learn what customers really like and do not like. They will learn how to run a factory, how to coordinate a broad set of marketing tactics and how to project cash flows. They will discover what their competition is trying to do and be able to take advantage of their weaknesses and defend against their strengths.

Executive Briefing for Quarter 3

The focus this quarter is on skillful adjustment. Each team needs to carefully study the available data, determine what needs fixing and what has gone well for the firm. Spend time on the problem areas. Make sure they understand the cause of the problem and the options for improving the situation. They can learn a great deal from the market data. They should not hesitate to copy a good idea.

This quarter might require some morale building. Firms with sizeable emergency loans (over 500,000) and large negative losses (over 800,000 minus) might be down in the spirits. They need to be pumped up, not artificially but through better decisions. Help them see how they can improve. If they know exactly what the problem was (i.e., low brand judgment, few sales people, etc.), their demand and fortunes should improve.

Executive Briefing for Quarter 4

Activities and Guidelines on How to Review Tactical Plans and Pro Forma Statements for the Business Plan

Quarter 4 is the most difficult decision period for the teams. The teams must analyze the results of Quarter 3, make Quarter 4 decisions and prepare a detailed business plan. For this reason, the students should be given 2 weeks to complete Quarter 4 and prepare and present their business plan. They should have one week for Q4 and one week for the business plan.

Here is a suggested sequence of activities for Quarter 4 and the Business Plan.

1. The teams should analyze Quarter 3 results and complete Quarter 4 in the normal manner.
2. The teams should meet with you as the teams would normally regard Quarter 4 and their analysis and decisions.
3. Within a couple of days of completing Quarter 4, the teams should complete the tactical plan and pro forma financial statements through Quarter 6 and submit these to you for review. The tactical plan and pro formas can be reviewed within the team's software or on paper.
4. You should provide feedback on the quality of the planned tactics and pro forma projections. The revised tactical plan and the pro forma financial statements should be turned in with the business plan.
5. The teams should prepare the final Power Point presentation and submit it to you for review a couple of days before the final presentation.
6. You should provide feedback on the quality of the Power Point presentation.
7. The teams should practice the presentation and question and answer secession.
8. Each team is given 15 to 20 minutes to present and up to 20 minutes for Q and A.
9. Everyone on the team must participate in the presentation.

Executive Briefings for Quarter 5

Quarter 5 is a relatively quiet quarter for most teams. They have a plan and they are executing it. Most will feel good about the future and are feeling good about having worked through and presented a rather difficult business plan. Thus, there tends to be few serious problems at this time. They will show up in Quarter 6.

Expect one in eight firms to go bankrupt in Quarter 5. One in three will have emergency loans. Here are a few things to watch for that may cause emergency loans and bankruptcies in Quarter 6.

First, teams that have not done any R&D will face competitors with better brands. Unless they are competing on price with many distribution outlets, they will lose market share and will probably not make their forecasted numbers.

If a tam has no R&D in progress, I strongly suggest that they begin an R&D program or find someone from whom they can license technology for Quarter 6. Licensing is especially attractive for a team that is low on equity.

Second, there are aggressive teams out there developing their sales outlets. Very conservative teams will be surprised by the jump in demand for some of their competitors. Unless a firm is expanding sales outlets, it is falling behind the competition. You might push them on this point.

Third, the students will be introducing new brands into the market with new technology. There will be a tendency to drop the older brands in favor of the new ones. There is an opportunity here to use the older brands and compete on price and use the new brands to compete on value, at a higher price. If they only have high-priced brands, they will strangle their demand because their price image could be too high for the market. They need some balance. And, if they discontinue advertising for these older brands, they can save money and add to the margin or the ability to drop price. Effectively, they can take advantage of the loyalty built up over the prior quarters.

I like to advise teams to offer multiple brands to each segment. It is a good idea to have a good, better and best brand.

Quarter 6 Executive Briefing—Helping Weak Teams

Quarter 5 can be disastrous. One out of eight teams will have gone bankrupt in Quarter 5 and one in three may have emergency loans.

I would not worry too much about emergency loans. Most teams will recover from this minor setback. Bankruptcy is more serious.

Bankruptcy can occur among good teams because they have overspent on R&D, new

sales outlets and new factory capacity. However, these teams will most likely pull out of bankruptcy. Most of what they have done will create more demand which will drive down production costs and improve gross and net margins. As long as they do not become too timid in Quarter 6, they will do fine.

In the case of weak teams, they are typically surprised by the strong teams that have introduced brands with better R&D features, more advertising and more sales outlets. When strong competition is combined with a weak market, revenues will be down which will send profit margins deep into the red.

APPENDIX C

Week 6

Taken directly from the proprietary online MBA course used in the study.

Your final project involves preparing a Team PowerPoint presentation using your Simulation organization and focusing on where to go next with your organization at the end of Quarter 4 for 120 points. Points were allocated for the PPT, peer evaluations, plus engagement based on Team DB posts.

This PowerPoint presentation, with annotated notes, should be posted in the Final Team Project discussion area by Sunday evening.

For this assignment, use the following format to help organize your presentation:

Final Group Project Format

The key is to provide the future direction for your business based on the outcome of the Marketplace Simulation results from Quarter 4 and connect your strategy with the course concepts learned in GB500. As a group, lay the foundation in the beginning so your classmates understand your strategy for the simulation and then discuss where you believe your company should go from here. Within the slides, incorporate discussion in the Notes section that includes American Psychological Association citations and connections to specific course materials.

To organize the PowerPoint presentation, use the format below:

1. Title Slide—include the name of your business and each group members' names (1 slide);
2. Introduction slide—discuss the company you developed and the strategy that you decided upon in the first quarter (1 slide);
3. Current situation—discuss the state of your business after the fourth quarter decisions were made. What was the position of your company in relation to each of the business functions decided each week? (1–2 slides);
4. Analysis of What Doesn't Work—explain what your team learned from the simulation related to the decisions that were made and what you would change if you could do it again (1–2 slides);
5. Direction to take—based on your strategy and current situation after quarter four decisions, discuss what direction you believe your company should take in the future and why. Be sure to include all of the business functions decided each week in the simulation (6–10 slides);
    - Include details about what you will do with sales, marketing (price, promotion, distribution, product), expansion/growth, R&D, human resources (sales force, compensation, etc.), production, et cetera and how your suggestions will affect your bottom line.
    - Support your strategy with numbers when possible.
    - Further explain your bullet points in the notes section below the slide using APA citations to course materials.
6. Conclusion—wrap up your presentation with how you believe these changes and/or strategy will help make your business as successful as it can be (1 slide);
7. References—Include the full references cited within the presentation (1 slide).

Your PowerPoint presentation will likely be between 12–15 slides, give or take a few. Do not write in paragraph form on the slides. Remember that PPT presentations are bullet points, so be clear and concise as others do not get the benefit of your additional comments. In the Notes Section of the slides, be sure to expand your thoughts using American Psychological Association citations to reference the course materials. This is the area to explain further the bullet points.