Full research paper

PROMOTING EFFECTS OF ABILITIES WHILE ENHANCING PROBABILITY OF COLLEGE-SUCCESS: A MODERATION ROLE OF HIGHER EDUCATION

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ABSTRACT

Studies revealed that college readiness promotes college success and higher education student learning outcomes. This study opted to 1) analyze the total effect and the conditional effect of college readiness on college success by university generations and departments; 2) analyze the differences in the probability of college success across departments and university generations; 3) describe the quality of university generations in terms of the conditional effects and the probabilities of college success. The study is an ex post facto research. The Ethiopian 1st, 2nd, and 3rd generation universities; and the National Educational Assessments and Evaluations Agency officers were the population of the study. The total sample size was 551. The Ethiopian General Education School Leaving Certificate Examination Grade Point Average, the Ethiopian Higher Education Entrance Examination score, and the College Cumulative Grade Point Average of the students were sources of the data. Using the Process Procedure for Software Package for Social Sciences, the binomial logistic regression was conducted. Maintaining the highest total conditional effect of college readiness on college success while heightening the probability of college success at a value of college readiness has been interpreted as a trait of the high performing university generation.

KEYWORDS

College readiness, college success, higher education quality

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Highlights

- *College readiness affects college success.*
- *The conditional effect of college readiness on college success varies by university generations and departments.*
- *The probability of college success at the value of college readiness varies by university generations and departments.*
- *Maintaining the effect of college readiness on college success while heightening the probability of college success is a trait of high-performing university generations.*

INTRODUCTION

College-ready students are more prepared for postsecondary education and expectations, as well as for workforce, social, and political responsibilities than less college-ready students (Mokher and Leeds, 2019). One of the strong determinants of college outcomes is the development of pre-college academic skills and readiness (Fina, Dunbar and Welch, 2018; Jackson and Kurlaender, 2014; Olani, 2017). Because of their unpreparedness for college-level learning, many college entering students are assigned to non-credit-bearing remedial education (Leeds and Mokher, 2019; Kallison, 2017; Relles, 2016). For these reasons, the college readiness factor is one of the most important issues ever discussed in educational research. College readiness is a dynamic term that is highly affected by time and space. The definitions may follow the changes in philosophies, aims, and objectives of global education and country-specific education (Klarin, 2016). For instance, the post-COVID 19 definitions of college readiness and success are having another shape. The average definition of college readiness is the maturity level of the students for college-level learning and expectations. Maturity level in a sense may show differences from place to place and from time to time.

Indicators of college readiness are course-taking, high school Grade Point Average (GPA), college entrance GPA, class rank, and Scholastic Aptitude Tests (SAT). Also, assignment to remediation, degree completion, time to degree, and cumulative college GPA have been discussed as the major indicators of college success (Hsieh, 2019; Davidson, 2015; Tucker and McKnight, 2019; Leeds and Mokher, 2019; Gaertner and McClarty, 2015; Kemple, Segeritz and Stephenson, 2013; Rasinski et.al, 2017; Balfanz and Byrnes, 2019). The current criticisms state that standardized measures of college readiness, such as the SAT and Program for International Student Assessment (PISA) are externally imposed, traditional, and they do not represent the local classroom learning and culture of learners (González Canché, 2019; Kim and Sunderman, 2005). These tests bias for high socio-economic families, and gender (Rattani, 2016; Saygin, 2020). Additionally, scholars state that the number of courses taken may not guarantee college readiness if they are not rigorously mastered (Callahan and Hopkins, 2017; Nagle et al, 2016; Wang, 2017).

On the other hand, college readiness is not fully the function of academic performance (Gray, Mcguinness and Owende, 2016; Savitz-Romer and Rowan-Kenyon, 2020). The non-cognitive factors, such as time management, finance, social integration, satisfaction with the institutional environment, perseverance, conscientiousness, motivation, goal-setting, help-seeking, self-advocacy, self-efficacy, critical thinking and reasoning, and college knowledge share the largest variance in college success than academic factors (Cho and Serrano, 2020; Tierney and Duncheon, 2015; Fennie et al, 2020). Despite the criticisms on them, utilization of the academic college readiness measures for college admission and placement decisions is very high compared to other measures. Academic preparation is the most determinant of college completion (Means et al, 2016). Also, a recent standards approach to curriculum design and standards-based test development increased the validity and the reliability of academic measures (Lunceford, Sondergeld and Stretavski, 2017; Hughes, 2006). The factors, such as the nature of the curriculum, the content, and the format of these academic measures highly determine academic measures' validity and reliability in measuring college readiness.

The studies and trends around the world took to the forefront the issue of consolidating and heightening the standards and quality of college readiness as one of the mechanisms to improve the quality of higher education (HE) outcomes. The reforms in terms of curriculum development, implementation, and assessment standards are the major academic approaches in building college readiness. Additionally, the more recent approach to HE quality assessment is taking into account these college readiness standards as a baseline in estimating the contributions of higher education institutions (HEIs) to student learning.

Although multiple factors widened the gaps between theory and practice, the Ethiopian Ministry of Education (MOE) (2009) has made reforms in terms of curriculum revisions to maintain the standards through the curriculum, especially in the form of shifting to competency-based curriculum development. The college readiness is realized when the written curriculum is rigorously practiced and integrated with the life world of learners throughout k-12 education. The validity and reliability of assessments also facilitate and monitor the effectiveness of student learning and they are the tools of assuring meritocracy and quality in student learning.

Regarding this, National Educational Assessments and Evaluations Agency (NEAEA) officer was interviewed to study the processes in determining cutting scores for the Ethiopian HE entry, and the test development processes. The interview result showed that college entry cutting score determination for different groups of applicants is dependent on the resource availability and the capacities of the universities. Taking the contextual factors into consideration as a good approach, however, the decision process failed to consider some scientific processes that are followed in different parts of the world. For instance, the yearly continuous studies that relate the cutting scores of the affirmative action groups and their college performances should have been used as additional information to make the decisions.

Also, an interview response from an Ethiopian Higher Education Relevance and Quality Assurance (HERQA) officer revealed that the Ethiopian quality assessment system did not consider the college readiness factors of the students as a covariate in assessing the performances of the HEIs. The current Ethiopian HE quality assessment system gives less attention to the direct assessment of HE learning outcomes (Wariyo, 2020). The research designs that take into account the contribution of college readiness need to guide the decision-making process in placement, admission, and HE quality assessment process. Furthermore, a comparative analysis of conditional effects of college readiness on college success at values of universities and fields of studies is important to study how the abilities of students are linked across universities and departments.

