

ANALYSIS OF PERFORMANCE FACTORS FOR ACCOUNTING AND FINANCE RELATED BUSINESS COURSES IN A DISTANCE EDUCATION ENVIRONMENT

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ABSTRACT

The objective of this study is to explore business courses performance factors with a focus on accounting and finance. Course score interrelations are assumed to represent interpretable constructs of these factors. Factor analysis is proposed to identify the constructs that explain the correlations. Factor analysis results identify three sub-groups of business core courses. The first group is labeled as management-oriented courses. Accounting, finance and economics courses are separated in two groups: the prior courses group and the subsequent courses group. The clustering order of these three groups was attributed to underlying performance factor similarities. Then, the groups are compared by the pre-assessed ratings of course specific skills and knowledge. The comparison suggests that course requirements for skills and knowledge were the latent variables for the factor analysis. Moreover, multivariate regression analyses are employed to reveal the required level of verbal and quantitative skills for the groups. Management-oriented courses are differentiated from others with requiring verbal skills, managerial skills and knowledge more. Introductory courses require quantitative and analytical reasoning skills more than the subsequent courses in accounting, finance and economics. Mathematics course score fails to be a suitable proxy of numerical processing skills as an accounting course performance factor.

Keywords: Business education, course performance, distance education, factor analysis, regression analysis.

INTRODUCTION

Academic success is of primary importance to students in pursuit of their career goals. It is also critical for faculty members and educational institutions to gain reputation in the challenging competition for attracting the most promising students. Thus, determinants of student performance have drawn the attention of researchers. Different factors affecting business course success have been investigated. The most notable factors are required skills and knowledge, student demographics and background, motivational effects and educational factors external to the student attributes.

This study explores business core course performance interrelations with a focus on accounting and finance courses. Analysis of the correlations between course scores provides interpretable information for the underlying performance factors. We propose a novel decomposition technique for an analysis of course performances. Factor analysis identifies the constructs that explain correlations among business core course scores.

Factor analysis identifies three sub-groups of business core courses that exhibit a clustering order, which can be attributed to underlying performance factor similarities. All of the management-oriented courses are clustered in one group. Accounting, finance and economics courses are separated into two groups by their course sequence. In factor loadings descending order, the third group is the prior courses set and the second group is the subsequent courses set for accounting, finance and economics. A post hoc analysis and multivariate regression analysis are then employed for these groups of courses to gain understanding of the latent factors. The results of these analyses suggest that required skills and knowledge are important for being successful in business core courses.

The analysis structure is also designed to test individual course performance relationships mainly for Financial Accounting, Cost Accounting and Auditing. We adopt a more comprehensive approach to accounting course interrelations. However, analyses cover other business specialties as well, particularly finance, economics and business management courses. We integrate the analysis of performance factors for accounting and these courses. Analysis outcome provides guidance for instructors and faculties to equip future accountants with proper skills and knowledge for pivotal roles in business functions. Vocational education program designers may benefit from the analysis outcome in firms that use job rotation throughout the functional departments. Our interpretation of business core courses performance interrelations may be intriguing for business education researchers who are trained in specialized fields and inclined to design research models from the perspective of their specialty.

Meristosis and Phipps (1999) stated that one of the measures of effectiveness is course performance for comparisons between distance and traditional classroom-based education. They also suggest that a complete set of course performances must be included for a robust comparison of effectiveness between these education techniques. Courses may differ in terms of performance factors which are unequally affected by the delivery process, i.e. distance education. This may cause a generalization problem for the results of single course investigations. An analysis of business course interrelations and performance factors is believed to be useful for distance education researchers who use course scores as a measure of effectiveness.

The paper is organized as follows. First, review of key areas in the literature is presented. Based on the review, a conceptual framework is defined for the determination of proper research environment and variable composition. Then, hypotheses are developed according to the preliminary discussion. The next section proposes research methodology for hypothesis testing. Following section introduces the sample. The analysis outcome is presented afterwards. The discussion section interprets the outcome within limitations and relates to the previous studies. The final section offers conclusions and insights for further research.

LITERATURE REVIEW

Eskew and Faley (1988), Doran et al. (1991) hypothesized that performance in an accounting course is a function of gender, general academic performance and ability, and prior accounting course performance. They employed multivariate regression models to explore accounting course performance measured by course scores. Results of the analyses drew attention primarily to course performance interrelations. After these studies, prior course performances were frequently included in both accounting and finance course performance models. Borde et al. (1996) investigated determinants of Introductory Finance performance with similarly hypothesized factors. They considered accounting course performance as a variable and investigated cross-relations between accounting and finance course performances. Having studied the upper level finance course performance determinants Trine and Schellenger (1999) also used independent variables alike. Over time, hypothesized factors have changed depending on different concerns or paradigms, while some factors were retained. These factors can be named as demographics, background and related course performances of student.

One of the important performance factor is overall student ability. It seems plausible to measure overall student ability by grade point average (GPA). Eskew and Failey (1988), Doran et al. (1991), Borde et al. (1996) considered GPA as important factor in terms of explaining the students' success of business courses. Kirk and Spector (2006) reported positive effect of GPA on Cost Accounting performance. GPA can be considered as the most frequent and significant among proposed predictors in the literature. Although GPA may contain information about students' ability and motivation, it is hard to differentiate the effect of motivation in quantifiable terms. Mo and Waples (2011), Denny (2014), controlled for students' choice of major, which was assumed to represent the motivational factors affecting past course performances. However, there is an ambiguous order of causality between choice of major and better performance in prerequisite courses related to that major. It is also possible that a student prefers to study a major which he or she proved to be good at. Another motivation aspect is the link between personality type and course performance. Bealing et al. (2006) claims that there is a relation between specific personality types (sensing-judging) and success of accounting courses. However, Filbeck and Smith (1996) found that personality types perform differently on certain types of examination methods. This means performance results may vary for the same personality types in different means of examinations. Thus, a robust generalization of relationship between personality types-oriented motivation and course performances has not been established yet. Apart from motivational aspects, GPA is deemed to be an objective but merely adequate factor indicative of student ability in undergraduate course work.

Various potential factors effect course performance. Guney (2009) structured these potential factors in terms of their internal relationships. An extensive review of factors in the literature can be found in this research. Guney (2009) points to a two-fold structure of potential factors in relation to students' performance in accounting: student-exogenous and student-endogenous. Age, gender, country of origin, effort, attendance, numerical processing skills, work experience, academic experience and future career motivations are factors related to the student, and thus are called student-endogenous factors. Instructor-related factors and teaching environment are student-exogenous factors. Student has nothing to do about these and cannot control these for his/her benefit. Examples are teaching quality and competence of lecturer, teaching and examination method and textbook or learning material quality. Guney (2009) introduced the concept of student-exogenous factors in addition to student-endogenous factors and formed a more comprehensive model. However, exogenous variable data were obtained from the questionnaire measuring students' perceptions of teaching. Students' lack of expertise and reporting bias may lead to false evaluation of the factors. That means possible measurement bias. In fact, students' perceptions may be a reflector of their motivation and attitude towards courses, instead of being an exogenous factor measurement.

Related Course Performance as a Determinant for Accounting Course Success

The models which explore factors associated with a specific course success tend to include various variables from each category of the factors mentioned thus far. A favored variable is performance of another course, which is theoretically related to target course performance. The assumption here is that related course performance can be a proxy of the level of knowledge, ability and skill needed for the target course. Related course performance can reflect specific requirements of the target course in a way similar to GPA which reflects overall ability. Thus, related course performance is a valid predictor of target course performance as well as GPA. Eskew and Faley (1988) established a relationship between pre-college study of accounting and the subsequent performance in an introductory accounting course. However, Doran et al. (1991) refers to a more complex outcome regarding the impact of prior accounting knowledge on academic performance in sequential accounting courses. They found that although earlier studies of high school bookkeeping had positive effects on performances in the first accounting course, these studies negatively affected performances in the subsequent accounting course. An attractive indication of this result is a complex relationship among undergraduate courses in terms of varying performance factors.

Bernardi and Bean (2002) reported that students' Intermediate Accounting I performances account for around 50 percent of the variation in Intermediate Accounting II test scores. If the course specific ability and skill (or even motivation) are to be controlled, then it is reasonable to consider courses from other branches as well as prior same-branch courses. Drenann and Rohde (2002) found that success in prior managerial accounting courses was related to students' achievement in the subsequent courses. They conducted similar tests for Business Finance on the ground that the subject has similar combination of quantitative, analytic, and interpretive performance criteria. Financial Accounting and Statistics performance relations with Business Finance performance supported their main analysis. Hartnett et al. (2004) observed statistically significant relationship between accounting performance and accounting course work prior to undergraduate education. Kirk and Spector (2006) found that students' success in Managerial Accounting Principles, first statistics course and overall performance were significantly related to Cost Accounting performance. Bealing et al. (2008) found that performances in prerequisite accounting courses were statistically significant to predict the subsequent accounting course performances. In another study, Baker et al. (2010) inferred that students' performance in their first financial accounting course could be a predictor of performance of all business core courses. Maksy (2012) reported significant relationships between Intermediate Accounting and upper level accounting courses, namely Contemporary Issues in Financial Accounting and Advanced Accounting. Schmidt and Wartick (2014) considered the effect of the time lag between related accounting courses. Nevertheless, performance difference was ambiguous.

