

Article

Understanding Gender Differences in Students' Perceptions of Competency Certification for Enhancing Sustainability in Higher Education

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Abstract: This study of 1780 college students in Korea explored gender differences in perceptions of competency certification programs in order to enhance sustainability in higher education. Structural equation modeling explained the optimal validity of the two-factor structure of perceptions between female and male students, and the structural relations between the two factors of competency were invariant across gender groups. A significant difference in latent means was found as well. The findings suggest that, for sustainable development, universities should develop systematic competency certification policies to accommodate students' needs, as well as those of society, and help bridge the gender gap in the job market.

Keywords: higher education; competency certification policy; certification program; gender difference; job market

1. Introduction

In tandem with rapid social change, educators and workforce experts suggest that college graduates need to be competitive specialists [1]. This competency-based movement is a reform initiative that has arisen in response to social and historical pressures in higher education [2–4].

Students tend to be less positive than in the past about the effectiveness of degree programs for helping them prepare for the workforce [5]. With competency-based curriculum designs aiming for practical fulfillment, the learning objectives include acquiring comprehensive solutions for the future of the workplace [6]. Successful undergraduate education programs with core competencies will help prepare students for work in contemporary society [7]. In this context, to manage educational quality, universities can operate new extracurricular systems that certify students in certain competencies [8]. Establishing such competency certification programs can contribute to our understanding of what practical competencies students should have, to cultivating excellent students, and to supplying students with the appropriate capabilities required by society. Therefore, it has become important for universities to help students enhance the competencies required by the society for the sustainability of higher education.

Meanwhile, the gender gap in the job market has long been a critical global issue. In recent years, deep-rooted discrepancies in employment between men and women have been reported worldwide [9–12]. These gaps include discrepancies in salaries as well as the employment of

college graduates. Therefore, competency-building programs are needed in universities to enhance students' capabilities in consideration of gender balance and sustainability in higher education.

2. Background

2.1. Sustainability in Higher Education

Universities are expected to offer sustainable education in the rapidly changing era of the Fourth Industrial Revolution. Indeed, higher education institutions play a critical role in societal transformation toward sustainability through their leadership and curricula [13]. Universities help society develop by preparing graduates to acquire knowledge and skills required by companies.

Meanwhile, it is necessary to consider the sustainability of universities for other reasons. With regard to the population, some countries are struggling with an ever-decreasing birthrate. Lower birthrates mean that the number of college entrants will continue to decrease, a fact directly related to the issue of the sustainability of some universities.

For example, Korea's fertility rate is 1.25, the lowest among OECD countries, and 220th out of a total of 224 countries surveyed [14]. The South Korean government warns that the number of college applicants will fall short of the quota, and hence, underqualified universities should reduce their quota or be closed within the next few years [15,16]. Therefore, universities are required to be more competitive in order to survive; they need to establish a strategic system that can prove their own needs through practical and effective student support.

2.2. Competency for the Sustainability in Higher Education

Competency predicts life-outcome behaviors and is generally useful compared to intelligence [17] (pp. 8–10). Klomp (1980) regarded competency as a potential characteristic of individuals that enhances the effectiveness of their work and achieves superior performance [18] (p. 21). Spencer and Spencer (1993) suggested that competency is a potential characteristic of individuals who perform effectively according to specific criteria in any task or situation [19] (pp. 11–15). Parry (1996) and Lee (2002) viewed competency as a collection of knowledge, skills, and attitudes that can aid performance [20] (p. 50), [21] (pp. 26–27).

It has been proposed that competency should replace grading as an indicator of educational performance in universities [22]. Along these lines, competency-based learning in higher education is required to make innovative changes [6] (pp. 851–852), [23] (p. 118). Competency-based education refers to a developmental progression through which students obtain the knowledge, skills, and attitudes needed to serve the public and work in interdisciplinary environments as competent professionals [7] (pp. 29–30). In competency-based learning processes, students are expected to learn in a self-regulated way in the selection of targeted learning activities [24].

Recently, employers demand that college students' competencies should match companies' needs, and higher education institutions are required to stimulate students' abilities [25]. In order for universities to be sustainable in the future, universities are actively accepting companies' demands for cultivating students' competencies [26].

2.3. Competency Certification and Its Contextual Background

The Korean government has recently emphasized competency in higher education [27]. In particular, the Advancement of College Education (ACE) Project, proposed by the National Research Foundation in 2010 [28], has encouraged universities to set essential competencies that students are expected to enhance and provide competency-based education to meet the demands of a rapidly changing society [29]. The Korean government provides an average of two million USD a year in national grants to selected universities to promote the implementation of competency-based education [30].

Competency-based curriculum shifts are considered substantive changes that include degree levels, course offerings, and delivery methods [8]. Among these changes, competency certification programs have been developed to manage educational quality [31]. Some of these programs focus on developing competencies in specific areas. The intercultural competency certification program, for example, aims to prepare students to face global challenges in workplaces [32]. This program requires students to engage in activities such as learning a new language, taking international classes, interacting with people from other cultures, and receiving coaching. Meanwhile, reading competency certification was established to strengthen thinking ability, self-regulated learning, and problem-solving ability [33]. Moreover, a personality education certification system was developed to cultivate professionals with the personality characteristics demanded by society [34].