Student college readiness levels for college learning and expectation is one of the major factors that affect the student learning outcomes of HEIs. This is reflected in performance-dependent funding of HE policies in which the institutions compete to attract high-performing high school students. As an input of HE, the college readiness factor of college entering students is highly confounded with HEIs' performances. For this reason, studies considered the contribution of the college readiness level of college entering students in HE quality assessment of the value-added (Coates, 2009; Cunha and Miller, 2014; Jackson and Kurlaender, 2014; Liu, 2011). Also, numerous studies emphasized direct assessment of HE student learning outcomes (Ďurišová, Kucharčíková and Tokarčíková, 2015; Sønderlund, Hughes and Smith, 2019; Martin and Mahat, 2017; Zlatkin-Troitschanskaia, Pant and Coates, 2016; Xu Solanki and Harlow, 2020). Čechová, Neubauer and Sedlačík (2019) used direct student college entrance data and college study results to assess the relationship between college entry scores and college performance. Similar to previous studies, this study dealt with analyzing the relationship between college readiness and college success measures and did not move further to make explanations on the meanings of this relationship in an applied sense. Also, Otavová and Sýkorová (2016) conducted a comparative analysis of college students' performance across different faculties at the University of

Prague. For the reason that the faculties have diversities in terms of the student abilities and the nature of disciplines, the highly matched groups within and between departments should be compared. The pre-college and college covariates are needed to be controlled.

In the European context, the assurance of the linkage between college readiness and HE learning quality of students is maintained through curriculum-based standardization and validation of prior learning (Sava, Borca and Danciu, 2014). Similarly, the curriculum standards-based approach is widely used in the USA to raise the students' college readiness in line with changing college expectations (Bridges, Wyatt-Smith, and Botelho, 2017; Alonzo, Mirriahi and Davison, 2019; Boud, 2017). For the reason that there is still no one-fits-all quality assessment model, the multidimensional standards-based HE quality assessment approaches have been being applied to assess HE quality (Boud, 2017; Tasopoulou and Tsiotras, 2017; Hrnčiar and Madzík, 2015; Noaman et al, 2017).

Generally, the HE quality assessment models vary in assessing different aspects of HE quality: 1) direct assessment and indirect assessment of HE quality; 2) consideration and inconsideration of the college readiness factors of the students; and 3) taking into account the value-added to student learning and income, and country's economy. Although dimensions of indirect HE quality, such as the service quality, resource quality, the management quality, quality in curriculum, and teaching-learning process are the causes for the quality of the HE student learning outcomes, the assessment remains incomplete and vague unless the comprehensive pre-college and college indicators and measures precisely link these dimensions of HE quality to changes in student learning.

For this reason, building a comprehensive model that merges the indirect HE quality assessment indicators with college readiness indicators to assess direct HE learning outcomes is highly important. However, previous studies focused on some aspects of HE quality. This study attempted to link the direct college readiness and success measures of the participants to the diversity of the HE to assess 1) how the college readiness factor affects the college success of the participants, 2) the quality of the institutions in linking the precollege and college aptitudes while raising the probability of college success; and 3) the extent to which universities and departments vary in maintaining the effect of students' abilities while heightening the probability of college success at the a value of college readiness level.

MATERIALS AND METHODS

Models of decision-making

This study considered test-based decision-making quality in college readiness and success assessment as a major factor that affects the validity of direct HE quality assessment. For this reason, the researchers attempted to make a review of the major decision-making models in this section. This is to show the role of decision-making science in enhancing efficiency through student learning management and thereby contributing significant indirect contribution to HE quality management.

In the decision-making process, the decision-maker chooses a course of action or inaction in which an outcome can be an expected behavior or not (McFall, 2015). The literature on decision-making discussed three major decision-making models: normative, prescriptive, and descriptive (Elqayam and Evans, 2011; Kowalski, 2008; McFall, 2015).

Normative decision-making depends on logic and reason and emphasizes the rationality of the decision-making process. In order to verify the norm and rationality of the decision-making process, normative decision-making science created a linear mathematical process that empirically relates alternatives and consequences. Therefore, the main objective of normative decision-making is choosing the best alternative or a group of alternatives that end in the highest expected utility. A normative decision-maker deals with or is challenged by 1) his/her background information about the problem, 2) what others do, and 3) by features or states of nature in the decision-making process (McFall, 2015; van der Linden, 1991).

Although the normative decision-making model is the most widely applied one, it faced criticisms because 1) people unpredictably behave and the rationality and the logical formula does not capture the reality of human behavior, 2) normative decision-making theories exclude cognitive characteristics of human beings such as, anxiety, charity, envy, and others, 3) there are so many extraneous variables that highly distort the logical expected relationship between the alternatives and consequences (Elqayam and Evans, 2011; McFall, 2015; Raiffa, 1994). Generally, the normative decision-making model is highly criticized for its low ecological validity.

The weaknesses of classical normative models caused the birth of bounded rationality in the second half of 20^{th} C (McFall, 2015; March, 1978; Wang, 1996). Let's elaborate on the difference between the normative model's expected utility assumption and the bounded rationality theory of the descriptive model. These studies stated that the normative model conducts an endless and exhaustive search for an alternative or a group of alternatives that ends in a maximum expected utility. However, the supporters of bounded rationality stated that this is fruitless and its benefit is low. Also, classical models depend on logic and norm rather than criteria. These proponents of bounded rationality, however, argue that norms and logic do not bring about satisfactory ends, but the criteria do. For this reason, they conduct a sequential search for a satisfactory criterion or standard that brings about satisfaction. In this study's context, we can raise examples. The contemporary college readiness policymakers tend to favor the descriptive approach; they work on selecting and incorporating the best competency-based standards in the curriculum and teaching-learning process before trusting the quantitative college readiness measures through sole predictions of college success.

Baron (2004) stated that, naturally, most of the problems in the world are more descriptive rather than normative; the decisions on them need descriptive procedure than normative procedure. He also stated that descriptive models deal with both actual behavior and reflective judgment. The descriptive decision-making model emphasizes heuristics and ethics in the contexts of the decision-making process rather than the algorism and the norm. Although the bounded rationality surpasses the expected utility model in practicality and importance across disciplines, the expected utility models are better in precision and parsimony or simplicity (Mcfall, 2015).

On the other hand, Raiffa (1994) and Baron (2004) pointed out that the prescriptive model especially considers the cognitive characteristics of the individuals. Raiffa argued that normative models should modify themselves in a more applicable manner for human behavior. Baron (2004) also asserted that prescriptive models provide the applicable decision-making procedure for individuals integrating the strong sides of normative and descriptive models. These studies describe the prescriptive model as a hybrid of normative and descriptive decision-making models. For instance, the behavioral model highly emphasizes describing behavior as related to consequences and uses mathematical linear procedures. For its descriptive approach towards a behavior (Mcfall, 2015) and, for the fact that it applies the principle of bounded rationality (Kowalski, 2008) in the decision-making process, it resembles the descriptive decision-making model while, on the other hand, for its use of mathematical linear procedure (Kowalski, 2008), it resembles the classical decision-making model.