Accounting course performance and non-accounting course performance relations were investigated as well. Tho (1994) found that scores in earlier high school mathematics and economics positively affected the academic accounting performance. Gist et al. (1996) reported positive effect of mathematical skills on performance of accounting students. Mathematics course score is an accepted variable in accounting course performance models in order to take the numeracy level of students into account. Fedoryshyn et al. (2010) fully focused on numeracy and they reported a significant correlation between arithmetic skills and performance in accounting courses.

Majority of the accounting course performance researches focus on sequential introductory accounting courses and upper level accounting courses. Auditing course performance relations are somewhat neglected. Jenkins (1998) investigated the performance in an upper division auditing course and associated it with GPA and critical thinking test score as a proxy for required skills. No other accounting course performance relation was assumed. Thus, auditing course was implicitly differentiated from other accounting courses in this study. On the other hand, the grade in Intermediate Accounting was found as a predictor of student performance in Advanced Accounting and Auditing by Maksy and Zheng (2008). They treated auditing as a regular constituent of accounting track. According to Maksy and Wagaman (2012), students' performance in Intermediate Accounting and their overall GPA were significant indicators of their performance in Auditing. However, their study had inconsistent results with a different cohort and they stated that there was almost no statistical connection between the grade in Intermediate Accounting and student performance in Auditing. In practice, an important educational aspect of Auditing course is to provide ethical background for accounting students. Cohen and Pant (1989), Bampton and Cowton (2002) conducted surveys and reflected the common opinion that the auditing course was the most suitable one for ethical topics among other accounting courses. Uyar and Gungormus (2013) investigated accounting professionals' perception of ethics education in university with a survey. The responses indicated that auditing courses were appropriate for ethics in business practice. Anzeh and Abed (2015) investigated the scope of ethics education for undergraduate accounting education. They employed thematic content analysis and reported that auditing courses dominated other accounting courses in terms of ethical topics in syllabus. They validated that auditing courses were rich in ethical materials so as to prepare the accounting students to face the ethical challenges in their professional career. Consequently, if there is Business Ethics as a separate course in

undergraduate business program, then there may be a relationship between Auditing and Business Ethics performances.

Related Course Performance as a Determinant for Finance Course Success

Studies in finance course performances tend to investigate cross-relations of course performances from other branches. Accounting course and finance course relations are well-established. Drennan and Rohde (2002) argued that accounting and finance course performance criteria were akin. Pritchard et al. (2004) indicated that skill requirement similarities between accounting and finance majors were more convergent compared to other business majors such as marketing and management. Ely and Hittle (1990) assumed that upper division finance courses require students to have a fundamental background in mathematics. Nevertheless, the analysis outcome was unresponsive. Their explanation was improper selection of mathematical skills proxy. Didia and Hasnat (1998) found that students with pre-knowledge of Calculus and other related mathematics courses exhibited better performance in finance courses, compared to individuals who had no prior coursework in mathematical fields. The investigation of upper level finance course success determinants by Trine and Schellenger (1999) presented positive and significant effects of first financial accounting course grades, basic finance course grades and American College Testing (ACT) mathematics scores. Marcal and Roberts (2001) stated completion of Statistics prerequisite positively affected finance course performance. Grover et al. (2010) pre-examined Introductory Finance students with a quantitative skills test at the beginning of the semester. Mathematics and accounting based questions were a significant predictor of student performance in Introductory Finance.

Related Course Performance as a Determinant for Economics Course Success

Economics and finance are often taught as separate disciplines. However, they are interrelated and influence each other. Historical interactions between finance and economics are well presented by Miller (1999). In spite of the different aspects of these disciplines, there may be similarities between undergraduate finance and economics course performance factors. In earlier work of Simpson and Sumrall (1979), it was reported that accounting and finance majors were better performers in prior economics courses.

Economics course performance is also a concern for instructors and researchers. Besides the undergraduate economics program, various undergraduate programs have economics courses in their curriculum. For example, a typical undergraduate business program has a set of these courses. However, this line of research uses similar performance determinants without referring to accounting, finance or any other business course performance research. Anderson et al. (1994) investigated Introductory Economics performance determinants. They focused on prior knowledge of economics and mathematical subjects, such as functions, algebra and calculus. Ballard and Johnson (2004) conducted a detailed analysis of Introductory Economics performance determinants. They examined the effect of GPA, gender, country of origin, quantitative skills, prior and knowledge, which are examples for identical factors in both lines of research.

A novel interdisciplinary analysis for economics course performance was conducted by Denny (2014). The author examined the relationship between student performance in Economics and student attributes in different specialty programs such as Law, Political Sciences and Business Management. This study has a comprehensive approach and has a wider set of course group interrelations. Model of the research has business organization and accounting variables to capture if the student studied business organization or accounting at upper level. It is hypothesized that if student chooses either of these subjects at upper level, then perhaps this indicates an interest in the financial sector, which may make them more motivated about studying Economics. The analysis outcome indicates a negative coefficient with business organization and a positive coefficient for accounting without statistical significance. Thus, the research hypothesis is declined. Therefore, upper level specialty subject selection may be a proxy of pre-existent skills, rather than a proxy of motivation. Accounting students seemingly have required skills for Economics more than Business Organization students. Denny (2014) also reported that the least successful

students were the Sociology and Computer Science students in Macroeconomics. Computer Science students had the poorest performance. If it is presumed that the motivational factors and prior knowledge are not different in these student cohorts, and Computer Science students are more skilled in quantitative courses, then the results contradict prior studies that establish a positive relationship between performances of quantitative courses and Economics.

Course Performance in Distance Education

Previous studies for undergraduate business course performance have been mostly conducted in conventional learning environments. There are less studies which have their focus on distance learning course performances rather than performances of face to face courses. An evaluation of Factors related to student performances in distance learning environments were presented by Cheung and Khan (2002), taking the case of Open University of Hong Kong. They reported significant relationship between Business Communications and Business Relations Communication with a sample of 168 students, which is a small number of observations for a research in open education system. Pretorius et al. (2009) presented a positive relationship between Introductory Economics and Mathematics performance in South African Distance Education environment. Papageorgiou and Halabi (2014) examined the determinants of performance on distance education students who completed three years of financial accounting to obtain a Bachelor of Accounting Science degree. Their results showed that mathematics background and prior academic performance were both significantly associated with student performance throughout the financial accounting subjects. Moreover, they reported that students' prior accounting knowledge improved the outcome especially for the first year-courses. Huh et al. (2010) investigated accounting course performance determinants at California State University. In the University, online and offline accounting courses were taught by the same instructor. This made a performance comparison possible. Their findings showed no difference in student performances between online and offline groups of learners. However, "online learners and offline learners may perform differently due to differences in student perception, available learning tools and other technical issues" (Huh et al, 2010, p.81). For example, Carpinelli et al. (2006) reported better performance in distance learning group than face to face group of students and explained their findings with better quality of distance learning in their specific research environment. On the contrary, Urtel (2008) reported lower final grades for distance learning students compared to face to face group with a same instructor and same assessments.

In comparative analysis of distance versus traditional business education, course performances are used as an effectiveness indicator (Brown & Liedholm, 2002; Anstine & Skidmore, 2005; Chen et al., 2013; Parks-Yancy & Cooley, 2015; Aly, 2016). These researches have target courses from a single discipline or two instead of covering all disciplines in business education. Arbaugh (2005) pointed that studies comparing business disciplines such as accounting, finance, marketing and management were limited and he conducted a discipline-level analysis on an internet based business program. The results imply that course grades are affected by subject matter. This study argues for a greater emphasis on multi-course and multidisciplinary studies to establish generalizable predictors of on-line course effectiveness. Here, we recall that the courses may differ in terms of performance factors which are unequally affected by the delivery media and techniques. In this sense, course score interrelations and performance factor analysis may be fruitful for effectiveness studies of distance education.

CONCEPTUAL FRAMEWORK

Thus far, course performance interrelations have been presented from various studies that mainly investigated the performance determinants of courses from individual fields, particularly Accounting, Finance and Economics. These studies do not necessarily focus on the related course performances as independent variables in their analyses. These studies include a few related course performance variables in their independent variable set. From

our point of view, most of the variable sets are arguably problematic. First, basic demographics (age, gender, ethnicity, etc.) are often employed without introducing a conceptual background. Analysis results of these variables yield less knowledge without theoretical reasoning. Second, some variables may contain considerable measurement error. According to Mo and Waples (2011, p.106), "most of the analyses use data collected from questionnaires that are inherently subject to self-selection bias". A remedy for this problem is to observe the student. However, Garcia and Jenkins (2003, p.29) stated "This may lead to a Hawthorne Effect with performance improving simply because student knows that observation is taking place". Measurement bias may occur by the influence of the observer on the students' behavior. In contrast, related course score as a predictor of course performance is a legitimate and objective variable with minor measurement error. A third concern is the arbitrary composition of explanatory variables, particularly for the related course performances. Some course relations are taken into account and some other courses are neglected without expressing the rationale. Required skills for business courses may be structured into sub-groups of courses. There may be relationship patterns among courses which indicate an important factor to be controlled in course performance prediction models. Based on these arguments, we concentrate on performance interrelations for Accounting and Finance in undergraduate business program.