To operate more systematic and sustainable competency certification programs, some Korean universities have held discussions on areas such as which courses to teach competency in and how to certify competency, among other issues [35].

2.4. Employment and Gender Issues

One of the critical issues to tackle when considering the sustainability of higher education regarding competency is the gender divide. It was recently reported that gender inequities still exist in this regard [36]. On average, among OECD countries with available data, men were less likely than women to attain tertiary education (38% of men aged 25–34 were tertiary educated compared to 50% of women the same age). Moreover, despite better educational attainment, women still had worse employment outcomes (80% of tertiary-educated women were employed, compared to 89% of young men with the same education). Further, tertiary-educated women earned 26% less than tertiary-educated men. As such, female and male graduates are situated in the labor market in line with tendencies toward gender inequality [37]. In addition, Vuorinen-Lampila (2016) found that male graduates more easily secured full-time employment than females and achieved better correspondence between their degree and their employment [38].

In Korea, issues related to the employment of female college graduates are similar to those found in other countries [39]. Women have been found to regard their gender as a major impediment to employment [40] and accordingly experience increased stress and anxiety about getting a job [41]. Female undergraduates, therefore, have shown more interest in acquiring competencies in hopes of improving their job prospects [42], and they devote more time and attention to preparing for their careers while in college [43].

3. Method

3.1. Research Problem and Hypotheses

The problem suggested in this study is that the sustainability of higher education is a critical issue in countries such as Korea, where the school-age population is decreasing. One of the university's efforts to cope with this problem is to operate a system that helps students improve their practical competencies and certify them so that graduates can actively perform their roles in society. In order to operate the competency certification program more systematically, it is necessary to understand and support major issues that arise between male and female college students. Therefore, in this study, we planned to analyze gender differences in perception of competency certification programs, and to make suggestions for sustainable education in universities.

Accordingly, the research questions to address the research problems were as follows. First, what are the baseline models of each gender that explain the factorial structures of the perceptions of the competency certification program? Second, is the factorial structure equivalent across populations? Third, were the latent means for the two gender groups statistically different?

3.2. Population and Sampling

The target population for the study was college students at K University in Korea, where competency certification programs were in operation. An online survey was conducted for about three weeks from 1 October to 17 October, 2018 by random sampling. A total of 1985 students (1045 females and 940 males) initially responded. After eliminating questionnaires with invalid or missing values, data from 923 female and 857 male students were used for analysis. In terms of grade level, 350 were freshmen (17.7%), 421 sophomores (23.7%), 485 juniors (27.2%), and 524 seniors (29.4%). They had various majors, ranging from arts and humanities to science and engineering. The survey questionnaire and data for examining the research questions were used after the researchers had obtained the institutional review board approval of the University.

3.3. Research Method

The questionnaire was initially developed based on the objectives of competency certification. It was then reviewed by experts in educational technology, measurement, and policy to enhance the validity of the items. The questionnaire used a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), to rate the extent to which the participants believed that the competency certification program would develop their personal competency (PC) and career competency (CC). The model to be tested postulated a priori that the questionnaire items had a two-factor structure composed of PC and CC. Table 1 presents the items for the two factors.

Table 1. Items for the hypothesized factor structure.

Factor	Variable	Item
PC	V1	It will help me improve my competency.
	V2	It will give me a balanced experience of various areas of learning.
	V3	It makes me think that activities other than regular subjects are also important.
CC	V4	It makes it easier to navigate my career path as it enables a variety of experiences.
	V5	It will help me navigate my career path if I am certified.
	V6	It contributes to the nurturing of human resources required by universities.

Structural equation modeling was adopted as the research methodology to address the research questions. Specifically, factorial validity and latent mean differences were employed. EQS software [44] was used for data analyses.

4. Results

4.1. Baseline Models by Gender

First-order confirmatory factor analysis was performed to test the multidimensionality of the theoretical constructs. There were six observed variables, and the two factors were intercorrelated. Ordered univariate test statistics and the χ^2 univariate increments associated with the cumulative multivariate statistics were used to test the overall model fits of the baseline models. Additionally, the Lagrange multiplier (LM) test was adopted to test the hypotheses' bearing on the statistical viability of specified restrictions [45].

Since kurtosis was more than 5.00 in the female and male models (33.12 and 27.78, respectively), they were considered non-normally distributed. Therefore, the Satorra–Bentler (S–B) χ^2 with accompanying difference in degrees of freedom and a robust statistics portion of the output were used in this study [46]. Regarding model reliability, the Cronbach's alpha coefficient was 0.890 and the Rho coefficient was 0.890 for the female group; the values for the male group were 0.888 and 0.890, respectively.