Concerned with the dispersed roles in the body of decision-making models, McFall (2015) stated that the previous decision-making models produced proliferative rather than ameliorative processes for decision-making science, and he argued for the development of a metatheory that integrates the merits of all decision-making models for practice. Also, recent studies by Arnold (2018) and Turner and Angulo (2018) integrated classical and contemporary decision-making models and offered a heuristic for analyzing both internal and external pressures in HE. Also, the mechanisms by which schools and HEIs store and use data for decision-making research help them to make rational and effective decision-making in the selection, admission, and placement (Al-Twijri and Noamanb, 2015; Martín-García, Martínez-Abad and Reyes-González, 2019). In general, the contemporary decision-making models in selection and placement take a pragmatic approach.

Theoretical framework

This study considered the role of test-based decision-making as one of the determinants of the quality of the inputs and outcomes of HE. Test-based prescriptive decision-making typology in HE is based on the use of flowcharts to define various types of decision-making in education. In each decision problem, three common elements are identified: (i) the test that provides the information is based on, (ii) the treatment at which the decision is made, and (iii) the criterion by which the success of the treatment is measured (van der Linden, 1991; van der Linden, 1996). Ben-Shakhar, Kiderman and Beller (1996) also used a threshold utility model to assess the utility of using the SAT, in addition to other tests, for selecting applicants for liberal arts programs. Sawyer (1996) studied the utility functions of placement tests for standard and remedial course placement.

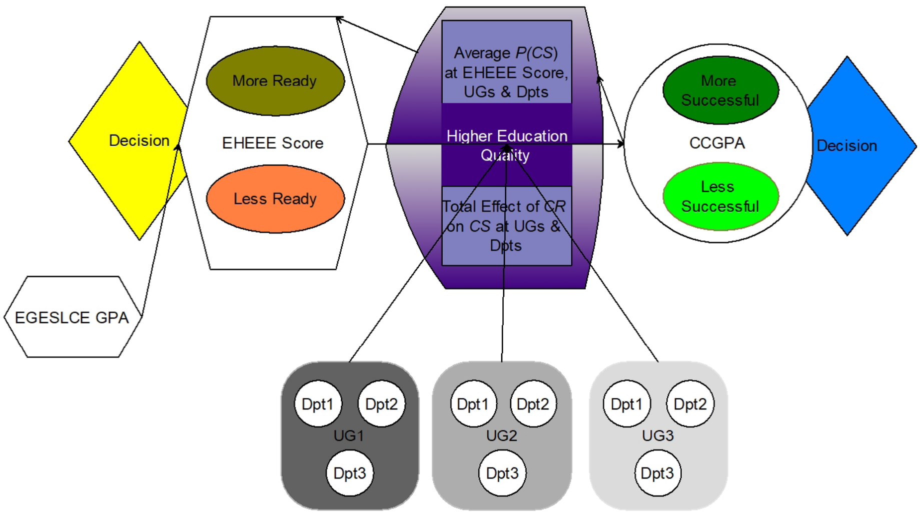
Sawyer elaborated the application of Bayesian theory in test-based decision making as follows: A placement committee determines a particular cutting score (d) from a set D of possible decisions. Then, after the student is admitted to a course, a particular outcome θ (e.g., grade in a course) occurs, from a set of possible outcomes Θ (e.g., a set of possible chances of achieving in a course). A Bayesian utility function $u(d, \theta)$ assigns a value to the accuracy and desirability of the decision of the placement committees' cutting score when the outcome is the course grade θ. In the Bayesian decision theory model, this information is described by a subjective probability distribution on Θ; the Θ quantifies the placement committees' beliefs about the probable values of θ assuming that both prior beliefs and any relevant data were previously collected. The Bayesian optimal model is to choose the decision d that approximates or maximizes the expected value of $u(d, \theta)$ with respect to the subjective probability distribution on Θ.

In the educational context, these models are used to predict the utility functions of the tests for selection, admission, and placement purposes. What makes these models relevant in this study is that they relate college readiness and success measures. These models emphasized the decisions on tests and their consequences, and they have not been applied for modeling HE quality assessment. However, this study adopted the decision theory's assumption for HE quality assessment taking into account the role of moderators and covariates. The idea is that the validity of the decision on the college readiness measure significantly affects the outcomes of students' college learning. The effect of the college readiness measure on college success is also affected by the moderators. Therefore, this study hypothesizes that, at a valid measure of college readiness, and at a better role of moderators, a higher conditional effect and probability of college success is expected.

Conceptual framework

In this study, the independent variable, the *Ethiopian Higher Education Entrance Examination (EHEEE)* score, and the covariate, the *Ethiopian General Education School Leaving Certificate Examination (EGESLCE) GPA* were the measures of *college readiness*. The treatment groups, i.e., the *University Generations (UGs)* and *departments*, were used as the moderators between *college readiness* and *college success*. Also, it is assumed that placement of the students to different treatment groups depending on their *EHEEE score* is in the assumption that the *EHEEE score* helped the individuals to be assigned to suitable areas for them; in other words, the treatment groups are assumed to promote the success of the individuals, and the result of success level of the individuals would be revealed through the criterion *College Cumulative Grade Point Average (CCGPA)*.

Although the assumption of the decision theory is used as a cornerstone in this study, the design of this study is built on the quasi-experimental approach. Unlike former decision models, this study gives a stronger emphasis on the role of moderators. Also, it attempted to control for precollege covariates of *college readiness measure*. For this reason, this study took a different statistical design from that is stated by Bayesian statistics although it adopted the assumption of decision theory as a cornerstone.



Note: P(CS) = Probability of College Success; CR = College Readiness

Dpt = department, UG, EHEEE Score, CCGPA, and EGESLCE GPA are previously defined.

Figure 1: Conceptual framework

Operational Definitions

In this study, the *college readiness* is defined as the academic preparation level of the participants for HE as measured by their *EHEEE scores*. The *College Success* of the participants is also defined as the college academic performance of the participants as measured by their *College Cumulative Grade Point Average (CCGPA)*. The *UG* is the coinage given for a group of Ethiopian universities which have approximately the same time of establishment. The *department* variable in this study refers to a field of study that participants joined after college entry. Also, an aspect of HE *quality* was measured in this study taking into account the extent that UGs maintain the effect of student aptitudes while they enhance the probability of *college success*.

Objectives

The major objectives of this study were to 1) analyze the total effect and the conditional effect of college readiness on college success at the values of UGs and departments; 2) analyze the differences in the probability of college success across departments and UGs at a value of the college readiness measure, and 3) describe the quality of UGs depending on the sum of the total conditional effects and the probabilities of college success.

