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A Q factor analysis of college undergraduate students' study behaviors

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Abstract

This study attempted to better understand the study behaviors of undergraduate students by categorizing students into distinctive typologies based on their self-reported study behaviors through an exploratory approach -- Q factor analysis. A sample of 152 undergraduate students completed a survey instrument, the Study Behavior Inventory. The Q factor analysis yielded a two-factor structure. Participants exhibiting the first behavioral type demonstrated reflective, well-organized study behaviors and favored high-level thinking; thus were described as "Organized Holistic Learners". Those exhibiting the second behavioral type were found to manage time poorly and primarily focus on memorizing facts; thus were labeled "Disorganized Procrastinators". Type 1 students had significantly higher average GPAs than Type 2 students. Student type was a significant predictor of academic achievement, as measured by self-reported GPA above and beyond students' attribute variables including sex, age, major, and enrollment status. Theoretical and practical implications were discussed.

Keywords: study behaviours; self-regulated learning; Q factor analysis; academic achievement

Introduction

Even as more and more students enter colleges and universities in the United States, the number of students who are academically underprepared to do college-level work is increasing (National Center for Education Statistics, 2011b). This lack of readiness to achieve at the post-secondary level often leads to high rates of attrition (National Center for Education Statistics, 2011a). This is because students who are academically underprepared must do remedial work prior to taking program related, credit bearing courses and this increases their time to graduation. Undergraduates who have enrolled in college for long periods of time without receiving a degree are less likely to graduate than other students. It is, therefore, not surprising that the graduation rates of students at U.S. institutions of higher education are stagnating (National Center for Education Statistics, 2012).

Educators and educational researchers have tried to deal with this problem by looking at the factors that may facilitate student learning. One of the often-mentioned factors related to student achievement is the typical behaviors and habits students exhibit when they are studying (Bliss & Sandiford, 2004; Zimmerman, 1989).

Study behaviors are the specific actions that students take in order to reach learning goals (Jones, Slate, Perez, & Marini, 1996). Unlike study skills, study behaviors represent what students actually do when they are equipped with necessary skills (Bliss & Mueller, 1987, 1993). They require the knowledge of study skills, but more specifically focus on the actualization of these skills by students when they carry out academic tasks. Research has repeatedly demonstrated that the appropriate use of study behaviors positively impacts academic outcomes

in various areas (Kitsantas, Winsler, & Huie, 2008; Zimmerman & Kitsantas, 1999).

This study examined students' learning behaviors and practices through the lens of the social cognitive model of self-regulation theory.   In the following section, the authors clarify the notion of self-regulated learning theory and its influences on study behaviors, and then discuss the relationship of self-regulated learning and academic achievement. Finally, in order to determine whether students can be classified on the basis of their study behavioral profiles in order to make useful choices when choosing instructional strategies, Q factor analysis was employed as the data analysis technique. Q factor analysis is not widely utilized in the educational field, so we will briefly introduce its goals and features.

Self-regulation, study behaviors, and academic achievement

The social cognitive model of self-regulation theory (Bandura, 1997) has often been used to understand what individuals do as they perform academic tasks. Bandura (1986, 1997) proposed the idea that human functioning is influenced by the reciprocal interaction between person, behavior, and environment.   Based on this triadic relationship of human functioning, Bandura (1986) considered self-regulation as the complex processes individuals use in response to the reciprocal interaction of the person, the behavior, and the environment.   In academic settings, self-regulated learning (SRL) signifies the self-directive processes that learners use to regulate their cognitive, motivational, and behavioral endeavors in order to accomplish academic goals (Zimmerman, 2000a).

Numerous variables influence the nature of the learning process and its quality. Therefore, the social cognitive model of self-regulated learning includes multiple self-regulatory

dimensions – regulation of thinking, regulation of motivation, and regulation of behavior (Pintrich & Zusho, 2007). Research has consistently shown that self-regulated learners are likely to set internal and high-standard goals, plan and select appropriate strategies to complete the tasks based on the goals they set, monitor the progress they make, and adjust the strategies they use when necessary based on their personal beliefs (Kanfer, 1971; Pintrich, 2000; Pintrich & Zusho, 2007; Zimmerman, 2000a). Therefore, understanding students' personal beliefs is important as they determine the degree to which they are motivated to initiate and maintain regulation of their own thinking and behaviors (Bandura, 1997; Pintrich & Zusho, 2007).

One of the most useful concepts for capturing such personal beliefs is self-efficacy, also introduced by Bandura.   Self-efficacy is defined as "the belief in one's capabilities to organize and execute courses of action required to produce given attainments" (Bandura, 1977, p. 3). Academic self-efficacy describes what individuals feel they *can do* rather than what they *will do* in academic settings. It involves students' judgments and beliefs concerning their abilities to perform academic tasks (Bandura, 1997).   If students believe they have necessary capabilities to execute an academic task, they are most likely to motivate themselves to apply self-regulatory processes and behaviors in academic situations. Research has shown academic self-efficacy beliefs impact the academic tasks students choose and the types of goals they set for themselves before starting the tasks (Pajares, 2008; Schunk & Zimmerman, 2006), the strategies they execute (Pintrich & Zusho, 2007), the efforts students invest in working toward the goals they are pursuing and their persistence in the face of difficult tasks (Schraw, Crippen, & Hartley, 2006); and the adjustments they make as they proceed (Pajares, 1996; Schraw et al., 2006).