Course performance is usually measured by course grade or final course score. For a robust comparison of course performances, factors that Guney (2009) mentioned as student-exogenous have to be considered for the research environment. Course score comparability depends on the equivalence of performance factors which are related to teaching, course material and examination. These factors may vary across courses in a regular face to face education program with diverse teaching conditions. We collected research data from Anadolu University Open Education System which has a standardized education process and objective examination for each course. Hence, there is minor concern over course performance comparability and course-specific factors can be observed by course interrelations.

Research Environment

Equivalence of performance factors such as the teaching method, course material, examination and evaluation methods were mentioned to be important for a robust course performance comparison. Distance learning with a standardized education process is suitable for this type of research. Accordingly, we preferred distance learning environment, namely Anadolu University Open Education System (OES). Anadolu University OES develops and distributes large scale programs via printed and web based materials to students in Turkey, Azerbaijan and 6 European countries. Anadolu University, which has completed the 33rd year of the Open Education System as of the 2015-2016 academic year, continues to offer educational services with 17 undergraduate and 34 associate degree programs (Anadolu University website). The programs have 1,388,573 students in 2015 (Anadolu University OE e-bulletin June Issue, 2015). As Figure 1 illustrates, the research environment is able to provide large number of observations.

Associate degree programs are Pearson Assured accredited in 2015 and bachelor degree programs are in accreditation process (Anadolu University OE e-bulletin April Issue, 2015). This yields additional reliability of educational quality standards. Anadolu University has specialized distance learning faculties, e.g. Faculty of Business Administration, Faculty of Economics, and departments for OES. The Distance Education Design Department coordinates the production of learning materials such as self-directed learning textbooks and other learning materials, which are co-developed by more than 750 authors and editors (Latchem, Ozkul, Aydin & Mutlu, 2006).



Figure 1. Number of active students by years
Source: Open Education System Student Statistics (Students enrolled in Fall)

This assures each course to meet course objectives. Evaluation of course performances are conducted through multiple choice tests. Teams of education specialists at Test Research Center developed the tests. The appropriateness and effectiveness of both the instruction of courses and the examinations are also monitored at Test Research Center. These conditions are deemed to be adequate for an analysis of course performance interrelations.

Variable Composition

Undergraduate business programs have various courses that construct abilities and competencies for prospective business professionals. These can be business core courses or courses from other disciplines. If the scope of research is limited to accounting and finance based courses, then it is plausible to investigate solely business core courses for the interrelations. However there are some theoretical relationships between accounting courses and others, such as quantitative courses. Those connections are to be covered after gaining understanding from a wider perspective.

Terzi et al. (2013) investigated Turkish undergraduate business programs and reported that accounting and auditing courses constitute an average of 15 percent, finance related courses and economics constitute an average of 18 percent, business management and organization courses constitute an average of 18 percent of compulsory courses in state universities on the basis of European Credit Transfer and Accumulation System (ECTS). Cumulative proportion of these courses is roughly over half of the program. Anadolu University OES undergraduate business program follows the proportional structure of the programs in Turkey, a participant country of Bologna Process - European Higher Education Area.

Schelfhauert and Crittenden (2005) interviewed with business consulting and accounting leaders and revealed that the functional depth might be essential for entry-level position. That means accounting courses are the most important courses for a beginner accountant. However, it is important to understand costs and income (accounting and finance insight) to do any effective planning and related performance evaluation (management insight) in a given market structure (economics insight). Thus, business core courses are the most important and theoretically integrated components of accounting and finance education. An a priori assumption had been made and the following groups of courses were taken into account as business core courses: management and organization courses, Principles of Economics and courses for accounting and finance. Although it is somewhat difficult to form theoretical transitions between selected subjects and marketing, Introductory Marketing Course was added for conducting a more comprehensive research. Course set determination process was carried out under scrutiny and core courses were retained as much as possible, while observation maximization was a minor criterion.

A detailed review of course contents helped us distinguish which courses are to be considered as business core courses. As being educational members of Anadolu University OES undergraduate business program, we were able to obtain content information of the

courses. Each of the courses has a standardized study material and course information documentation, which are helpful for an unbiased elimination process.

The International Accounting Education Standards Board determined three business core components in the International Education Standards documentation (IES 2, 2012). The primary knowledge part of professional accounting education programs is shown under three major headings: 1. Accounting, finance and related knowledge; 2. Organizational and business knowledge; and 3. Information technology knowledge and competences. From our point of view, first and second major components are core competencies. The third component is a complementary competency for the contemporary business environment. In addition to this, learning process and applications for information technology (IT) courses are divergent from business core courses. Inclusion of IT courses would hamper a sound performance comparison. For the purpose of the study, IT course is compromised, even though it is essential for business job requirements. Eventually, except for IT, our set covers IES 2 major education headings.

In an undergraduate program, final evaluation of student success is the overall score which determines whether or not the student passes the course. A-F basis grading may also be a good proxy for student performance, yet some information loss is possible due to the wider gap between grades. Fedoryshyn et al. (2010, p.97) argued that "the numerical grade provided a more precise measure and differentiates students with the same final grade but different numerical averages". Celik and Ecer (2009) used examination scores as measures of knowledge and skills acquired by students. One can argue that being enthusiastic about a course distinctly may lead the student to study more and score high. Thus, the overall score may inform less about being capable or skilled. Without involving any debate over which one is more dominant on success, overall score is considered as a valid proxy for students' course specific abilities. In the set, there is at least one course for each year and both courses are taken if the course is separated into two semesters. Therefore, any potential year/semester related factors can be captured. Student may perform better or worse in a specific period due to time-varying factors such as psychological condition and level of workload. If there is a strong relationship among courses which are taken in specific period of time, this may indicate that course performance is not a good indicator of student ability. Non-appearance of such a factor provides additional validity for the variables.

HYPOTHESES

Borde et al. (1996) reported positive relationship between the Introductory Finance and Accounting course. Drenann and Rohde (2002) argued that the combination of quantitative, analytic and interpretive performance criteria were similar for accounting and finance. According to these arguments, H0.1 null hypothesis is expected to be rejected.

H0.1: Accounting course scores are not distinctively correlated to finance course scores in the set of business core course scores.

Pritchard et al. (2004) found that students of Accounting and Finance majors showed more similar skills compared to the students of other Business majors such as Marketing and Management. On the other hand, Baker et al. (2010) have found that prerequisite accounting course performances were statistically significant predictors for subsequent business course performances. This statement implies accounting courses are so involved with the remainder of business courses, that a strong relationship may be expected between accounting course scores and management course scores. According to these opposing arguments, H0.2 null hypothesis is developed.

H0.2: Accounting and finance course scores are not distinctively correlated to management course scores in the set of business core course scores.

Eskew and Faley (1988), Doran et al. (1991), Bernardi and Bean (2002) Drenann and Rohde (2002), Hartnett et al. (2004), Maksy and Zheng (2008), Maksy (2012) reported that prior accounting courses positively affected subsequent accounting courses. On the finance

branch, similar findings are reported by Ely and Hittle (1990) and Trine and Schellenger (1999). Based on these arguments, H0.3 null hypothesis is expected to be rejected.

H0.3: Accounting and finance prior course scores are not distinctively correlated to subsequent accounting and finance courses in the set of business core course scores.

Maksy and Zheng (2008) and Maksy and Wagaman (2012) found a positive relationship between Intermediate Accounting and Auditing. However, there may be a higher correlation between Auditing and management courses, as auditing requires a deep understanding of managerial concepts. Thus management course performance interrelation may suppress the correlations between auditing and accounting courses. According to these opposing arguments, H0.4 null hypothesis is developed.

H0.4: Auditing course score are not distinctively correlated to accounting course scores in the set of business core course scores.

Eskew and Faley (1988), Tho (1994) Gist et al. (1996), Koh and Koh (1999) Güney (2009), Uyar and Gungormus (2011), Fedoryshyn et al. (2010) reported a positive relationship between Mathematics performance and Financial Accounting performance. Mathematics course performance is a common independent variable in accounting course performance models in order to control the numeracy of student. However, Mathematics deals with logical reasoning as well as numerical processing. Even secondary school Mathematics course syllabus covers a wider range of topics than the accounting course requirements. Thus, Mathematics score may not be a statistically significant predictor of accounting course performance. According to these opposing arguments, H.05 null hypothesis is developed.

H0.5: Mathematics course score is not a significant predictor of Financial Accounting course score.

Cost Accounting may differ from Financial Accounting in use of statistics. For example, regression analysis is one of the methods for separating mixed costs into their fixed and variable cost components. Kirk and Spector (2006) reported that course performance in Mathematics was not significant. In contrast, success in Statistics was highly significant in explaining success in cost accounting. Alcock et al. (2008) reported insignificant Mathematics performance relationship as well. According to these arguments, H06 null hypothesis is expected to be rejected while H.07 null hypothesis is expected not to be rejected.

H0.6: Statistics course score is not a significant predictor of Cost Accounting course score.

H0.7: Mathematics course score is not a significant predictor of Cost Accounting course score.