Research methodology

Hypotheses

The major null and alternative hypotheses of this study were spelled out as follows:

1. H0a: The effect of college readiness on college success is not significant.
2. H1a: There is a significant effect of college readiness on college success.
3. H0b: The conditional effect of college readiness on college success does not significantly differ by UGs and departments.
4. H1b: The conditional effect of college readiness on college success significantly differs by UGs and departments.
5. H0c: The probability of college success at a value of college readiness does not significantly vary by UGs and departments.
6. H1c: The probability of college success at a value of college readiness significantly varies by UGs and departments.
7. H0d: A UG with the highest total conditional effect of college readiness on college success has no highest average probability of college success
8. H1d: A UG with the highest total conditional effect of college readiness on college success has also the highest average probability of college success.

The research paradigm

The research paradigm is defined as a broad philosophical approach to understanding and researching a phenomenon (Cohen, Manion and Morrison, 2018). The positivist approach makes a quantitative theoretical explanation of a problem depending on what is observed (Hughes and Sharrock, 1997). Post-positivists argue that the positivists' search for the absolute truth of knowledge only through observable data cannot be achieved, particularly, when studying the behavior and actions of humans (Creswell, 2014; Cohen, Manion and Morrison 2018). For this reason, post-positivists updated the assumption of positivists and took a deeper approach to understand a phenomenon; they use additional methods to get adequate information about a phenomenon in addition to observable data.

In the process of understanding the relationship between college readiness, college success, UGs, and departments, this study took a post-positivist stance. After making a quantitative description of the nature of the relationship between these variables, some possible underlying contextual factors that can modify these relationships have been discussed. For this reason, this study moves beyond the deductive test-based decision theory's assumption in understanding the nature of the relationship between these variables.

Explanatory correlational research design

Explanatory correlational research design gives explanations on how one variable affects another variable by using more advanced statistical tests, such as regression and Analysis of Variance (Ary et al, 2010; Edmonds and Kennedy, 2017). In this study, how college readiness explained college success through UGs and departments was studied. A type of explanatory correlational research design, i.e., causal-comparative ex post facto design, was a research design of this study. In this design, the groups were those more college-ready and less college-ready participants as they have been grouped depending on the manipulation of the independent variable (i.e., EHEEE). The dependent variable is college success as measured by the CCGPA. The design also included moderating variables (UGs and Departments), and a covariate (i.e., EGESLCE GPA).

Sampling

It is stated in the theoretical framework of the study that students are placed in various departments (treatments) depending on the college entrance test results. It is assumed that the assignment of the groups to different categories and the manipulation of the variables to observe the effects had already been accomplished by other bodies (MOE and Universities) other than the researcher. For this reason, this study is an ex post facto experimental research in which already matched groups have been selected using a combination of probability and non-probability sampling design. For the reason that universities have significant diversities, the best approach to take a representative group was careful matching, inclusion, and exclusion of the already formed groups.

To this end, the sampling process followed this procedure: 1) the total 33 universities from the three UGs were listed; 2) depending on their similarities in terms of the faculties they consisted of, the total 30 UGs (9 1st generation, 11 2nd generation, and 10 3rd generation) were included in the study. The rest three universities, such as Ethiopian Defense University, Civil Service University, and Adama Science and Technology University were excluded from the study because they show a significant difference from others; 3) The stratified sampling formula[1], $n_k = (n/N)N_k$ was used to calculate the number of universities should be selected from every three groups of universities; 4) After sample size determination and calculation, the total three UGs (i.e., one 1st, one 2nd, and one 3rd generation universities) were randomly selected from each of the three groups; 5) These three universities were compared depending on the faculties they consisted of, and the faculties that were not found in all three universities were excluded from the sample; 6) Three faculties (i.e., Business and Economics, Social Sciences and Humanities, and Natural and Computational Sciences) were randomly selected from the faculties that represent all three universities. In this case, for the reason that the three universities have the same type and number of faculties, the number of faculties that should be selected from each university was not calculated; 7) the departments in all three selected faculties were also matched. Then, departments that were not found in all three faculties were also excluded from the sample; 8) Three departments (i.e., accounting, psychology, and mathematics) were randomly selected from the departments that represent all three faculties; 9) all students in these three departments were included in the study. The 202 (Male = 128, Female = 74) participants from first generation; the 168 (Male = 91, Female = 77) participants from second generation; the 181 (Male = 107, Female = 74) participants from the third-generation university were included in the study. Due to time and financial constraints, only three departments were selected for the study. When all participants are added together, the total sample is 551. Also, two key informants (i.e., one from NEAEA and one from HERQA) were purposively selected for interview using the purposive sampling of non-probability sampling design.

Interviews

The primary data for this study was the NEAEA and HERQA officers' interview responses. These data were collected through an unstructured interview that was guided by two general interview questionnaire items: 1) How HE quality assessment relates to the college readiness and success measures of students and, 2) What are the procedures of HE entry cutting scores? In this case, the HEQRA officer responded only to the first interview questionnaire item; the second questionnaire item does not refer to him.

Data collection procedure for the interview data

Before the pilot visit, a formal letter was received from the department of Curriculum and Instruction at Addis Ababa University. During the pilot visit, appointments and schedules were arranged to contact the participants at NEAEA and HERQA. Depending on the appointments, the NEAEA and HERQA participants were interviewed. During the interview, the major responses for the interview were recorded into a notebook.

Academic achievement data

The academic achievement data for this study were three types: 1) The EGESLCE GPA; 2) the EHEEE score, and 3) the CCGPA. The EGESLCE is a grade 10 nationally prepared certificate examination. This examination recognizes the eligibility for the entry of the Ethiopian Preparatory School for HE. Students who are not eligible for preparatory school enter technical vocational education and training institutions and teachers' college. The EHEEE is a nationally prepared examination for the national assessment of preparation for HE entry. The third document data were the CCGPA of the 2011 Ethiopian Calendar (E.C.)/2018/2019 G.C. graduates.

The EGESLCE tests achievements in 10 subjects, such as Mathematics, English, Geography, History, Biology, Chemistry, Physics, General Academic Aptitude, Civics, and Ethical Education and one subject test that belongs to a local or regional language of the students (NEAEA, 2019; Trines, 2018).

1 n_k = the sample size for k_{th} strata; N_k = the total population of k_{th} strata; *N = the total population size; n = total sample size*

Grading scales of EGESLCE follow A-F norm-referenced scale. A cumulative GPA out of 4.00 is calculated for each of the exam takers. The MOE decides on the minimum cutting score of EGESLCE that makes it eligible for preparatory for HE school.