Academic self-efficacy beliefs that students hold help determine how they think and what they do with the knowledge they have and thus affect their academic performances. Literature has consistently suggested learners' self-efficacy perceptions and their use of self-regulatory processes are highly correlated with academic achievement in a broad range of settings (Bliss & Sandiford, 2004; Kitsantas, 2002; Schraw et al., 2006; Schunk & Zimmerman, 2006). Furthermore, academic self-efficacy beliefs predict academic performance independently of several exemplary predictors of performance such as cognitive ability and prior academic achievement (Bandura, 1997; Zimmerman, 2000b). Students with similar cognitive abilities or previous academic achievements have been found to differ significantly on academic performances due to the judgments and beliefs they have about their capabilities to perform a task and subsequent course of actions they take (J. L. Collins, 1982; Kitsantas, Winsler, and Huie, 2008; Zimmerman & Bandura, 1994).

Last but not the least, time and effort management is another typical self-regulatory behavior. Managing and regulating time usage requires students to allot and prioritize the time and effort they spend on various academic and non-academic activities based on their own needs and expectations (Ogonor & Nwadiani, 2006). Additionally, as they proceed in academic tasks, students may realize they are spending too much or too little of their effort and time, and therefore adjust the time and effort devoted to the tasks based on their goals. Self-regulated learners have shown to manage their time effectively (Ogonor & Nwadiani, 2006; Pintrich & Zusho, 2007) and adjust their time allocation actively when necessary (Zimmerman & Kitsantas, 1999).

A number of studies have supported the claim that effort and time management positively predict academic performance (Bliss & Sandiford, 2004; George, Dixon, Stansal, Gelb, & Pheri, 2008; Lahmers & Zulauf, 2001; Young, Klemz, & Murphy, 2003).   Effective time management for academic activities generally is positively related to students' performance and attitude with high achieving students being better at time planning and managing their time than average achieving students (Eilam & Aharon, 2003; Ogonor & Nwadiani, 2006).   By contrast, poor time management has been found to predict underachievement, academic failure and withdrawal (Balduf, 2009; Goldfinch & Hughes, 2007).

In conclusion, a large body of literature has shown the positive relationship between students' use of various self-regulatory learning behaviors and their academic performance (e.g., Yumusak, Sungur, & Cakiroglu, 2007; Zimmerman, 2001).   However, few studies have examined the key characteristics of the learning behaviors students do carry out that actually contribute to their academic performances. In order to do that, this study used a unique exploratory technique called Q factor analysis, attempting to categorize students based on their academic behavioral profiles and make predictions concerning academic achievement based on these categorizations.   The purpose of this study was to determine whether it was possible to produce a taxonomy composed of typologies (groups) of students based on their self-reported study behavioral profiles/patterns through Q factor analysis and, after that, to test the relationship between group membership and student academic achievement.

Overview of Q factor analysis

Q factor analysis (QFA) is an exploratory method that reveals a person's responses or

opinions on a given topic and the extent to which that person's responses are shared by other

individuals (McKeown & Thomas, 1988).   Individuals with a similar pattern of behaviors or

responses on an issue can be categorized into a typical group, also known as a typology of

subjects (McKeown & Thomas, 1988; Newman & Ramlo, 2010).   Equipped with Q analysis,

researchers are able to further compare various typologies of individuals in order to find out the

similarities and differences among behavior patterns displayed by distinct groups of people.

It is called Q in order to contrast it with R factor analysis, which refers to a generalization

of Pearson's *r*, mostly used in the study of relationships among distinct traits, such as academic

ability (Addams & Proops, 2000).   In traditional research using R analysis, researchers seek to

determine the relationship among variables represented by instrument items (McKeown &

Thomas, 1988).   In other words, R factor analysis generates patterns across particular variables.

By contrast, Q factor analysis is a method that enables researchers to categorize people based on

their patterns of responses and opinions on a particular phenomenon, in this case, study

behaviors (L. D. Brown, 1991). It establishes patterns across individuals; that is, the patterns are

generated from individuals' similar responses on items concerning their study behaviors

(Galayda, 2006).   Therefore, unlike R factor analysis, Q factor analysis groups people rather

than items (Newman & Ramlo, 2010).

Its capacity to help researchers systematically understand human subjectivity through

rigorous statistical analyses has made Q methodology useful in various disciplines such as

medicine, agriculture, public policy, marketing, and political science (e.g., Kerr, 2011; Mally,

2011; Sylvester, 2010; Ward, 2011; Zenor & Kinsey, 2011).   Q studies have been done to

explore typologies of behaviors in these fields, such as nurse caring behaviors (White, 2003), smoking behaviors (P. Collins, Maguire, & O'Dell, 2002), and seeking or rejecting counseling services behaviors (J. Smith, 2001).

In education, Q studies have examined individuals' views on various general educational topics, such as academic readiness (Coggins, 2011), teaching methods (Carpenter, 2012), academic misconduct (Wink, Henderson, Coe, & Read, 2012), learning epistemology (Ramlo, 2008), policy changes (Zhang, Satlykgylyjova, Almuhajiri, & Brown, 2012), and college choices (Thorman & Howard, 2011).

Q methodology is not a widely used strategy in the field of education field and until now only a few studies have used this approach to investigate behavior-related topics in education fields. For example, Johnson (2011) examined superintendents' behaviors and the role they may play in school district governance. Similarly, Q method was also used to by Poling (2009) to explore superintendents' leadership behaviors for Dynamic Indicators of Basic Early Literacy Skills (DIBELS) implementation.   Janson (2009) utilized Q technique to understand school counselors' leadership behaviors in a high school.   To our knowledge, no research has used the Q technique to explore typologies of study behaviors among college undergraduate students.

Research questions

The two research questions were:

1.   What are the typologies of undergraduate students that represent students' different patterns of study behaviors?

2.   Is there a relationship between the typologies and students' academic achievement as

measured by current GPA?