Didia and Hasnat (1998), Trine and Schellenger (1999) Marcal and Roberts (2001) Grover et al. (2010) found that Mathematics score (or quantitative skills test score) was a positive predictor of finance course performance. Anderson et al. (1994), Ballard and Johnson (2004) reported similar findings for Economics course performance. Drenann and Rohde (2002), Marcal and Roberts (2001) found positive relationship between Statistics course score and Finance course score. Based on these studies, H.08-H0.9 null hypotheses are developed.

H0.8a: Mathematics course score is not a significant predictor of finance course scores.

H0.8b: Statistics course score is not a significant predictor of finance course scores.

H0.9a: Mathematics course score is not a significant predictor of economics course scores.

H0.9b: Statistics course score is not a significant predictor of economics course scores.

An important educational aspect of Auditing course is to provide ethical background for accounting students. Cohen and Pant (1989), Bampton and Cowton (2002), Uyar and Gungormus (2013), Anzeh and Abed (2015) indicated that Auditing was the most suitable

course for ethical topics. Auditing courses are supposed to cover ethical discussions and accounting ethics. Hence, there may be a significant relationship between Auditing and the prior Business Ethics course. According to this argument, H0.10 null hypothesis is expected to be rejected.

H0.10: Business Ethics score is not a significant predictor of Auditing score.

METHODOLOGY

The research design is clearly described and appropriate for the purpose of the study. Overall scores are the measured variables for the structural analysis of underlying performance factors in undergraduate business program. In this phase, an analysis methodology is required to identify interpretable constructs that explain correlations of measured variables. The constructs are to be revealed by distinguishing course sub-groups in business core courses group. These sub-groups are assumed to be formed by some underlying variables (for example required skills and knowledge), which can be defined as latent variables. Exploratory factor analysis is appropriate for the research objective, as it is a suitable approach to identify unobservable variables that account for correlations among course performances.

Identifying clusters of variables based on the interrelations technique is generally implemented for three main purposes. First one is to reduce data to a more manageable size, while keeping as much of the initial information. This application also helps mitigating multicollinearity problems in a multivariate regression. Second is to construct a questionnaire to measure underlying variables. This is the common application of factor analysis in related literature; generating factor analyzed variables from a questionnaire and adding them into the multivariate regression models. A third application of factor analysis is to determine the structure of a set of variables. We adopted the third application of factor analysis. Instead of having limited observations and artificially created questionnaire variables, our research covers a vast observation set (11,646 students graduated in 2015) with naturally formed variables (students' overall course scores). This manner resembles more of a natural science factor analysis. For example, Riemann et al. (2002) gathered many regional soil samples and investigated various geochemical matters' quantities by factor analysis. Our intention is to gather student samples and to investigate various course scores by factor analysis. The present study shares the essence of their approach and avoids subjective investigations on course performance interrelations.

Exploratory factor analysis (EFA) and principal component analysis (PCA) are two approaches used for assessment of underlying dimensions and there is confusion about which one is applicable for what purpose. Briefly, PCA is a data reduction method. Its purpose is to arrive at a reduced number of components that explain most of the variance of a relatively larger set of variables. If the goal is to determine composites of measured variables that retain as much of the variance as possible, then PCA is applicable. On the other side, in order to identify interpretable forming of variables that explain correlations, EFA is the right choice. According to Preacher and Maccallum (2003), EFA's success is not determined by the explanation level of the variance, because the approach is not intended to reach an optimal explanation level of variance. As an extraction technique, PCA has an iterative component reduction process. This helps explaining the variance as much as possible with less components. Without this iteration, PCA can be used as a factor extraction technique with EFA approach. Pedhazur and Schmelkin (1991) argued that PCA technique is applicable in factor analysis as it revealed a great deal of information about the number and nature of factors. In our study, we use EFA approach with non-iterative PCA extraction technique.

Hypotheses and their testing are foundations of modern scientific methodology. Our research is designed to conform to this methodology as well. However there are some shortcomings of using EFA as a confirmation for an *a priori* hypothesis test. According to Riemann et al. (2002, p.203) "Factor analysis cannot be used as a proof for the existence

of certain processes – it can indicate certain relations and help stimulate ideas, they have to be proven in different way”. Furthermore, Tabachnick and Fidell (2012, p.656) stated “tests of theory (in which theoretical factor loadings are compared with those derived from a sample) and comparisons among groups are currently the province of structural equation modeling”. Yet these explanations may not be considered as an objection to applying EFA for hypothesis testing. Since factor loadings have statistical significance, hypothesis over correlated variable sub-groups can still be appropriate for statistical testing, e.g. hypothesis for some courses being in the same component/sub-group. Another way to overcome the confirmation problems of EFA is adopting *a posteriori* hypotheses. Erren (2007) argues for the value of clearly stating *a posteriori* hypotheses as the result of advanced thinking in the course of a scientific study. *A posteriori* hypotheses reflect the author’s inference in a research scheme. Eventually, it is a preference of presentation, an alternative to introduce post hoc analysis. In our study, hypotheses set is a combination of *a priori* and *a posteriori* hypotheses: H0.1, H0.2 and H0.5 - H0.10 are *a priori* hypothesis which initiated the research. H0.3 and H0.4 are *a posteriori* hypotheses.

ANALYSIS

In this section, descriptive statistics, sampling adequacy and reliability are presented separately. H0.1 - H0.4 are hypotheses are to be covered in Section 5.2: Factor Analysis. H0.5 - H0.10 are to be covered in Section 5.3: Regression Analysis and its sub-sections.

Sample

Analysis data was gathered from Anadolu University IT Department in transcript format. Bulk data was handled and formatted for SPSS input scheme. The sample consists of all (11,646) graduated students in 2015. Hence, sample is the program population. Descriptive statistics for the business core courses data are presented in Table.1. Year and semester based course sequence for business core courses resides in the table. The sequence information is to be referred to Section 5.2: Factor Analysis and Section 6: Discussion.

Guney (2009) stated that the average grades for accounting courses tends to be lower than others. In Table 1, accounting and finance courses have lower overall scores than management courses (except for Organization Theory).

Table 1. Business Core Course Sequence and Overall Scores Descriptive Statistics

Code	Course	Year / Semester	Mean	Std. Dev.	N
MUH103	Financial Accounting I	1 / 1	53.352	10.795	11,646
MUH104	Financial Accounting II	1 / 2	42.750	10.333	11,646
MUH301	Cost Accounting	3 / 1	50.061	8.967	11,646
ISL401	Auditing	4 / 1	45.773	8.752	11,646
FIN201	Financial Management I	3 / 1	45.766	9.323	11,646
FIN202	Financial Management II	3 / 2	46.723	8.749	11,646
FIN402	Financial Statement Analysis	4 / 2	43.790	10.304	11,646
ISL403	Financial Institutions and	4 / 1	54.623	11.332	11,646
IKT103	Principles of Economics I	1 / 1	50.582	11.084	11,646
IKT104	Principles of Economics II	1 / 2	46.807	11.225	11,646
ISL405	Strategic Management I	4 / 1	60.117	13.217	11,646
ISL406	Strategic Management II	4 / 2	56.165	12.395	11,646
ISL302	Organization Theory	3 / 2	40.429	9.251	11,646
PZL103	Marketing Management	2 / 2	57.546	11.319	11,646

Large sample size makes factor analysis more reliable. MacCallum et al. (1999) demonstrated that 100 to 200 sample size is acceptable with appropriate factors. Comrey and Lee (1992) classified 100 as a poor sample size, 300 as good and 1000 as excellent for

factor analysis. Our sample size, 11,646, is far beyond these quantities and this is the strength of our sample compared to other research samples in the literature. The sample has Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy 0.87, a satisfactory score for conducting factor analysis.

An appropriate factor analysis needs fair amount of correlation between measured variables. As a preliminary examination of this condition, Bartlett's Test controls whether the correlations are significantly different from zero. For our sample, Bartlett's Test is significant at a level of 0.1%.

Reliability means that a measure should consistently reflect the construct that it is measuring. Reliability score Cronbach's Alpha is 0.766, which means reliability is a minor concern for the measurement of business core courses performance. On the other hand, if a measure has more than one concept or construct, it may not make sense to report Cronbach Alpha for the complete measure, as the larger number of entities will inevitable inflate the value of Cronbach Alpha. According to Tavakol and Dennick (2011), Cronbach Alpha should be calculated for each of the construct rather than for the entire test or scale. Cronbach Alpha is to be reported for each component in Section 5.2: Factor Analysis. Validity is another pillar of measurement evaluation that is concerned with the extent to which an instrument measures what it is intended to measure (for validity arguments, see Section 2.2: Variable Composition). Overall scores, in other words final marks, are smoothed data by its nature. Overall scores are averages of several exams throughout the semester; non-existence of outliers is presumed. Thereby, data intervention, such as truncating, is avoided.

Assumptions regarding the distributions of variables are less important when factor analysis and principal component analysis are used descriptively to summarize the relationships in a large set of observed variables. If the variables are normally distributed, the solution is enhanced and more reliable. However, multivariate normality is assumed when statistical inference is used to determine the factors. Multivariate normality assumption means that all variables, and all linear combinations of variables, are normally distributed. Tabachnick and Fidell (2012) argued that normality of single variables could be assessed by skewness and kurtosis. For our sample, skewness and kurtosis values are slightly deviated from normal distribution parameters, which have to be zero (for SPSS) and there are a few values over 1. In this situation, data transformations may result in an improvement.