Grades 11 and 12 are known as the preparatory for HE grades in Ethiopia. Depending on their EGESLCE GPA, students choose either a natural science stream or a social science stream. These streams provide common core courses, such as English, mathematics, physical education, civics, information communications technology, and an elective language (Amharic or local languages). The common core curriculum makes up 60 % of the study load. The courses, such as Biology, Chemistry, Physics, and Technical Drawing are taught in the natural science track whereas geography, history, economics, and business are covered by the social science track (NEAEA, 2019; Education in Ethiopia, 2019).

Students sit for the EHEEE at the end of grade 12. The EHEEE for the social science stream tests achievement in seven subjects, such as mathematics, English, civics, general academic aptitude, history, geography, and economics. Also, the EHEEE for the natural science stream tests the achievement in the seven courses, such as mathematics, English, civics, general academic aptitude, biology, chemistry, and physics.

The EHEEE grading follows a criterion-referenced scoring system; achievements in the subjects are graded on a numerical 0–100 point scale with a total possible score of 700 in the seven test subjects combined. The performance of students in each seven test subjects is converted to 100, and all of them are added and graded out of the total possible score of 700. (NEAEA, 2019; Education in Ethiopia, 2019).

The general grading scales and credit systems that are used in the Ethiopian HEIs share similarities with those that are used in U.S. universities; however, some Ethiopian universities have recently started using the European Credit Transfer and Accumulation System (ECTS). One credit unit is defined as one contact hour per week that is taken over a span of 16 weeks in most of the public Ethiopian universities including the sample universities for this study. The common minimum credit requirement in most of the four-year bachelor's programs is 128 to 136 credits (i.e., 16 or 17 credits or 30 ECTS per semester). Also, a three-year degree can be completed with a minimum of 102 to 108 credits (i.e., 180 ECTS) (NEAEA, 2019; Education in Ethiopia, 2019). All sample departments that were included in this study graduate with three-year degrees. The largest number of Ethiopian universities uses a standard A-F scale. However, some institutions use a simplified version without the "+" and "-" designations. To graduate from bachelor's programs, a minimum cumulative GPA of 2.0 (C) is required (NEAEA 2019; Education in Ethiopia, 2019).

Data collection procedure for academic achievement data

The document data collection was accomplished in the following procedure: 1) the principal researcher visited the academic vice president offices of the selected universities and received permission to conduct the research; 2) the academic vice presidents sent letters to the registrars of the universities; 3) the heads of registrars formally instructed technical registrar record officers to cooperate on the collection of EGESLCE GPA, EHEEE score, and CCGPA; 4) the researchers made arrangements and appointments with the registrar record officers to collect data. Those data that had not been archived online on the computer were collected from the records. The data collectors who collected the data from the records were funded. Those registrars, whose data were available online, sent the organized data to the researchers via email. Others printed the data and gave it to the researcher.

Also, the documents, such as journal articles, dissertations and theses, books, and conference reports were collected in hardcopy in local libraries and in softcopy from online accredited sources. Especially, those journals subscribed by AAU, such as Science Direct sources, Sage Journals, and Emeralds were the major literature sources for this study.

UG	Department	EHEEE Score			EGESLCE GPA			CCGPA		
		M	SD	N	M	SD	N	M	SD	N
1	Accounting	443.11	58.92	138	3.10	.44	138	2.89	.47	138
	Psychology	351.58	24.58	40	2.77	.26	40	2.75	.52	40
	Maths	393.83	25.66	24	3.01	.37	24	2.99	.49	24
	Total	419.13	62.76	202	3.03	.42	202	2.88	.49	202
2	Accounting	399.80	20.72	115	2.95	.41	115	2.84	.47	115
	Psychology	342.39	16.05	38	2.78	.43	38	2.74	.50	38
	Maths	361.27	16.96	15	2.90	.23	15	2.74	.40	15
	Total	383.38	31.40	168	2.91	.41	168	2.81	.47	168
3	Accounting	408.59	21.34	135	3.03	.31	135	2.88	.47	135
	Psychology	352.75	9.11	24	2.72	.23	24	2.92	.64	24
	Maths	363.32	15.91	22	2.81	.24	22	2.96	.57	22
	Total	395.69	29.63	181	2.96	.32	181	2.90	.50	181
Total	Accounting	418.26	43.21	388	3.03	.39	388	2.87	.47	388
	Psychology	348.43	19.20	102	2.76	.33	102	2.79	.55	102
	Maths	374.82	25.44	61	2.93	.31	61	2.92	.50	61
	Total	400.53	47.44	551	2.98	.39	551	2.86	.49	551

Note: M = Mean; SD = Standard Deviation; UG = University Generation; EHEEE = Ethiopian Higher Education Entrance Examination; EGESLCE = Ethiopian General Education School Leaving Certificate Examination; CCGPA = College Cumulative Grade Point Average

Table 1: Descriptive statistics for document score data

Data analysis method

The Process Procedure for SPSS was installed on the SPSS software version 24 and used for the analysis. In this analysis, the effect of college readiness on college success; the conditional effects of college readiness on college success at the values of the UGs and departments; and the probabilities of college success at the values of college readiness level, UGs, and departments were analyzed. Using the binomial logistic regression analysis as the statistical method, the EHEEE score was used as a continuous predictor variable while the UG (i.e., coded as UG1, UG2, and UG3) and department (i.e., coded as Dpt1, Dpt2, and Dpt3) were used as categorical moderators. Also, the EGESLCE GPA was used as a continuous covariate; the CCGPA less than 2.75 was coded as 'less successful', and the CCGPA greater than or equal to 2.75 was coded as 'more successful' was used as a binary dependent variable.

The assumption of linearity in logistic regression assumes that there should be a linear relationship between quantitative predictors and the logit of the outcome variable. This assumption was tested by analyzing the interaction term between the predictor (EHEEE score) and its log transformation, and found that the interaction was not statistically significant ([1]B = .03, [2]se = .03, p > .05). The interaction term between EGESLCE and its log transformation was also not significant (B = -6.04. se = 3.88, p > .05) (See Appendix 2). For this reason, the assumption of linearity was met in this study.

According to Menard (1995), tolerance values less than 0.1 show multicollinearity in the data for the regression analysis. For the reason that the logistic regression does not have the multicollinearity analysis option, testing multicollinearity through linear regression for the logistic regression data is recommended (Field, 2018). In this study, the multicollinearity assumption was checked by running the multicollinearity test using linear regression analysis in SPSS. All tolerance values for the independent variables were greater than 0.1 and all the VIF values were less than 10 (see Appendix 3), and this shows that there were no high correlations between independent variables.