Method

Participants

In Q method, persons are considered the variables and, therefore, a large sample size and random sampling are not required in Q factor analysis (L. D. Brown, 1986; N. W., Smith, 2001). Q analysis typically involves small numbers of participants, and this is psychometrically acceptable because, in essence, it is an inductive and exploratory process rather than a deductive or predictive one (McKeown & Thomas, 1988). A sample with 30-50 participants is usually considered more than adequate mathematically (L. D. Brown, 1986; Wilson, 2002). Having said that, Newman and Ramlo (2010) suggested that if any part of a study will be using statistical analysis such as linear regression, a large sample would be very desirable in order to have satisfactory statistical power. A power analysis for achieving a power of .80 ($\alpha = .05$) on linear multiple regression indicated that a sample size of 103 is sufficient for a medium ($f = .15$) effect size.

A total sample of 152 undergraduate students volunteered to participate in this study. The participants were all enrolled in fall semester of 2010 at a large public southeastern university. The study included both female and male participants from diverse ethnic groups with a dominant portion in their late teens and early 20s.

Sixty three percent of the respondents were women and 37% were men. Participant ages ranged from 18 to 50 years old ($M = 23.93$, $SD = 4.89$). Participants were from a variety of disciplines including education, STEM (science, technology, engineering, and mathematics),

business, and several others (Table 1).   Four-fifths of the participants were enrolled at the

participating institution as full time students.

Table 1. Participant characteristics by major

Statistic	Major					
	Education	STEM	Business	Other	Unknown	Total
Frequency	72	47	22	10	1	152
Percentage	47.4%	30.9%	14.5%	6.6%	0.6%	100%

Instrumentation

The *Study Behavior Inventory* (SBI) developed by Bliss and Mueller (1993) was used to

gather data from students concerning their study behaviors.   The SBI is a 46-item self-report

instrument that measures study behaviors and habits of undergraduate students enrolled in

colleges and universities.   Participants respond to a series of statements on a 4-point scale

according to how often a specific statement applies to them.   The SBI is a well-established

measure that has been used for decades in a great many institutions of higher education. The

instrument has established good estimates of validity and reliability, with Cronbach's alpha

estimates for the three factors of the instrument ranging from .70 to .86 (Bliss & Mueller, 1993).

Another indication of the construct validity of the instrument is the high correlation found

between students' SBI scores and their grade point averages (Bliss & Mueller, 1993).

Self-reported current grade point averages were used to indicate students' academic

performance.   Data were collected about participants' sex, age, enrollment status, and the

degree programs they were pursuing.   Data about participants' races/ethnicities were not

collected because in their review of the literature the researchers found no theoretical or

empirical studies linking race/ethnicity to self-regulated study behaviors.

Procedure

All participants were recruited with the cooperation of course instructors. The researchers approached faculty members from different departments and solicited their permission to administer the instrument to their students during a regular class session during fall semester of 2010. The researchers gave a brief overview of the purpose of the study and asked students to read the consent information on the first page of the questionnaire. Students wishing to participate in the study filled out the questionnaire at their own pace. Most students were able to complete the questionnaire in 15 minutes.

Data analysis

In this study, Q factor analysis (Cattell, 1978) was used to analyze data instead of the traditional R factor analysis. By using Q factor analysis, the study was not exploring the patterns/factors underlying instrument variables, which R analysis does. Instead, this Q study examined the participants in relation to each other and resulted in a pattern of intercorrelations among participants (McKeown, Hinks, Stowell-Smith, Mercer, & Forster, 1999). In this study the relationships were based on participants' self-reported study behaviors. In other words, Q factor analysis was used to group people instead of items (McKeown & Thomas, 1988).

Some researchers may be more familiar with Q methodology than Q factor analysis. It should be noted that Q factor analysis is different from Q methodology, although they both may be considered mixed-methods strategies and share some characteristics and procedures (Newman & Ramlo, 2010). What differentiates Q factor analysis and Q methodology is the way data are

collected.   Q methodology requires the participants to follow a rank-ordering procedure by

ordering a set of statements on the topic of interest according to their perceptions and beliefs.

This process is known as Q-sorting (Stephenson, 1975).   Q factor analysis does not necessarily

involve Q-sorting.   Instead, when using Q factor analysis, data can be collected through various

sources such as interview and survey (Newman & Ramlo, 2010).   In this study, data were

collected using a survey instrument.

It is also worthwhile to compare Q factor analysis to another commonly used technique,

cluster analysis. While both cluster analysis and Q factor analysis (QFA) are people profile

analysis techniques, cluster analysis has greater susceptibility to sampling fluctuations than QFA

(Morf, Miller, & Syrotuik, 1976).   Second, while cluster analysis tells about within-group

distance versus between-group distance, Q gives similar information about who loads on which

factor. But more importantly, Q goes much further and gives us tools to understand the factors

themselves by providing extremely ranked items and distinguishing items. Q does not stop with

the groupings, but passes through there on the way to understanding the key behavioral

characteristics and/or points of view that are behind them (S. R. Brown, 1993).

The PQMethod program (Schmolck, 2011) was employed to perform the Q factor

analysis and it produced the correlation matrix that was entered into the analysis, carried out the

factor analysis, and calculated the factor scores.   The researchers chose principal components

extraction and varimax rotation to run the factor analysis.   Noteworthy, many Q methodologists

prefer centroid extraction with hand rotation over the frequently used principal components

extraction with varimax rotation as they believe that the former combination (i.e., centroid

extraction with hand rotation), because of its indeterminacy, allows researchers to examine data

from a theoretical rather than a statistical standpoint (S. R. Brown, 1980; Stephenson, 1975).