Data transformation is a tool for obtaining a particular type of distribution. In addition, it was also used, as Treiblmaier and Filzmoser (2010) argued, to establish a simple systematic relationship between an independent and a dependent variable as well as to stabilize the variance. In econometric studies, logarithmic transformation is applicable for indicating elasticities and establishing a comparable relationship between variables. In a full log-transformed model, a percentage change of the dependent variable affects the dependent variable as a unit of percentage. Log-transformed course performances may be interpreted in the same way. Hartnett et al. (2004) used log-transformation of the student performance grades to strengthen normality and variance homoscedasticity assumptions. Values for skewness and kurtosis for both logarithmic and non-logarithmic data presented in Table 2.

Table 2. Variable Normality Parameters Before and After Log-Transformation

Code	Non-Logarithmic		Logarithmic Data		Improvement over	
	Skewness	Kurtosis	Skewness	Kurtosis	Skewne	Kurtosis
MUH103	0.391	-0.014	-0.141	-0.228	+	-
MUH104	0.929	1.009	0.317	-0.306	+	+
MUH301	0.639	0.679	0.081	0.086	+	+
ISL401	0.733	0.479	0.268	-0.387	+	+
FIN201	0.832	0.902	0.274	-0.165	+	+
FIN202	0.817	1.214	0.241	-0.018	+	+
FIN402	0.815	0.453	0.304	-0.53	+	-
IKT103	0.524	0.249	-0.063	-0.243	+	+
IKT104	0.812	0.69	0.196	-0.293	+	+
ISL403	0.472	-0.186	0.01	-0.531	+	-
ISL302	1.14	1.664	0.535	-0.057	+	+
ISL405	0.265	-0.455	-0.223	-0.464	+	-
ISL406	0.231	-0.504	-0.223	-0.634	+	-
PZL103	0.478	-0.148	0.02	-0.417	+	-

Logarithmic transformation makes certain improvement for the skewness values, while it makes moderate improvement over kurtosis values. Moreover, transformation effectively reduces extreme values above 1. Nevertheless, transformed variables failed at Shapiro-Wilk and Lilliefors Tests of Normality. A Power transform, namely Box-Cox transform is another prospect for the normality tests (Box & Cox, 1964). Osborne (2010, p.5) stated that "Given that Box-Cox parameter lambda can take on an almost infinite number of values, one can calibrate a transformation to be maximally effective in moving a variable toward normality, regardless of whether it is negatively or positively skewed". Data was Box-Cox transformed with optimum lambda estimated by the Matlab function. Box-Cox transformed variables failed the normality tests as well. The results were neither any better, nor more easily interpretable than the results obtained with the same data with log-transformation. Measured variables of our research are in the same unit. The parity enables comparisons without complication. However, even though the variables are in the same unit, some comparison problems may occur due to distribution parameter differences. While it is preferred to calculate standard beta coefficients for regression models, there is no such application for the factor analysis; log-transformed variables are considered adequate. When the raw data is used in factor analysis (the outcome is not reported in present study), the components are identical to the log-transformed results. This can be interpreted as robustness of the analysis. However, there is difference in factor loadings and we believe that the log-transformed loadings are more accurate.

Factor Analysis

Correlation coefficients for each pair of variables were calculated first. Correlation matrix helps clarify course interrelations and allows for a reproduction of factor analysis outcome (see Appendix A). There is no negative correlations among courses except one, which is almost zero. Wider range of correlations could be monitored if course set was not internally consistent. Supporting courses from other disciplines, e.g. Mathematics, Law and Information Technology might show negative correlations due to greater difference in prerequisite skills and knowledge. In our study, the course set is limited to business core courses in the program and thus, positive correlations are observed as expected.

Table 3. Obliquely Rotated Component Loadings

		MAN	AFE-2	AFE-1
ISL405	Strategic Management I	0.697		
ISL406	Strategic Management II	0.671		
ISL403	Financial Institutions and Markets	0.584		
ISL302	Organization Theory	0.528		
ISL401	Auditing	0.491		
PZL103	Marketing Management	0.446		
MUH104	Financial Accounting II		0.629	
FIN202	Financial Management II		0.612	
FIN402	Financial Statement Analysis		0.540	
IKT104U	Principles of Economics II		0.510	
MUH103	Financial Accounting I			0.687
IKT103	Principles of Economics I			0.607
MUH301	Cost Accounting			0.585
FIN201	Financial Management I			0.581
Eigenvalues (values > 1)		3.58	1.39	1.08
Explained Total Variance (% , Cumulative)		25.59	35.6	43.24
Crombach Alpha (Overall 0.77)		0.69	0.52	0.58
Number of Items (Loading > 0.40)		6	4	4

When inspected as a whole, the correlation matrix has lower intermediate level of correlations. Low levels of correlation may indicate that students' intrinsic characteristic that cannot be measured by the present data do not suppress course specific characteristic. For example, if being hardworking overly affected all course scores no matter what the course was, then there would have been less course specific effects, even with high correlations. To conclude, correlations are appropriate and as mentioned before, Bartlett's Test score is sufficient for conducting factor analysis.

Calculation of the correlation coefficient matrix initiates factor analysis. The following procedure is to reduce the correlation matrix down to its underlying dimensions by clustering variables. This reduction is achieved by searching for variables that have high correlations among themselves, but have low correlations with other variables. These groups are called factors (or components) and are obtained by factor extraction. The convention is to retain factors which have eigenvalues over 1. Scree plot observation also helps determine which factor to be included. Zwick and Velicer (1986) recommended parallel analysis instead of scree plot and Kaiser's criterion. In our analysis, scree plot graph criterion and Kaiser's criterion gave consistent results, as the point of flexion is right before the factor has an eigenvalue over 1. Other criteria, including parallel analysis, are skipped and three factors are retained after extraction. For precise factor items and their loadings, factor rotation is needed. Field (2009) stated if there were theoretical grounds for supposing that the factors might correlate, then oblique rotation (direct oblimin, with default delta) should be selected. Our theoretical ground is that all courses are affected more or less by students' intrinsic characteristics, e.g. diligence, thereby factor groups of courses are expected to be correlated. Moreover, Browne (2001, p.114) stated that "oblique rotation is probably more appropriate in most practical situations".

Any loading that is going to be used to interpret a factor should be statistically significant at a minimum. Stevens (2009) argued that loadings in very large samples were reliable without a significance test. With 11,646 observations, our sample outnumbers common definitions of large sample size. Stevens (2009, p.332) stated that "Once one is confident

that loadings being used for interpretation are significant (because of a significance test or because of large sample size), then the question becomes which loadings are large enough to be practically significant". The common threshold is 0.40 or greater loadings for interpretation purposes. When loadings less than 0.40 are suppressed, the analysis yields a three-factor solution with a simple structure. The results of an oblique rotation (converged in 7 iterations) of the solution are shown in Table 3.

When inspected as a whole, factor analysis decomposes the components of business core courses are clustered in smaller internally correlated sub-groups. Here, factor analysis outcome exhibits three groupings of courses that contribute students' performance on a business core course set.

The first component is the most influential course group which covers management courses. We will use a label, "MAN", for this sub-group. MAN includes Auditing, Financial Institutions and Markets. These courses are hybrid courses which mostly have management concepts with accounting and finance themes. Financial Institutions and Markets is a systematic introduction of financial system and regulations. Auditing is not a pure accounting course. In fact, Auditing covers operational audits, as well as financial audits.

The second and third sub-groups consist of accounting, finance and economics courses. There is a clear pattern that introductory courses of these subjects cluster in the third component and subsequent courses constitute the second component. As a single semester course, Cost Accounting is a first-time course which take part in third component. On the other hand, Financial Statement Analysis is a subsequent course which is based on prior accounting and finance courses. We will use a label, "AFE-1", for the prior courses sub-group and, "AFE-2", for the subsequent accounting, finance and economics courses sub-group. As large sample size justifies the significance of factor loadings, hypothesis tests are based on course placement among the components defined in factor analysis outcome:

- Accounting courses and finance courses are in the same component. Therefore the first null hypothesis is rejected in favor of the following alternative hypothesis (H_a):
H_{a.1}: Accounting course scores are distinctively correlated to finance course scores in the set of business core course scores.
- Accounting and finance courses are not in the same component with management courses. Therefore the following null hypothesis is failed to be rejected:
H_{0.2}: Accounting and finance course scores are not distinctively correlated to management course scores in the set of business core course scores.
- Sequential accounting and finance courses are not in the same component. Therefore, the following null hypothesis H_{0.3} is failed to be rejected:
H_{0.3}: Accounting and finance prior course scores are not distinctively correlated to subsequent accounting and finance courses in the set of business core course scores.
- Auditing course is not in the same component with accounting courses. Therefore, the following null hypothesis H_{0.4} is failed to be rejected:
H_{0.4}: Auditing course score are not distinctively correlated to accounting course scores in the set of business core course scores.

A post hoc analysis can be designed to investigate the reason behind the decomposition of business core courses. The course scores are assumingly determined by underlying performance factors, in particular, required skills and knowledge. As a result, sub-groups of courses are expected to be formed by these factors. At this point, we propose a comparison of sub-groups (MAN, AFE-1, AFE-2) with the documented data for the assessment of course contributions to business program objectives.