Sample size determination

To check the adequacy of the sample for binomial logistic regression test, a priori type of power analysis was used in G-power software version 3.1.9.6 (2020). Using effect size input mode of probabilities and the Hsieh, Bloch and Larsen (1998) procedure in G-power, and when the following input parameters were used: Tails = 2; pr(y = 1)(x = 1)H1 = .6; pr(y = 1)(x = 1)Ho = .05; alpha error probability = .05; power(1-beta error probability) = .95; R^2 other than x = 0; x distribution = normal; X population mean = 0; X standard population deviation = 1, the appropriate sample size was 317. Also, the critical z = 1.96 and the *actual power* was also.95. Therefore, the total sample size (n = 551) of this study is more than adequate for binomial logistic regression.

Ethical considerations of the study

Before the data collection, the universities' Academic Vice Presidents were contacted; and presidents sent the formal letters to the registrar officers. Then, assurance of the confidentiality for data was clearly described to all concerned groups, and the data were collected after the researchers have received the consent from the participants. In the research report, the names of the universities were left anonymous for purpose of ethical considerations.

RESULTS

The study was aimed at testing these hypotheses: 1) H1a: There is a significant effect of college readiness on college success; 2) H1b: The conditional effect of college readiness on college success significantly differs by UGs and departments; 3) H1c: The probability of college success at a value of college readiness significantly varies by UGs and departments; 4) H1d: A UG with the highest total conditional effect of college readiness on college success has also the highest average probability of college success.

The effect of college readiness on college success

It is a generally accepted meritocratic assumption in any education system that college readiness significantly affects college success. In other words, well-ready students will successfully complete their college studies than less college-ready students. However, the degree of preserving this meritocratic principle in education for quality is highly affected by so many institutional and non-institutional moderating and confounding factors. Controlling for some covariates and moderating factors, this study tested the first hypothesis that 'H1a: There is a significant effect of college readiness on college success.' Using the EHEEE score as a continuous predictor variable; the EGESLCE GPA as a continuous covariate, UG and department as moderators, and the CCGPA as a binary criterion variable, the process procedure for SPSS was used to analyze the effect of college readiness on college success at the values of UGs and departments.

As can be seen from Table 2, when the college readiness measure (EHEEE score) is used as a predictor, and the EGESLCE GPA used as a covariate, the model significantly predicted college success (i.e. as measured by CCGPA), Nagelkerke R^2 = .26, p < .001. Also, the EHEEE score significantly predicted college success, B = .02, Se = .00, CI = .01 – .03. Therefore, this study fails to reject the hypothesis, 'H1a: There is a significant effect of college readiness on college success.'

1 Unstandardized Beta;
2 Error for Beta

Coefficients	*B*(*se*)	LLCI	ULCI
Constant	-10.79***(1.65)	-14.01	-7.56
EHEEE Score	.02***(.00)	.01	.03
W1	-.04(3.10)	-6.03	6.12
W2	2.40(2.92)	-3.32	8.12
EHEEE Score x W1	.00(.01)	-.01	.02
EHEEE Score x W2	.00(.01)	-.02	.01
Z1	-18.21* (6.64)	-31.23	-5.20
Z2	-5.78(6.60)	-18.72	7.17
EHEEE Score x Z1	.06***(.02)	.02	.09
EHEEE Score x Z2	.02(.02)	-.02	.05
EGESLCE GPA	.94*(.35)	.26	1.61

*Note: *p < .05; **p < .01; ***p < .001; ModelLL = 116.95; df = 10; p <. 001; Nagelkerke R^2 = .26; W1 = UG2; W2 = UG3; Z1 = Department 2; Z2 = Department 3*

Table 2: The effect of college readiness on college success (N = 551)

The conditional effect of college readiness on college success

The extent to which the effect of college readiness on college success is promoted may not be similar across UGs and departments. This study defined this quality of UGs as quality in linking student aptitudes. The conditional effect of college readiness on college success at the values of UGs and departments (see table 3) was used to test the second hypothesis, 'H1b: The conditional effect of college readiness on college success significantly differs by UGs and departments.'

UG	Dpt	Effect(se)	Z	LLCI	ULCI	Effect scores	Total effects
1	1	.02***(.00)	4.32	.01	.03	3	6
1	2	.07***(.02)	3.92	.04	.11	3	
1	3	.04(.02)	2.10	.00	.07	0	
2	1	.02*(.01)	2.55	.00	.04	1	5
2	2	.08***(.02)	4.22	.04	.11	3	
2	3	.04*(.02)	2.26	.01	.07	1	
3	1	.01 (.01)	1.87	.03	.11	0	3
3	2	.07***(.02)	3.51	.00	.03	3	
3	3	.03(.02)	1.91	-.002	.07	0	

*Note: *p < .05; **p < .01; ***p < .001; *** = 3; ** = 2; * = 1*

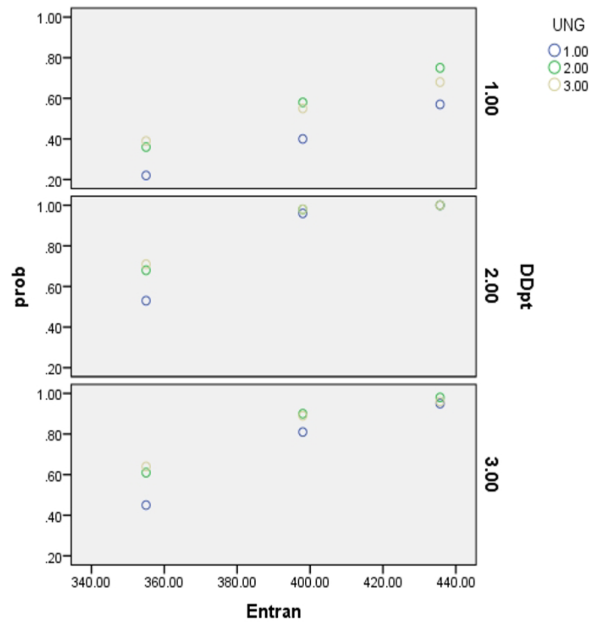
*The effect scores (*** = 3; ** = 2; * = 1) are the measurements given to the significance level of conditional effects to produce simple method to compare the differences across institutions. For example, the effect score for p <.05 is less than the effect score for the p <.01.*

Table 3: The conditional effect of college readiness on college success at the values of the moderators

The conditional effect of college readiness on college success at the values of the first two departments in the UG1 is statistically significant, $p < .001$ in both cases (see Table 3). However, the conditional effect is not statistically significant for department three, $p > .05$. The total conditional effect at UG1 is the highest compared to others, total effect = 6 (Table 3); Mean EHEEE score = 419.13 (Table 1).

The conditional effect of college readiness on college success is also found to be statistically significant at the values of three departments in UG2, $p < .05$, $p < .001$, and $p < .05$ respectively. However, the total conditional effect is equal to 5 (table 3); Mean EHEEE score = 383.38 (Table 1).