Nevertheless, several Q methodologists (e.g., S. R. Brown, 1971; McKeown & Thomas, 1988)

have suggested that there is little statistical difference between using principal components,

centroid, or any other available method.   Regardless of the statistical procedures employed, the

resulting factor structures would have little difference (Burt, 1972).   In addition, varimax

rotation was used in order to "maximize the purity of saturation [as estimated by loadings] of as

many … [items] as possible on one or the other of the … factors extracted initially" (McKeown

& Thomas, 1988, p. 52).   Our purpose for choosing principal components extraction with

varimax rotation was to keep the subjectivity of the researchers at a relatively low level.

The unrotated eight factor solutions (i.e., the default) from the PQMethod program

showed that factors 6, 7, and 8 each accounted for a very small portion of the total variance

and/or did not have an adequate number of respondents highly load on them.   These three

factors did not provide enough help in interpreting student types.   Therefore, when using

varimax rotation, we reexamined the data beginning with the five factor solution, followed by

four, three, and two factors. Among these, the two-factor structure provided the most stable and

interpretable description of participant types.

We also did cross-validation on the sample of participants considering that factors

emerging from Q factor analysis, as in other types of exploratory factor analysis, are sample

specific and may be unstable.   We randomly divided the sample of participants in half to see

what types of group membership emerged from one half and cross-validated the factors from the

other half sample.   The two similar factors that replicated between two half samples were

judged to be more stable in the population than the others (Newman & Ramlo, 2010). Therefore

the two-factor structure is the final factor solution presented in the "Results" section.

The factor analysis generated Q factors, also known as typologies.   Each Q factor

represents a group of students responding to statements in a similar way (N. W. Smith, 2001) and,

therefore, in this study having similar study behavior patterns.   The PQMethod program

automatically indicates the defining respondents for each factor – those who loaded strongly on a

factor and thus defined that factor.   These defining subjects are the key to understanding the

factors because these subjects' shared behaviors are the primary representation of the underlying

patterns of the group. The factor score for each of the SBI statements was then calculated based

on the responses of the defining participants for each factor.   A factor score for a statement item

is an average of the scores given to that statement by all the definers on that factor.   PQMethod

automatically normalizes factor scores, which are essentially weighted z-scores for each item on

the instrument.   The normalized factor scores (i.e., z-scores) were mainly used to understand

and compare the characteristics of each type.   Hierarchical multiple regression was then

employed to examine the relationship between student type and academic achievement as

measured by current grade point averages (GPAs).

Results

Question 1.   What are the typologies of undergraduate students that represent students'

different patterns of study behaviors?

The most stable and interpretable factor solution yielded by Q factor analysis is a two

factor structure representing two distinct student types among participants regarding their study

behaviors (Table 2).   Table 2 also shows the number of defining respondents for each factor.

Participants who strongly loaded on a given factor were considered to be definers of that specific

factor and were assumed to share a common perspective.   Only the responses from the definers

of a factor were used to calculate and explain the characteristics of that given factor (e.g.,

eigenvalue and percentage of explained variance). Thus, the percentage of explained variation on

each factor was the variance accounted for by the definers of a given factor.   In this study, 140

out of 152 respondents loaded strongly on Factors 1 and 2, thus defining these factors. The first

student type (i.e., Factor 1) was defined by 88 participants while 52 respondents represented the

second type (i.e., Factor 2).   Factors 1 and 2 combined explained 38% of the observed total

variance in the data with Factor 1 explaining 25%.

Table 2. Two-factor solution with number of defining respondents (n = 152)

Characteristic	Factor 1	Factor 2	Total
Number of Definers	88	52	140
Eigenvalue	38.25	19.89	
Percent of Variation Explained	25	13	38

So far, we have identified two types of students represented by Factor 1 and Factor 2. We

then examined the study behavioral patterns between these two types of students through their

actual responses on instrument items. The first piece of key information provided by PQMethod

output is the statements ranked the highest or the lowest by each type of participants, known as

"extremely ranked" statements. These statements with extreme rankings are very important as

they strongly define a given student type.   Table 3 contains the statements that characterize

Type 1 students' study behaviors most strongly ($z \geq 1.00$) and the least strongly ($z \leq -1.00$).

These extremely ranked statements, shown in Table 3, suggest that Type 1 students are reflective

and well-organized.   This type of students learn in a holistic way by connecting study materials

and seeking the underlying structures that made sense to them (agreement with Statements 5 and

37).   Additionally, Type 1 students manage their time effectively (agreement with Statements

40, 4, 9, and disagreement with Statement 39) and do not let non-academic activities interfere

with their studying (disagreement with Statement 19).

Table 4 provides the extremely ranked statements ($z \geq 1.00$ or $z \leq -1.00$) for Type 2

students. Students in this group are poorly organized about their studying (disagreement with

Statements 29 and 31).   Although Type 2 students complete their assignments on time, they

manage their time poorly (agreement with Statement 1), and appear to procrastinate (agreement

with Statements 16 and 18).   Additionally, because they procrastinate, Type 2 students usually

need to cram for tests and focus on remembering facts rather than comprehending materials and

carrying out deep thinking (agreement with Statements 44 and 43).

To further compare and contrast study behaviors between two student types, we

examined the statements that two student types scored the most differently, known as

"distinguishing statements".   Distinguishing items are the statements that differentiate a given

typology the most from the other type(s).   In other words, distinguishing items show what is

unique about a given student type.   To differentiate the study behavior patterns of Type 1 and

Type 2 students, Table 5 provides the distinguishing statements based on the z-score differences

of items' loadings on the two factors.   In this study, statements with a *z*-score difference of 1 or

greater were considered distinguishing statements.   Table 5 shows that some distinguishing

statements reinforced the interpretation of the extremely ranked statements previously noted.

Specifically, Type 1 students were found to be good organizers concerning both learning

materials and their time (Statements 7, 9, and 27).