Students' overall success depends on aggregate set of skills and knowledge that is cooperatively developed by the delivery of courses in the program. This set is comprehensively defined in the

business program documentation. We inspected the documentation that covers 19 items of objectives standardized for each course. In this study, objectives are reduced down to five items with respect to their importance and research relevancy:

- Analytical thinking and problem solving skills (Analytical, item 1)
- Verbal skills and written communication proficiency (Verbal, item 10)
- Knowledge and skills in business practices (Knowledge, item 2)
- Organizational and managerial skills (Organizational, item 7)
- Interpersonal skills (Interpersonal, item 3)

The program documentation comprises assessment of course contributions to the objectives. The courses were assessed by Educational Members Committee under the supervision of the Distance Education Design Department. The assessment presented in Table 4 has a four category rating scale (0-3), where zero represents "no contribution".

Table 4. Assessments of Course Contributions to Business Program Objectives

		Analytical	Verbal	Knowledge	Organizational	Interpersonal	Total
ISL405	Strategic Management I	3	3	3	3	2	14
ISL406	Strategic Management II	3	3	3	3	3	15
ISL403	Financial Institutions and	0	1	1	0	1	3
ISL302	Organization Theory	2	2	1	3	2	10
ISL401	Auditing	2	2	1	2	2	9
PZL103	Marketing Management	2	2	2	2	1	9
	MAN Avg. Rating	2.00	2.17	1.83	2.17	1.83	10
MUH104	Financial Accounting II	2	2	2	1	0	7
FIN202	Financial Management II	3	1	1	1	0	6
FIN402	Financial Statement Analysis	2	2	2	3	2	11
IKT104	Principles of Economics II	1	1	1	0	1	4
	AFE-2 Avg. Rating	2.00	1.50	1.50	1.25	0.75	7
MUH103	Financial Accounting I	2	2	2	1	0	7
IKT103	Principles of Economics I	1	0	1	0	0	2
MUH301	Cost Accounting	3	2	2	1	2	10
FIN201	Financial Management I	3	2	2	3	2	12
	AFE-1 Avg. Rating	2.00	1.33	1.67	0.67	0.67	6.33

According to the program objectives, courses are designed to develop the attributes presented in Table 4. From another perspective, these attributes are the required skills and knowledge to be developed for being successful in a specific course. In this manner, average ratings are comparable so as to reveal sub-group differences in terms of skills and knowledge.

First, the sum of average ratings are in the same order with the factor loadings. MAN has the most contributive courses to the program objectives. AFE-2 and AFE-1 have similar contribution ratings for similar items. MAN differs from the others with higher ratings, except for analytical thinking and problem solving skills. MAN has notably high ratings for organizational and managerial skills. Thus, a name such as management-oriented courses is appropriate for MAN. This group of courses require (or develop) verbal skills more than AFE-1 and AFE-2 courses. Some courses have lower total ratings than others. As mentioned

before, we selected five items from a larger set of objectives in the documentation. This may be the reason for an unbalanced total ratings among courses. Nevertheless, this unbalance is not a handicap for our intent. Post hoc analysis provides evidence for the fact that sub-groups of courses are formed according to required skills and knowledge.

Regression Analysis

In the previous section, factor analysis has revealed sub-groups of courses according to course interrelations among business core courses. However, undergraduate business program has many supplementary courses that further equip students for their professional career. Some supplementary courses may have performance determinants similar to accounting and finance courses. For example, Guney (2009) reported this similarity as the predictive power of a specific course (Mathematics) score on a target course (Accounting) performance. In this section, regression analysis is proposed to test null hypotheses H0.5-H0.10, which are in line with the previous studies. Our interest is the underlying performance factor similarity, instead of predicting course performance. This will establish business core course interrelations with supplementary courses, particularly Mathematics and Statistics.

The studies that have been mentioned thus far mostly controlled GPA as a measure of general student ability that affects individual course performances. GPA has the potential to be the most effective and statistically significant explanatory variable in course performance regression models. Hence, it has to be controlled when regressing the course performances. In our model, GPA is an average of course scores weighted by their respective ECTS credits.

Our scheme aims to explain target course score as a dependent variable by a bivariate regression model. The independent variables are related course score and GPA. Multicollinearity may be a concern, as both GPA and individual course scores measure similar attributes. However, the research data exhibits lower intermediate level of correlations. In addition, variance inflation factors (VIF) are below 3 for the entire set of bivariate models with raw data. These indicate a low risk of multicollinearity.

Coefficient interpretation for the same scale variables is straightforward. A single unit change in the independent variable results in several unit changes in the dependent variable which is equal to the respective regression coefficient of the independent variable. However, comparison of independent variable coefficients may be inaccurate with incompatible means and standard deviations. On the other hand, standardized coefficients are comparable as they all refer to a one standard deviation change in their respective independent variables rather than a one unit change. In the regression outcome, standardized coefficients are reported as well.

Regression Analysis for the Components

Factor analysis suggested three components of courses that contribute students' performance on a business core course set. MAN covers management-oriented courses. AFE-2 and AFE-1 cover accounting, finance and economics courses by their sequence. These patterns may be caused by similarities within group courses in terms of required skills and knowledge. As it is presented in Section 1: Literature Review, prior studies found that Mathematics course score was a positive predictor of course performance for accounting, finance and economics courses. We interpret these findings as the sign that quantitative and analytical reasoning skills are in the required skills set of those courses. AFE-1 and AFE-2 courses may differ from MAN courses with a significant coefficient of Mathematics score variable. A similar result can be expected for the Statistics score, as it is another quantitative course in a business undergraduate program. Bivariate regression output for Mathematics and factor analysis sub-groups interrelations are presented in Table 5.

Table 5. Sub-Groups Average Score Prediction Model with Mathematics Score

Independent Variable: Mathematics Courses Avg. MAT (MAT105, MAT106)

Dependent Variable	Coefficients		Standardized		Model Statistics	
	MAT	GPA	MAT	GPA	F prob.	R ²
MAN Avg. Score	-0.035 (0.000)	1.026 (0.000)	-0.080***	0.942***	0.000	0.834
AFE-2 Avg. Score	0.002 (0.905)	1.057 (0.000)	0.003	0.862***	0.000	0.745
AFE-1 Avg. Score	0.067 (0.000)	0.991 (0.000)	0.129***	0.772***	0.000	0.690

Collinearity Statistics for Independent Variables, Tolerance: 0.847 VIF: 1.181

*Significance values in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01*

The undergraduate business program comprises mathematics courses (MAT105, MAT106) in the first and second semesters of the freshman year. Statistics courses (IST201, IST202) are delivered in the first and second semesters of the sophomore year. These courses are averaged into single mathematics and statistics course scores. Course scores in each sub-group are averaged into a combined group score. Bivariate regression output for statistics course and factor analysis sub-groups interrelations are presented in Table 6.

Table 6. Sub-Groups Average Score Prediction Model with Statistics Course Score

Independent Variable: Statistics Courses Avg. IST (IST201, IST202)

Dependent Variable	Coefficients		Standardized		Model Statistics	
	IST	GPA	IST	GPA	F prob.	R ²
MAN Avg. Score	-0.027 (0.032)	1.033 (0.000)	-0.039**	0.945***	0.000	0.851
AFE-2 Avg. Score	0.005 (0.777)	1.011 (0.000)	0.007	0.858***	0.000	0.741
AFE-1 Avg. Score	0.089 0.000	0.953 0.000	0.115***	0.770***	0.000	0.707

Collinearity Statistics for Independent Variables, Tolerance: 0.673 VIF: 1.485

*Significance values in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01*

Regression models in Table 5 and Table 6 are all significant as a whole (F prob. 0.00) with medium-high percentages of variance explained by the model. GPA is significant and the dominant predictor in all models. Mathematics and Statistics course score coefficients are positive, but insignificant for AFE-2 courses. This group covers Financial Accounting II, Financial Management II, Principles of Economics II and Financial Statement Analysis. On the other side, Mathematics and Statistics course scores are positive and significant predictors of AFE-1 courses' average score. This group covers Financial Accounting I, Cost Accounting, Financial Management I and Principles of Economics I.

MAN covers management-oriented courses. Mathematics and Statistics course scores are negative and significant predictors of MAN courses' average score. First, this may indicate that quantitative and analytical reasoning skills are not in the required skillset for these courses. Quantitative reasoning skills may be the performance factor that differentiates the sub-groups of business core courses. The students intended for management majors had the lowest Graduate Record Examinations (GRE) quantitative reasoning score average among the students intended for Business majors, including accounting and, banking and finance (Educational Testing Service, 2014). This may imply that management studies require less quantitative reasoning skills than accounting and finance. Second, the students

who are motivated for management oriented courses probably lack interest for quantitative courses. These students may perform worse in Mathematics and Statistics.

MAN courses are courses that are mostly taught by verbal explanations and are provided by text-based written content. On the other side, such courses as accounting, finance and economics (AFE courses) are delivered mainly by expressions of schedules, graphics and are provided by quantitative processing of examples. MAN courses presumably require verbal reasoning skills more than quantitative reasoning skills. Thereby, we considered that MAN courses are verbal-oriented courses (in short, verbal courses).