In UG3, the conditional effect is statistically significant only at the value of department two, $p < .001$. The conditional effect is not significant at the values of the rest two departments, $p > .05$. The total conditional effect is the lowest in the UG3, total conditional effect = 3; Mean EHEEE score = 395.69. The total conditional effects for UG1 and UG2 show similarity (i.e. 6 and 5). Both of the UGs moderated the effect of college readiness on college success in a similar manner. Generally, this study failed to reject the hypothesis, 'H1b: The conditional effect of college readiness on college success significantly differs by UGs and departments.'



Note: UNG = University Generation; DDpt = Department; Entran = EHEEE score; prob = Probability of college success

Figure 2: The probability of college success at the values of college readiness, UG, and department

The probability of college success at a value of college readiness, UGs, and departments

When the measurement of college success is seen in a comparative view, many factors can be considered. The two factors that can be considered are the students' college readiness level and the institutional diversities. The probability that the UGs heighten college success is gauged at the values of college readiness. If the probability of college success for a group of students with a higher college readiness level is found to be lower compared to a group of students with lower college readiness, the measurement of college success for employment may go wrong. To analyze this issue, this study tested the hypothesis, 'H1c: The probability of college success at a value of college readiness significantly varies by UGs and departments.'

In this section, the probability of achieving more than or equal to 2.75 in CCGPA at a value of EHEEE score was studied. Appendix 1 and figure 2 displayed the probability of college success (i.e., achieving greater than or equal to CCGPA of 2.75) at a value of an EHEEE score across UGs and departments when the contribution of EGESLCE GPA is taken into account. In other words, it answers the question, 'when the contribution of EGESLCE GPA is taken into account, what is the probability of achieving more than or equal to CCGPA = 2.75 at a value of EHEEE score for somebody who joins one of these three UGs and departments?'

The probability of college success is lowest for UG1, total sum *p levels*[3] = 14; whereas it is 20 and 19 for UG2 and UG3 respectively (see Appendix 1 and figure 2). This finding indicates that those students who join UG2 and UG3 with a value of EHEEE score tend to graduate with high CCGPAs compared to those students who join UG1. It is clearly shown in figure 2 that students who joined UG1, especially those students with lower EHEEE score, achieved lower CCGPA than their peers in other UGs with the same EHEEE score. Therefore, this study failed to reject the hypothesis, 'H1c: The probability of college success at a value of college readiness significantly varies by UGs and departments.'

College readiness, college success, and HE quality

Linking students' aptitudes through promoting the effect of college readiness on college success is not sufficient if the students cannot be competent in the job market according to their abilities. In other words, the higher linkage of abilities needs to imply higher college success. To deal with this issue, this study tested the hypothesis, 'H1d: A UG with the highest total conditional effect of college readiness on college success has also the highest average probability of college success.'

Depending on the analysis results, the quality of UGs was interpreted from three perspectives: 1) Those UGs that promote the effect of college readiness on college success are more successful in linking the aptitudes of students in education; 2) Naturally, heightening the probability of college success at a value of college readiness is what is expected from any HEI; and 3) Maintaining the highest conditional effect of college readiness on college success while heightening the probability of college success at values of college readiness is a trait of high performing UGs. Therefore, these perspectives have to be promoted simultaneously in order to enhance the performance. Table 4 shows that UG1 is the best in linking student abilities compared with others as it registered the highest total conditional effect (Total effect for UG1 = 6). However, its power in enhancing the probability of college success at a value of college readiness is lower than UG2 (Average probability of college success for UG1 = 4.67; for UG2 = 6.67). On the other hand, UG1 and UG2 have similar performance (e.g., performance = 10.67 for UG1, and 11.67 for

3 *p level* refers to the probability level of college success

UG2) in promoting the effect of college readiness on college success while increasing the probability of achieving high in CCGPA at a value of college readiness. Relatively, UG2 has the highest performance compared to the others. Therefore, the alternative hypothesis, 'H1d: A UG with the highest total conditional effect of college readiness on college success has also the highest average probability of college success,' is rejected in this study. Universities can link the student aptitudes by maintaining the effect of college readiness on college success but they may still fail to heighten the probability of college success at a value of college readiness if their students show low average performance in their cumulative graduation GPAs compared to the graduates from peer UGs.

UG	Department	Total conditional Effect	Average Probability of college success	Performance
1	1	6	4.67	10.67
	2			
	3			
2	1	5	6.67	11.67
	2			
	3			
3	1	3	6.33	9.33
	2			
	3			

Note: Average Prob. of College success = Sum p level Total for a UG / 3; Performance = Total Conditional Effect + Average Probability of College success

Table 4: Performance: Total effects and average probability of college success

According to the current practice in Ethiopia, the CCGPA equals to or greater than 2.75 is the most acceptable in the job market. For this reason, the probability of being recruited (i.e. 4.67 for UG1) in the job market is lower than those who graduated from UG2 and UG3 even though UG1 graduates were well-prepared for college and their ability significantly affected their CCGPA. Most probably, this happens when the UGs focus on a conservative approach in guiding student learning and assessment regardless of utilizing supportive approaches to different groups of students to raise their CCGPA.

DISCUSSION

Even though academic measures of college readiness, such as SAT scores, High School CPAs, class ranks, and others have faced criticisms in terms of their depth in assessing student readiness, their fairness and freedom from bias, and the low variance they share in explaining college readiness (Niu and Tienda, 2010; Atkinson and Geiser, 2009; Kim and Sunderman, 2005; Lehman, 1999; Rattani, 2016), they are still highly utilized and leading measures of college success. On the other hand, college outcomes are also measured through the number of credits earned in college, CCGPAs, alumni income levels, retention, assignment to remediation, and degree completion. Similar to academic college readiness measures, academic college success measures, e.g., CCGPAs, dominate other college success measures in selection for employment. Especially, the academic college readiness measure (e.g. EHEEE) plays a dominant role in HE entry decisions while the college CCGPA also shares the largest percentage in the decision process of screening the graduates for employment in Ethiopia.

Consistent with the result of this study, previous studies by Allensworth and Clark (2020), Galla et.al (2019), and Shewach et.al (2017) revealed that academic college readiness measures significantly predict college success. Beyond predicting college success from college readiness using these measures, the recent applied studies used the academic college readiness measures as covariates while they used college cumulative GPAs as measures of college outcomes in HE quality assessment studies (Coates, 2009; Liu, 2011; Jackson and Kurlaender, 2014). Also, the value-added HE quality assessment models emphasize direct measurement of student learning outcomes (Shavelson et al, 2016; Brown, McNamara and O'Hara, 2016; Sønderlund et al, 2019).