Table 3. Factor 1 extreme statements with high and low z-scores

No.	Statement	*z*-score
11	In preparing reports, themes, term papers, etc., I make certain that I clearly understand what is wanted before I begin to work.	1.867
4	I complete my homework assignments on time.	1.765
40	If time is available, I take a few minutes to check over my answers before turning in my examination paper.	1.692
30	I keep all the notes for each subject together carefully arranging them in some logical order.	1.463
26	When in doubt about the proper form for a written report, I refer to an approved model to provide a guide to follow.	1.388
5	I try to carry over and relate material learned in one course to that learned in others.	1.357
7	I keep my assignments up-to-date by doing my work regularly from day to day.	1.353
37	When preparing for an examination, I learn facts in some logical order of importance, order of presentation in class or textbook, order in history, etc.	1.336
9	At the beginning of a study period, I organize my work so that I will utilize the time more effectively.	1.256
19	I watch too much television, and this interferes with my studies.	-1.140
39	Although I work until the last possible minute, I am unable to finish examination within the allotted time.	-1.142
14	My teacher criticizes my written reports as being hastily written or poorly organized.	-1.175
33	I do poorly on tests because I find it hard to think clearly and plan my work when I am faced with an exam.	-1.181
38	I am careless with spelling and mechanics of English composition when answering examination questions.	-1.194

Furthermore, some distinguishing statements offered additional information about the type characteristics.   Type 1 students considered "think things through" to be more important than memorization in getting good grades (Disagreement with Statement 43).   Additionally, Type 1 students appeared to be active learners who take the initiative in their studying in spite of the obstacles (Statements 10 and 12). Type 1 students are also far more likely to seek help when necessary than Type 2 students.

As for Type 2 students, distinguishing statements suggested that these students are poorly organized in terms of both learning materials and time (Statement 1, disagreement with Statements 7, 31, and 29).   They also procrastinate while studying and cram for assignments and tests as deadlines approach (Statements 44, 18, and 16).   Type 2 students are far more likely to consider memorizing facts more important than thinking through and understanding contents (Statement 43), which is very different from Type 1 students, who indicated they do more than memorization by connecting the materials and seeking the underlying logic of the materials (See Table 3, Statements 5 and 37).   Additionally, Type 2 students lack help-seeking behaviors (disagreement with Statement 10).

In conclusion, based on the results of both extremely ranked items and distinguishing items, we noted several key studying behavioral characteristics from each type of students, shown in Table 6.   The first student type (determined from Factor 1) describes learners who not only organize both their study materials and study time well, but also actively reflect and connect the knowledge they have learned (or "reflect and seek deep understanding of the knowledge"). Accordingly, Type 1 students are labeled "Organized Holistic Learners".   The second type (i.e.,

Factor 2) represents students who are poorly organized as well as learning superficially.   Type 2

students are therefore labeled "Disorganized Convenience-driven learners".

Table 4. Factor 2 Extreme statements with high and low z-scores

No.	Statement	z-score
4	I complete my homework assignments on time.	1.872
40	If time is available, I take a few minutes to check over my answers before turning in my examination paper.	1.709
26	When in doubt about the proper form for a written report, I refer to an approved model to provide a guide to follow.	1.609
44	I study harder for final exams than for the rest of my coursework.	1.562
43	I believe that grades are based upon a student's ability to memorize facts rather than upon the ability to "think things through".	1.527
11	In preparing reports, themes, term papers, etc., I make certain that I clearly understand what is wanted before I begin to work.	1.519
1	My time is unwisely distributed; I spend too much time on some things and not enough on others.	1.190
16	My studying is done in a random, unplanned manner impelled mostly by the demands of approaching classes.	1.188
18	I put off writing themes, reports, term papers, etc., until the last minute.	1.053
10	When I am having difficulty with my schoolwork I try to talk over the trouble with my teacher.	-1.346
38	I am careless with spelling and mechanics of English composition when answering examination questions.	-1.378
31	Before attending class, I prepare by reading or studying the assignment.	-1.400
39	Although I work until the last possible minute, I am unable to finish examination within the allotted time.	-1.585
29	After a class lecture, I go back and recite to myself the material in my notes – rechecking points I found doubtful.	-1.687
14	My teacher criticizes my written reports as being hastily written or poorly organized.	-1.882

Table 5. Distinguishing statements for Factor 1 and Factor 2

No.	Statement	F1 z-score	F2 z-score	Difference
10	When I am having difficulty with my school work I try to talk over the trouble with my teacher.	0.87	-1.35	2.22
7	I keep my assignments up-to-date by doing my work regularly from day to day.	1.35	-0.56	1.91
31	Before attending class, I prepare by reading or studying the assignment.	0.22	-1.40	1.62
9	At the beginning of a study period, I organize my work so that I will utilize the time more effectively.	1.26	-0.35	1.61
29	After a class lecture, I go back and recite to myself the material in my notes – rechecking points I found doubtful.	-0.25	-1.69	1.44
27	When reading a long textbook assignment, I stop periodically and mentally review the main points that have been presented.	1.04	-0.18	1.22
12	When I get behind in my schoolwork for some unavoidable reason, I make up back assignments without prompting from the teacher.	0.88	-0.14	1.02
44	I study harder for final exams than for the rest of my coursework.	-0.08	1.56	-1.64
1	My time is unwisely distributed; I spend too much time on some things and not enough on others.	-0.49	1.19	-1.68
18	I put off writing themes, reports, term papers, etc., until the last minute.	-0.72	1.05	-1.77
16	My studying is done in a random, unplanned manner impelled mostly by the demands of approaching classes.	-0.68	1.19	-1.87
43	I believe that grades are based upon a student's ability to memorize facts rather than upon the ability to "think things through".	-0.39	1.53	-1.92

Table 6. Comparison of the key characteristics of study behaviors between two types

Typical Study Behavioral Characteristics	Organized Holistic Learners (Type 1)	Disorganized Convenience-Driven Learners (Type 2)
Strategy for getting good grades	Consider "think things through" matters more than memorizing facts	Believe memorization is more important than critical thinking and understanding
Organization	Good organizers concerning both study materials and study time	Organize both learning materials and time poorly
Time management	Do assignments in a timely manner in spite of obstacles	Procrastinate while studying and cram for assignments and tests as deadlines approach
Help seeking	Ready to seek help when necessary	Do not seek help when needed

Question 2.   Is there a relationship between the typologies and students' academic achievement as measured by current GPA?