The negative coefficient in Table 5 and Table 6 may be explained as a potential antagonism between verbal-oriented and quantitative courses. In the business program, some students tend to develop verbal skills and somehow neglect quantitative skills which result in a quantitative course apathy or discouragement. Inversely, some students tend to develop quantitative skills and neglect verbal skills, which result in a verbal-oriented course apathy or discouragement. This may be observed by regressing business course scores with completely quantitative (Mathematics, Statistics) or completely verbal-oriented (Linguistics) course scores. Accordingly, a regression outcome with basic verbal-oriented course score coefficient is expected to be opposite to Table 5 and Table 6 quantitative course score coefficients. The undergraduate business program comprises introductory linguistics course (TUR201), which is deemed to be a completely verbal-oriented course. Bivariate regression output for Introductory Linguistics course and factor analysis sub-groups interrelations are presented in Table 7.

Table 7. Sub-Groups Average Score Prediction Model with Linguistics Course Score

Independent Variable: Introductory Linguistics Course (TUR201)

Dependent Variable	Coefficients		Standardized		Model Statistics	
	TUR201	GPA	TUR201	GPA	F prob.	R ²
MAN Avg. Score	0.026 (0.074)	0.984 (0.000)	0.034*	0.909***	0.000	0.857
AFE-2 Avg. Score	-0.017 (0.415)	1.028 (0.000)	-0.020	0.875***	0.000	0.750
AFE-1 Avg. Score	-0.059 (0.016)	1.080 (0.000)	-0.065**	0.869***	0.000	0.707

Collinearity Statistics for Independent Variables, Tolerance: 0.783 VIF: 1.277

*Significance values in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01*

Introductory Linguistics course score coefficient is positive and significant for MAN courses. However, it is negative for the remaining sub-groups with statistical significance only for AFE-1. To summarize, Table 7 exhibits a reversed outcome compared to Table 5 and Table 6. There seems to be a contraposition of performance factors in MAN and AFE-1 courses. To conclude, MAN course performances are similar to verbal-oriented course characteristics. AFE-1 and AFE-2 course performances are similar to quantitative course characteristics, yet AFE-2 courses are more neutral.

Regression Analysis for the Hypotheses

Scores of sequential courses are averaged for Accounting (MUH103, 104), Finance (FIN201, 202) and Principles of Economics (IKT103, 104). Averaged scores are to be used in regression models in order to test the null hypotheses developed earlier. Bivariate regression outcomes for Mathematics and hypothesized courses interrelations are presented in Table 8.

Table 8. Accounting, Finance and Economics Score Prediction Model with Mathematics Score

Independent Variable: Mathematics Courses Avg. (MAT105, MAT106)

Dependent Variable	Coefficients		Standardized		Model Statistics	
	MAT	GPA	MAT	GPA	F prob.	R ²
Financial Accounting	0.019 (0.440)	1.087 (0.000)	0.030	0.670***	0.000	0.465
Cost Accounting	0.040 (0.191)	0.955 (0.000)	0.057	0.543***	0.000	0.322
Financial Management	0.048 (0.011)	1.106 (0.000)	0.082**	0.757***	0.000	0.629
Principles of Economics	0.094 (0.000)	0.929 (0.000)	0.163***	0.650***	0.000	0.532

Collinearity Statistics for Independent Variables, Tolerance: 0.847 VIF: 1.181

*Significance values in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01*

Mathematics course score coefficient is positive and significant for Financial Management and Principles of Economics, while it is insignificant for Financial Accounting and Cost Accounting. Hypothesis tests are based on statistical significances of the independent variable coefficient. Hypotheses H0.5 and H0.7 are failed to be rejected. Null hypotheses H0.8a and H0.9a are rejected in favor of the Ha.8a and Ha.9a alternative hypotheses. To conclude, our findings are:

H0.5: Mathematics course score is not a significant predictor of Financial Accounting course score

H0.7: Mathematics course score is not a significant predictor of Cost Accounting course score

Ha.8a: Mathematics course score is a significant predictor of finance course scores

Ha.9a: Mathematics course score is a significant predictor of economics course scores

Bivariate regression outcomes for Statistics course and hypothesized courses interrelations are presented in Table 9.

Table 9. Accounting, Finance and Economics Score Prediction Model with Statistics Course Score

Independent Variable: Statistics Courses Avg. (IST201, IST202)

Dependent Variable	Coefficients		Standardized		Model Statistics	
	IST	GPA	IST	GPA	F prob.	R ²
Financial Accounting	0.032 (0.334)	1.024 (0.000)	0.034	0.661***	0.000	0.462
Cost Accounting	0.137 (0.001)	0.814 (0.000)	0.134***	0.498***	0.000	0.340
Financial Management	0.065 (0.008)	1.057 (0.000)	0.075***	0.760***	0.000	0.648
Principles of Economics	0.085 (0.003)	0.960 (0.000)	0.096***	0.678***	0.000	0.541

Collinearity Statistics for Independent Variables, Tolerance: 0.673 VIF: 1.485

*Significance values in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01*

Statistics course score coefficient is positive and significant for Financial Management, Cost Accounting and Principles of Economics, while it is insignificant for Financial Accounting. Hypothesis tests are based on statistical significances of the independent variable coefficient. Null hypotheses H0.6, H0.8b and H0.9b are rejected in favor of the Ha.6, Ha.8b and Ha.9b alternative hypotheses. To conclude, our findings are:

Ha.6: Statistics course score is a significant predictor of Cost Accounting course score

Ha.8b: Statistics course score is a significant predictor of finance course scores

Ha.9b: Statistics course score is a significant predictor of economics course scores

Bivariate regression outcomes for Business Ethics and Auditing interrelation is presented in Table 10. Business Ethics is a verbal-oriented course, so it may require skills similar to MAN, which covers Auditing. A significant coefficient in Auditing course regression may stem from the required skillset instead of corresponding interests. Thus course sub-groups are also regressed with Business Ethics to control validity of a possible interpretation that establishes a relationship between Auditing and Business Ethics.

Table 10. Auditing Score and Sub-Groups Average Score Prediction Model with Business Ethics Score

Independent Variable: Ethic Course (ISL201)

Dependent Variable	Coefficients		Standardized		Model Statistics	
	ISL201	GPA	ISL201	GPA	F prob.	R ²
Auditing	0.018 (0.032)	0.832 (0.000)	0.020**	0.512***	0.000	0.274
MAN Avg. Score	0.006 (0.110)	1.169 (0.000)	0.009	0.873***	0.000	0.770
AFE-2 Avg. Score	-0.111 (0.000)	0.940 (0.000)	-0.162***	0.764***	0.000	0.471
AFE-1 Avg. Score	-0.116 (0.000)	1.050 (0.000)	-0.164***	0.822***	0.000	0.552

Business Ethics course score coefficient is positive and significant for Auditing course score, while it is insignificant for MAN average score. Business Ethics and Auditing relationship seems to be independent from the required skill similarity within MAN. The coefficient is negative and significant for both AFE-1 and AFE-2 that cover accounting, finance and economics courses. This pattern supports studies indicating that Auditing is the most suitable course for ethical topics. Null hypothesis H0.10 is rejected in favor of the Ha.10 alternative hypotheses. To conclude, our finding is:

Ha.10: Business Ethics score is a significant predictor of Auditing score

DISCUSSION

Factors affecting course performances were investigated in different schemes in the previous studies. Underneath the overall score interrelations, we assume that there are interpretable constructs of various factors. For our data, course scores are deemed to be equally affected by student-exogenous factors due to the standardized course delivery and examination process for each course. Our approach is to analyze business course interrelations and interpret underlying performance factors, particularly required skills and knowledge.

Business core courses are management courses, Principles of Economics and courses for accounting and finance. Factor analysis identifies three sub-groups of business core courses that explain the correlations between the overall scores. Management courses, Auditing, Financial Institutions and Markets are in the first sub-group (MAN). Financial Accounting II, Financial Management II, Principles of Economics II and Financial Statement Analysis are in the second sub-group (AFE-2). The third sub-group (AFE-1) comprises Financial Accounting I, Financial Management I, Principles of Economics I and

Cost Accounting. These groupings exhibit a clustering order, which can be attributed to underlying performance factor similarities.

Inferences can be based on the forming of courses in the sub-groups MAN, AFE-1 and AFE-2. First, time-varying factors have minor effect on course performances. If these factors were in control, the same year/semester courses would possibly be in the same sub-group. In the analysis outcome, each group has a scattered set of year/semester courses. Second, main sub-groups for accounting do not comprise Auditing course, which is essential for a student dedicated to pursue an accounting career path. A similar finding can be highlighted for a finance course, namely Financial Institutions and Markets, which is a fundamental subject for potential finance professionals. Therefore, career motivation may be argued to be a less important performance factor for accounting and finance students.

Course sub-groups are compared by the pre-assessed ratings of course specific skills and knowledge. The ratings are obtained from the assessment of course contributions to program objectives in the business program documentation. MAN has a high rating for organizational and managerial skills. Thus, it can be labeled as management-oriented courses. This group of courses require verbal skills more than others. AFE-1 and AFE-2 have similar contribution ratings for the skills. Thus, program objective ratings provide inadequate evidence for the AFE-1 and AFE-2 courses being formed by the program objective set of attributes. However, the findings are encouraging for widening the analysis of required skills and knowledge as a major performance factor.