Although the previous studies used the college readiness and success measures for modeling and estimating the HE quality of the value-added, they did not compare conditional effects of college readiness on college success and probabilities of college success for comparative analysis of university performance.

In theory, there is an established assumption that college readiness affects college readiness. This is because students' college aptitudes significantly correlate with their college readiness. Positive university factors strengthen this relationship. However, the distortion of this relationship can represent the errors and mistakes in the education system.

For this reason, the ability to link the precollege preparedness level of students with their abilities to prepare and be ready for employment is the quality of HE. However, this is not adequate to make a UG a high performer. In addition to linking student abilities precisely, UGs should be able to enhance the probabilities of college success. This means that they should make their alumni competitive in the job market. The standardization of the effects of college readiness on college success and the probability of college success across institutions can be highly assured through standardization of the curriculum, teaching-learning, and degrees like that attempted in Europe. If the curriculum, the teaching-learning, the management, and other services show significant differences across institutions, the achievement of standardized measurement for comparative purposes may not be realized. Also, standardization is not adequate, and modeling a measurement for applied comparative purposes is highly warranted.

However, some factors may distort this relationship. These factors spread their roots in the education system in general and some of them can be institutional. The lower curriculum and teaching-learning standards that tolerate shallowness in learning; shortage of early warning assessment, and monitoring of student preparedness that simply passes students to higher learning may cause a voluntary and inevitable admission of unprepared students to HE. Especially, the problems in the assessment system contribute to the imbalances between students' CCGPAs and their abilities. The shortage of resources and trained teachers, and the students' motivation towards learning are some causes for unpreparedness.

CONCLUSION

Generally, there is an established assumption by decision-makers in the selection, admission, and placement system around the world that those students who are screened for college learning through appropriate processes and placed in fields of study that match their interest and ability will also successfully complete their college learning and training. The contemporary decision theory in education, however, tends to take a pragmatic approach and mixes the assumption of all decision theories in practice.

In order to test this assumption in the Ethiopian context, this study tested the assumption that 'college readiness affects college success.' Although this study failed to reject this assumption, the model accounted for only 26 percent of the variance in college success. This means that 74 percent of the variance in college success is explained by other factors. The objective of this study was not only to study how college readiness affects college success; rather, the study was aimed at the meanings of these effects in the applied comparative sense. Firstly, when the conditional effect of college readiness on college success was compared across UGs and departments, a significant difference was observed. Secondly, the study found that the probability of college success at a value of college readiness significantly varied across UGs and departments. Thirdly, in a UG with the highest conditional effect of college readiness on college success, the lowest probability of college success at a value of college readiness is observed. This shows that maintaining a higher effect of college readiness on college success alone may not guarantee the effectiveness of a UG unless the UG simultaneously heightens the probability of college success.

The study also analyzed how this can be related to the quality of HE. Firstly, the study revealed that a UG which significantly promoted the effect of college readiness on college success is relatively more conservative and accurate in managing student learning. Secondly, awarding the highest CCGPA at the lowest conditional effect may show the poor quality of a UG. Also, maintaining a higher conditional effect of college readiness on college success without simultaneously promoting the probability of college success at a value of college readiness ends in poor performance of a UG. Therefore, maintaining a higher conditional effect of college readiness on college success while simultaneously heightening the probability of college success at a value of college readiness is a characteristic of high-performing UG.

The study recommends redesigning of college readiness depending on a rigorous curriculum and teaching-learning standards. To this end, the development of college readiness should be ensured through multidimensional early interventions, monitoring, and partnerships to develop student college readiness. The education system should redesign the college readiness models in line with the feasible and relevant expected outcomes and should monitor the assurance of the college readiness step by step from the early education years.

For the reason that the college readiness level of college entering students is an input for HE quality, HE quality assessment should consider the college readiness variable as a covariate in HE quality assessment. In addition to the current multidimensional models of HE quality assessment, it is believed that the model used in this study can be a new additional input for the HE quality assessment system. This model also can be one of the models that use student university inputs, processes, and students' HE learning outcomes in HE quality assessment.

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APPENDIX

EHEEE Score	UG	Department	Z	Prob.	*p* Level	Sum *p* level	Sum *p* Level Total
355.00	1	1	-1.24	.22	0		
398.00	1	1	-.42	.40	0	1	
435.68	1	1	.29	.57	1		
355.00	1	2	.11	.53	1		
398.00	1	2	3.30	.96	3	7	14
435.68	1	2	6.10	1.00	3		
355.00	1	3	-.21	.45	0		
398.00	1	3	1.43	.81	3	6	
435.68	1	3	2.87	.95	3		
355.00	2	1	-.58	.36	0		
398.00	2	1	.32	.58	1	4	
435.68	2	1	1.10	.75	3		
355.00	2	2	.78	.68	2		
398.00	2	2	4.04	.98	3	8	20
435.68	2	2	6.90	1.00	3		
355.00	2	3	.45	.61	2		
398.00	2	3	2.17	.90	3	8	
435.68	2	3	3.68	.98	3		
355.00	3	1	-.44	.39	0		
398.00	3	1	.19	.55	1	3	
435.68	3	1	.74	.68	2		
355.00	3	2	.91	.71	2		
398.00	3	2	3.91	.98	3	8	19
435.68	3	2	6.54	1.00	3		
355.00	3	3	.59	.64	2		
398.00	3	3	2.04	.89	3	8	
435.68	3	3	3.31	.96	3		

Note: If prob < .50, p level = 0; If .50 < = prob. < .61, p level = 1; If .61 <= prob > .75, p level = 2; If prob >= .75, p level = 3 prob. = p – value, N = 551

Appendix 1: The probability of college success at values of Moderators

		B	*Se.*	*df*	*p*	*Exp*(*B*)	95% C.I.for *EXP*(*B*)	
							Lower	Upper
Step 1[a]	EHEEE Score	-.23	.23	1	.31	.79	.51	1.24
	EGESLCE GPA	13.98	8.15	1	.09	1173837.56	.14	1.02
	EHEEE Score by Log Transfornation for EHEEE Score	.03	.03	1	.29	1.04	.97	1.10
	EGESLCE GPA by Log Transfornation for EGESLCE GPA	-6.02	3.88	1	.12	.00	.00	4.79
	Constant	-11.28	13.95	1	.42	.00		

p < .05; N = 551

Appendix 2: Linearity assumption checking for the binomial logistic regression

Coefficients[a]			
Model		Collinearity Statistics	
		Tolerance	VIF
1	UG	.917	1.091
	Dpt	.722	1.386
	EHEEE	.413	2.420
	EGESLE	.551	1.816

a. Dependent Variable: CCGPA; N = 551

Appendix 3: Multicollinearity assumption check