The findings from the first question have shown that Type 1 and Type 2 students took very different approaches to managing their time and effort for studying; therefore, it would be helpful to examine the actual academic achievement of these two types of students. Understanding how these two types of study behaviors relate to students' academic outcomes would in turn inform researchers about the difference that students' study behaviors make.

Among the 140 participants who defined either Factor 1 or Factor 2, seven failed to report their current GPA, one missed enrollment status, and one missed age.   The following regression analyses were based on 131 cases, with 80 students in Type 1 group and 51 students in Type 2 group.

The results of the independent-samples *t*-test revealed that participants who were in the typology represented by Factor 1 had significantly higher GPAs than those in the topology represented by Factor 2. The mean GPA for Type 1 students in the sample was 3.35 ($SD = .37$) whereas the Type 2 students' GPA averaged 3.18 ($SD = .54$). The difference between these mean differences is significant at the .05 level, $t(129) = 2.17, p = .016, d = 0.39, 95\%$ CI $[0.15, 0.33]$.

Table 7. Hierarchical multiple regression analyses predicting GPA from student type, sex, age, major, and enrollment status

Predictor	ΔR^2	β
Step 1	.150**	
Sex		.318*
Age		-.018
STEM		-.511***
Business		-.224*
Other Major		-.153
Enrollment status		.180*
Step 2	.026*	
Type		.167*
Step 3	.057	
Type × Sex		.412
Type × Age		1.041
Type × STEM		-.089
Type × Business		-.256
Type × Other Major		.092
Type × Enrollment Status		-.015
Total R^2	.234	
n	131	

Note. * $p < .05$. ** $p < .01$. *** $p < .001$.

Hierarchical multiple regression was employed to estimate the unique contribution of student type to the variance of academic achievement as measured by current grade point

averages (GPAs) when student attributes were controlled. The results of hierarchical multiple

regression analyses are shown in Table 7. The first step of the regression analysis, or Model 1

indicated the four attributes (i.e., sex, age, major, and enrollment status) combined significantly

predict academic achievement, $R^2 = .150, F(6, 124) = 3.656, p < .005$.   As indicated by the

value of R^2, these attribute variables accounted for a total of 15.0% of the variance of academic

achievement.   Among the attribute variables, sex ($\beta= .318, t = 2.294$), STEM major ($\beta = -.511, t$

$= -3.524$), and business major ($\beta = -.224, t = -2.230$) emerged as significant predictors of

academic achievement.

In the second step of the regression analysis, or Model 2, the researchers added the

student type (i.e., study behavior type) as an independent variable.   The purpose was to evaluate

the potential predictive ability of study behavior type on academic achievement when controlling

for sex, age, major, enrollment status.   Model 2 overall was significantly related to academic

achievement, $R^2 = .177, F(7, 123) = 3.771, p < .001$, and, therefore, accounted for a total of 17.7%

of the variance of academic achievement.   More importantly, the increase in R^2 showed that the

student type added significant incremental variance to the first model.   Student type was a

significant predictor of academic achievement beyond and above the four attributes ($\beta= .167, t =$

1.985), and accounted for a proportion of the variance of predicted GPA ($\Delta R^2 = .026, F(1, 123) =$

$3.938, p < .05$).

In the third step of the analysis, or Model 3, in order to determine whether or not student

type interacted with sex, age, major, or enrollment status in predicting students' academic

achievement, four interaction terms were added (i.e., type × age, type × sex, type × major, and

type × enrollment status).   The 5.7% increase in R^2 was non-significant ($p > .05$).   Interaction

variables did not add significant incremental variance to the second model and thus did not

contribute to the prediction of academic achievement.   In particular, all interaction terms were

non-significant ($p > .05$).   In other words, students' sex, age, major, and enrollment status did

not interact with their study behavior types in predicting academic achievement.

Discussion and future research recommendations

This exploratory study, through Q factor analysis, revealed two types of study behavior

patterns displayed by undergraduate students and allowed us to examine differences in these

study behavior types.   A few of these differences were particularly important in understanding

study behaviors and self-regulatory behaviors of students. These were differences in how

students processed academic materials and in students' behaviors when it came to seeking help.

Processing academic materials

One main finding of the current study is that the two types of students processed

academic materials in contrasting ways.   For instance, item 43 in the SBI reads, "*I believe that

grades are based upon a student's ability to memorize facts rather than upon the ability to 'think

things through.*'"   Type 1 students generally believed that "thinking things through" is more

important than memorizing plain facts in their academic study whereas Type 2 students

considered remembering facts more important in order to acquire high course grades.   This is a

finding unique to the current study because in previous studies using the SBI (e.g., Bliss &

Mueller, 1993; McDermott, 2004) item 43 provided inconsistent scores and failed to load

strongly on any of the factors. However, in the current study, item 43 has one of the most

extreme negative *z*-scores between the two student factors (z = -1.92; see Table 5).   In other

words, one thing that strongly differentiates the two types of students is their beliefs about

successfully approaching academic work.   That is, do they merely memorize the facts and

surface information (like those in the Type 2 group) or do they go through deep thinking to

understand the materials, concepts, and the meaning or logic behind them (like those in the Type

1 group) if they want to receive good grades?