Factor analysis suggests three components of courses that contribute to students' performance on a business core courses program. MAN covers management-oriented courses. AFE-1 is the introductory courses set, while AFE-2 is the subsequent courses set for accounting, finance and economics. Quantitative reasoning skills may be the performance factor that distinguishes AFE-1 from AFE-2. To test this argument, AFE-1 and AFE-2 group average of course scores is regressed onto quantitative course overall score and control variable GPA. The analysis outcome indicates that the introductory courses require quantitative and analytical reasoning skills more than the subsequent courses in accounting, finance and economics. Both the introductory and subsequent courses are concerned with monetary subjects from the business perspective. However, students' first encounter with these matters may be confusing to some extent. In accounting, finance and economics introductory courses, analytical reasoning skills are essential for a fresh learner to comprehend a complex set of fundamental concepts and connections between. When AFE-1 and AFE-2 courses are modeled as individual courses, each model has a positive coefficient for quantitative course scores. However the coefficient for Financial Accounting performance model is statistically insignificant and relatively lower.

Quantitative course scores partially explain clustering order of AFE-1 and AFE-2. Interest towards monetary issues may be a supportive performance factor which correlates course scores of accounting to finance and economics. Further research could be conducted for motivational performance factors, including interests involved to monetary subjects. This type of study requires methods of data gathering different than our research.

An unexpected outcome of our analysis is the negative and significant coefficient for linguistics course in the regression models for AFE-1. Our prediction was insignificant and low effect of verbal skills measured by linguistics course. Another unexpected outcome of our analysis is the negative and significant coefficient for quantitative courses in the regression models for MAN. Here, we predicted at least a non-negative effect of quantitative skills. The outcomes indicates a contradiction of performance factors for MAN and AFE-1 courses. Further research is suggested for motivational performance factors, including interest in quantitative and verbal-oriented subjects.

The forming of the course clusters and the interrelations discussed above may be caused by varying effect of distance education on course performances. Anstine and Skidmore (2005) found online learning method was less effective for a more quantitative course,

Statistics compared to Economics. Estalami (2012) reported the varying effects of distance education environment on marketing courses of different nature, such as qualitative (Marketing of Financial Services) and quantitative (Marketing Research) courses. Stevens and Zhu (2015) compared traditional course performance with online course performance and reported significantly lower grades for online quantitative business courses. According to these studies, course delivery effect can be seen as an endogenous performance factor which differentiated AFE and MAN course scores as these groups of courses are different in nature of being quantitative or qualitative oriented subjects. Furthermore, there may be a "within subject" differentiation as well as "between subject" differentiation of distance education effectiveness. Chen et al. (2013) investigated outcomes of principle-level and advanced-level accounting courses in both traditional and distance education environment. They argued that principle-level accounting courses better fitted to distance education environment than advanced accounting courses. This argument supports our basic grouping of course performances for AFE-1 and AFE-2 which comprises accounting and related courses. Again, course delivery effect can be seen as an endogenous performance factor which differentiated AFE-1 and AFE-2 courses as they are different in terms of being prior or subsequent subjects of accounting, finance and economics.

The findings of course performance interrelation analyses are presented in the form of hypothesis statement. First finding is that accounting course scores are distinctively correlated to finance course scores in the set of business core course scores. This finding is interpreted as performance factor similarities, the result is parallel to Drenann and Rohde (2002). Accounting and finance course scores are not distinctively correlated to management course scores in the set of business core course scores. This finding supports the argument of Pritchard et al. (2004), that accounting majors and finance majors demonstrate similar skills compared to the students of other business majors, such as marketing and management.

Accounting and finance prior course scores are not distinctively correlated to subsequent accounting and finance courses in the set of business core course scores. This statement does not mean that the prior accounting course does not positively affect subsequent accounting course. Eskew and Faley (1988), Doran et al. (1991), Bernardi and Bean (2002) Drenann and Rohde (2002), Hartnett et al. (2004) reported positive effect of prior knowledge on accounting course performance. However, our inference is a minor effect of prior knowledge on course performance when compared to skill-based factors.

Auditing score is not distinctively correlated to accounting course scores in the set of business core course scores. Auditing course performance depends on managerial skills and knowledge. Thus, management course performance correlations suppress the correlations between Auditing and accounting courses. This implies less relevance of accounting related skills for Auditing course performance. Maksy and Zheng (2008) and Maksy and Wagaman (2012) found a positive relationship between Auditing and accounting course performance. According to our conclusion, the majority of their finding should be attributed to the factors other than required skills and knowledge.

Mathematics and Statistics scores are significant predictors of finance and economics course scores. This finding supports Anderson et al. (1994), Didia and Hasnat (1998), Trine and Schellenger (1999) Marcal and Roberts (2001), Drenann and Rohde (2002), Ballard and Johnson (2004), Grover et al. (2010). On the contrary, Mathematics score is not a significant predictor of Financial Accounting course score. We agree that Financial Accounting course requires a particular quantitative skill, which is numerical processing. However, Mathematics deal with logical reasoning as well as numerical processing. Thus, Mathematics score fails to be a suitable proxy of numerical processing skills as an accounting course performance factor. Our conclusion contradicts Eskew and Faley (1988), Tho (1994), Gist et al. (1996), Koh and Koh (1999), Guney(2009), Uyar and Gungormus (2011).

Mathematics course score is not a significant predictor of Cost Accounting course score. On the other hand, Statistics score is a significant predictor of Cost Accounting course score. Cost Accounting differs from Financial Accounting in the use of statistics. Thus, statistical knowledge is a performance factor for Cost Accounting course performance. Kirk and Spector (2006) found that course performance in Mathematics was not significant. In contrast, success in Statistics was highly significant and positive in explaining success in Cost Accounting. Alcock et al. (2008) reported insignificant Mathematics course performance relationship. Our findings are consistent with their findings.

Business Ethics score is a significant predictor of Auditing score. Business Ethics score coefficient is positive and significant for Auditing model, while it is insignificant for MAN group average score. Thus, ethics and Auditing relationship seems to be independent from required skill similarity within MAN courses. A positive and significant coefficient in Auditing course regression can be explained by corresponding interests and knowledge. On the other hand, remaining courses, such as Financial Accounting, Financial Management and Principles of Economics may not be suitable for ethical topics due to required skills mismatch. Our conclusion is parallel to Cohen and Pant (1989), Bampton and Cowton (2002), Uyar and Gungormus (2013), Anzeh and Abed (2015), who stated that Auditing was the most suitable course for ethical topics.

Structure of the performance factors for the courses vary depending on the program properties and the applicant profile. In the present research, the data was collected from A.U. Open Education System, which has a mission to ensure educational opportunity by providing quality university education. The program accepts students with different motives. In our research environment, motivational factors such as career motivation may not be as important as in a face to face education at a top-notch university. Additionally, a research sample from graduated students limits us to control the level of motivational factors, which may affect course score interrelations and distort the interpretation of performance factors. This limits the generalization of our results and can be considered as a weakness of our research. However, presumably minor importance of motivational factors with a standardized education process refine the analysis of course performance interrelations based on required skills and knowledge. We present business core course interrelations that reveal performance factors, notably for required skills and knowledge. We hope the findings to be beneficial for further studies investigating the determinants of business course performances.

CONCLUSION

This study explores business core course performance interrelations with a focus on accounting and finance courses. Analysis of the correlations between overall course scores provides interpretable information for the underlying performance factors. The analysis suggests that course requirements for skills and knowledge are effective performance factors for our research data. This verifies the usage of examination scores for gained skills and knowledge as an education output in efficiency analysis of academic departments (Celik & Ecer, 2009).

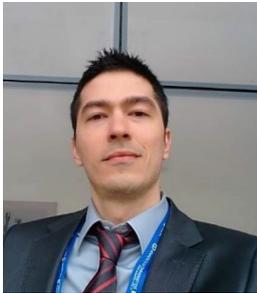
The analysis outcome indicates that the introductory courses require quantitative and analytical reasoning skills more than the subsequent courses in accounting, finance and economics. Management-oriented courses differed from these courses with requiring higher verbal and organizational skills. Auditing, Financial Institutions and Markets have main performance factors that are similar to management-oriented courses. Skill based forming of these groups implies less relevance of accounting related skills for Auditing course performance. In addition, Auditing is the most suitable course for ethical subjects among business core courses.

The research is designed to expose the course interrelations investigated in the previous studies. Mathematics and Statistics scores are significant predictors of finance and economics course scores. On the contrary, Mathematics score is not a significant predictor

of Financial Accounting and Cost Accounting scores. Thus, Mathematics score fails to be a suitable proxy of numerical processing skills as an accounting course performance factor. Cost Accounting differs from Financial Accounting in the use of statistics. In the analysis outcome, Statistics score is a significant predictor of Cost Accounting course score. Thus, statistical knowledge is a performance factor for Cost Accounting.

Results of this study provide a benchmark of course interrelations for researchers who controlled for related course scores in their performance prediction models particularly for Accounting. The analysis results may also be indicative for finance, economics and management course performances studies. The statistically clustered course scores imply similarities between courses, which have been separately investigated thus far. This may promote a multidisciplinary approach and result in further research that defines the common and unique performance determinants for business courses.

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