The goal orientation construct could be one theoretical explanation for such differences in

study behaviors.   Goal orientation helps explain the reasons why individuals pursue an

academic task. Goal orientation largely determines students' motivations for academic learning,

which in turn influences the efforts and behaviors they demonstrate in their learning process

(Ames, 1992).   As previously noted, there are two main types of goal orientations, which

usually link with different self-regulatory learning practices (Ames, 1992; Dweck & Leggett,

1988).   The first is *mastery (learning)* goal orientation.   Students setting mastery goals focus

on learning new knowledge, increasing competence, gaining deep understanding, and mastering

tasks (Ames, 1992; Anderman & Midgley, 1997; Pintrich, 2000).   To achieve such goals,

students are more likely to monitor their cognition and behaviors to enhance comprehension

(Pintrich & Zusho, 2007), to adapt their learning strategies and behaviors when facing obstacles

(Dweck & Leggett, 1988), and to regulate their time and effort (Pintrich, 2000). The second type,

performance goal orientation, usually involves avoiding negative judgment (e.g., getting lower

grades or looking stupid) and/or outperforming peers (Ames, 1992; Dweck & Leggett, 1988).

Students who set performance goals care more about avoiding negative judgment; not

surprisingly, they are less likely to devote sufficient time and effort in their studies to pursue

deep understanding (Pintrich, 2000) or demonstrate other poor self-regulatory processes and

learning outcomes (Middleton & Midgley, 1997; Skaalvik, 1997).

The current finding that students display different study behaviors when approaching

academic tasks is consistent with the literature on goal orientation.   Specifically, Type 1

students pay more attention to the deep understanding of meaning and logic behind the materials

being taught. By contrast, Type 2 students may believe that getting a good grade simply entails

the memorization of facts and there is no need to "dig deeper"; therefore, they focus more on

surface information and facts.   This could be due to the different types of academic goals

students set as they pursue tasks.   That is, Type 1 students are likely to be mastery goal

orientated and Type 2 students to be performance goal oriented.   Additionally, Type 1 students

tend to plan ahead, monitor their progress and understanding, and regulate their study time and

effort.   This is consistent with the previous literature on mastery goal orientation.

This differentiation of students' behaviors concerning critical thinking or memorizing

demonstrated that these students had different goals in their learning. In this study, Q factor

analysis followed by the use of multiple regression techniques clearly indicated that deep

thinking distinguished high-performing students from their average/lower performing peers.

Help seeking behaviors

Another characteristic that strongly differentiates the two types of students in this study

was the students' responses to item 10 of the SBI, which probes students' help-seeking behaviors.

Type 1, high-achieving students, tend to seek help when it is needed whereas Type 2,

low-achieving students, are reluctant to do so. Self-regulated learning theories and empirical

studies have both supported the idea that seeking help and feedback not only helps change the

way students think, feel, and behave as they learn, but that the valuable information provided by

teachers or peers may also facilitate students' learning (Dibenedetto & Bembenutty, 2011;

Pintrich & Zusho, 2007; Szu et al., 2011). The current findings suggest that self-regulated

learners are more likely to be aware of their need to seek help and more willing to seek help than

their underperforming peers.

Other behaviors

The findings also substantiated the literature on several specific self-regulated learning

behaviors and practices and their positive impact on academic performances. These include

planning (Whipp & Chiarelli, 2004), managing and prioritizing time (George, et al., 2008;

Ogonor & Nwadiani, 2006), and self-monitoring (Pintrich & Zusho, 2007; Zimmerman, 2000a).

In regard to planning, this study showed that Type 1/high-achieving students schedule

their academic work ahead in a productive manner while Type 2 students usually study in a

random fashion and are less likely to be involved in planning for their study, be it preparation in

advance or review after class. Similarly, literature has suggested that students' active

engagement in planning and organizing is related to high performance in various academic tasks

(Pintrich & De Groot, 1990; Whipp & Chiarelli 2004). Achievement increases as students take

greater control over their own learning.

As for managing time, Type 1 students characterize themselves as spending adequate

time on academic assignments and not letting non-academic activities interfere with their

studying.   By contrast, Type 2 students spend more time on entertainment and other

non-academic related activities.   Previous research has shown that students who are better at

allocating and prioritizing their time tend to have higher achievement than their peers who

manage time poorly (Eilam & Aharon, 2003; Ogonor & Nwadiani, 2006).   This study again

demonstrates that whether or not college and university students devoted an adequate amount of

time to study activities is related to their academic performance.

Related to this, a further thing that differentiates the two types of students is whether they

spend time on their studying on a regular basis.   As the findings have shown, Type 2 students

usually start working on their assignments or papers as deadlines approach rather than starting

early and spending time regularly on them as Type 1 students do.   One of the explanations for

this behavior is that many believe they are more productive under pressure, such as that imposed

by limited time, which was partly supported by Chu and Choi's (2005) findings.   However,

most of the literature suggests the opposite; that is, dividing up work systematically and spending

time on it regularly is more likely to yield satisfactory performances and outcomes (Garcia-Ros,

Perez-Gonzalez, & Hinojosa, 2004; George et al., 2008).   By the same token, failing to regulate

one's time usage effectively (e.g., procrastination) usually leads to all kinds of negative

outcomes, such as the need for cramming, high stress levels, and overall low academic

performance (Ferrari, 2001; Steel, 2007).   It is reasonable to suggest that devoting an adequate

amount of time to academic-related activities outside of class regularly is necessary for academic

success (Nonis & Hudson, 2006).

In terms of self-monitoring, this study also found that high-achieving (i.e., Type 1)

students are more likely to check and reflect on the academic activities they are engaged in than

Type 2 students.   Bandura, Zimmerman, and other researchers of self-regulated learning theory

all agree on the critical role of students' self-monitoring in improving their learning quality and

academic outcomes (Pintrich & Zusho, 2007; Zimmerman, 2000a; Zimmerman & Bandura,

1994).   Students who regularly involve themselves in self-checking and monitoring tend to be

acutely aware of the progress (or lack of it) that they made in academic activities and regulate

their own studying correspondingly (Kanfer, 1971).   From this study, it appears such study

behaviors indeed turn out to be conducive to academic achievement, as the literature has

suggested.

The need for replication

Considering the unstable nature of factor analysis results, future research should consider

replicating this study using different samples in order to determine whether the two-factor

structure found in the current study is replicable in different student samples. Should a two-factor

structure be found, it would be important to determine whether a similar relationship between

student type and academic achievement reemerges. When replicating the study, researchers

should also pay attention to the effect size of student study behavioral type in predicting

academic achievement.

In this study, the effect size of predictor variable study behavioral type was statistically

significant at $\alpha = .05$, but fairly small ($R^2 = .026$).   Several researchers (e.g., Newman &

Newman, 2000) have argued that while a large R^2 is preferable, a small R^2 could be meaningful if

the effect size is reliable (i.e., consistent).   This is because a small increase of effect size would

improve predictive efficiency, and if a small R^2 is replicable, the predictor can have huge effects

in the efficiency of the prediction over time (Newman & Newman).   An example used by

Newman and Newman was the odds ratio at casinos.   The roulette tables usually give the house

a slight advantage for each play.   Yet over a long run, that small advantage/effect generates

billions of dollars for the house as it is consistent over time. Therefore, future research should

use different samples to examine whether student type would yield similar effect sizes when

predicting academic achievement.   Considering the sheer size of the entire population of

university/college undergraduate students, a variable with a small R^2 that replicates over different

samples could potentially impact a large number of undergraduates' learning behaviors and

outcomes.

Inferences concerning causality

This study demonstrated that study behavior type is significantly related to academic

achievement, which is a correlational statement.   In order to be able to make causal inferences

about the relationship between these two variables, experimental research is needed. One action

that educators and institutions can take is to provide an intervention using treatment and control

groups. Specifically, researchers can offer training to a random half of Type 2 students on study

behaviors that characterize Type 1 students, while using placebo training on a control group of

Type 2 students.   After determining that the treatment was successful and that the group of

students developed study behaviors more like Type 1 students, a difference in achievement

scores in the advantage of the treatment group comparing with their baseline (pre-treatment)

academic scores would be evidence of a causal relationship between group membership and

academic achievement.

Previous research suggested that study behaviors can be taught and changed.   For

example, Cuesta (2007) found a causal relationship between acquiring appropriate study

behaviors and increased academic achievement in college remedial mathematics classes.   While

the study was convincing, more research is needed on regular non-remedial student populations.

If a causal relationship is ultimately found in regular students, training programs on the

acquisition and application of effective study behaviors should be widely implemented in

colleges and/or universities, especially to students who are more likely to be at risk academically.

Implications and conclusion

The current study enabled the researchers to profile undergraduate students according to

their study behavioral patterns and to examine the relationship between the outcomes of this

classification and academic outcomes.   The findings from the current study have provided some

potentially useful information concerning how we use the measurement as well as students'

study behavior patterns.   First, This study provided a unique analytical approach, Q factor

analysis (QFA), to utilize *Study Behavior Inventory* (SBI) to understand undergraduate students'

study behaviors. Till now, the only way to use SBI was to calculate scores at the scale level

obtained from R factor analysis in order to represent different levels of demonstrated study

behaviors.   But the results from QFA suggest that students' study behavior profiles/patterns (i.e.,

Q factors) are largely demonstrated by a few statement items. In other words, this study showed

that students' typical learning behaviors could be differentiated by several items (including

extremely ranked statements and distinguishing statements).   If a similar Q factor structure can

be replicated and a similar relationship between student type and academic achievement can

reemerge, QFA would potentially present an efficient way to use the SBI.   That is, instead of

having students complete the entire SBI and calculating scores at the scale level, we would only

need to use the items that strongly characterize each type of students (i.e., extremely ranked

statements and distinguishing statements). Students' responses on these key items can be a strong

indication of their overall learning behaviors and the possible academic outcomes associated

with the study behavior patterns.

In terms of understanding students' study behavioral patterns, by using undergraduate

students' responses on SBI, it is possible to place them in one of two groups based on, among

other things, their levels of reflectiveness, organization, and tendency to think deeply while

learning, as well as their willingness to ask for help.   Group membership was found to be

related to academic achievement with Type 1 students having higher mean GPAs than Type 2

students.   If these findings can be replicated, the instrument can be used as a screening devise

for incoming students at an institution since it can be used to identify Type 2 students who may

be at risk for lower achievement, and potentially address the behavioral shortcomings early in

students' careers in higher education.

In addition, the results of such screening could be used to inform students about strengths

and weaknesses in their study habits as well as the potential academic consequences associated

with them.   As the self-regulation literature has repeatedly suggested, self-awareness is critical

for students to direct and regulate their own learning practices (Pintrich & Zusho, 2007;

Zimmerman, 1998).   Institutions should not only inform students that appropriate study

behaviors can be taught which may lead to increases in GPAs (e.g., Cuesta, 2007), but more importantly, provide learning support through training programs and workshops to help students adjust study behaviors and processes to be more conducive to academic success (Cuesta, 2007; Zimmerman, 2000a). Unless such interventions are available, we would argue against such profile analysis being performed on student bodies as mere labeling students could cause more harm.

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