Table 2 presents the standardized estimates of the baseline models for the items by gender. All estimates were shown to be reasonable as well as statistically significant. In the standardized

solution, each measured variable was accompanied by an R^2 value representing the proportion of variance accounted for by its related factor [45].

Table 2. Standardized estimates of the baseline models.

Factor/Variable		Female		Male	
		Factor Loadings	R2	Factor Loadings	R2
PC	V1	0.799 ^a	0.638	0.797 ^a	0.635
	V2	0.803 [*]	0.645	0.809 [*]	0.654
	V3	0.718 [*]	0.515	0.691 [*]	0.478
	V4	0.761 ^a	0.579	0.780 ^a	0.608
CC	V5	0.740 [*]	0.548	0.739 [*]	0.546
	V6	0.744 [*]	0.554	0.746 [*]	0.556

^a These values were constrained at 1.00 in the unstandardized models. ^{*} $p < 0.05$.

In testing the validity of the two-factor structure regarding perceptions of the competency certification program, the findings consistently revealed optimal goodness-of-fit statistics for the initial model for both females and males. Accordingly, any post hoc model fitting with the results for the multivariate LM test statistics that pointed to additional misspecification was not considered. The two models' goodness-of-fit statistics were as follows:

- Female group: $S-B \chi^2_{(8)} = 12.00$; comparative fit index (CFI) = 0.997; incremental fit index (IFI) = 0.997; root mean square error of approximation (RMSEA) = 0.023; 90% confidence interval (C.I.) 0.000, 0.049
- Male group: $S-B \chi^2_{(8)} = 10.66$; CFI = 0.998; IFI = 0.998; RMSEA = 0.020; 90% C.I. 0.000, 0.047

According to the results from the baseline models by gender, the students in the study believed that the certification program was designed to improve both personal and career competency. This implied the fact that students had a high expectation of having practical skills that could be used directly in society after graduation, not just acquiring cognitive knowledge through participation in the program. This provides information on how universities should organize their curriculum to satisfy students' needs.

4.2. Factorial Invariance

In testing the validity of the two-factor structure regarding perceptions, the findings consistently reveal optimal goodness-of-fit statistics for both genders. Accordingly, any error covariances or cross-loadings suggested in the LM test statistics were not estimated in the research. Therefore, testing for equivalence in the perceptions of female and male students was conducted with the baseline models.

To check for configural invariance, the same parameters estimated in the baseline model for each group were estimated. The results show a well-fitting multigroup model, with an $S-B \chi^2_{(16)}$ value of 22.61. Therefore, the structure of the perceptions was optimally represented as a two-factor model with the pattern of the factor loadings specified in accordance with the multigroup model.

In addition, invariance in the factor loadings and measurement error variances-covariances were reviewed. In testing for measurement invariance, equality constraints were placed on those that were freely estimated. The results show that the multigroup model with equality constraints imposed on all appropriate factor loadings and error covariances was not statistically deteriorated in terms of model fit (corrected $\Delta S-B \chi^2 = 6.26$; $p > 0.05$; $\Delta CFI = 0.002$). Accordingly, the multigroup model exhibited overall a good fit to the data (CFI = 0.995; RMSEA = 0.0220).

In testing for invariance related to the structural model, factor covariances were examined. The goodness-of-fit statistics reflected a model that still showed a good fit to the data with negligible differences in fit from the configural model. Comparison with the configural model

also yielded nonsignificant differences in S-B χ^2 values (corrected $\Delta\text{S-B } \chi^2_{(21)} = 6.94$; $p > 0.05$). Likewise, the difference in CFI values was minimal ($\Delta\text{CFI} = 0.002$). As the $\Delta\text{S-B } \chi^2$ value was statistically nonsignificant; this finding suggests that all specified equality constraints were tenable. Therefore, it was concluded that the structural relations between the two factors of competency were invariant across the two gender groups. The results of the invariance tests are shown in Table 3.

Table 3. Results of the invariance tests for females and males.

Model	S-B χ^2	df	CFI	RMSEA	$\Delta\text{S-B } \chi^2^a$	p
Configural	22.61	16	0.995	0.022		
Measurement	28.59	20	0.997	0.022	6.26	>0.05
Structural	29.59	21	0.997	0.021	6.94	>0.05

^a Corrected value.

The results from the factorial tests including configural, measurement, and structural invariances suggested that both female and male students shared a similar view of the objectives of the competency certification program. In other words, females also had a strong need for enhancing career competency as well as personal, which implied that females had hopes for social advancement after graduation overcoming the current reality of gender inequality in the job market [37,38].

4.3. Latent Mean Differences

A constant variable was created to determine the latent mean structures of the models. It was designated as V999 in EQS (Byrne, 2006). In Figure 1, the latent factor (F) means are represented by factor intercepts leading from the constant, and the factors had related disturbance terms (Ds) as dependent variables. There were six observed measures regressed on each of the two factors in both the female and male groups associated with the error terms (Es). The asterisks (*) represent parameters to be estimated and the first of each factor of congeneric measures was fixed to 1 for model identification and latent variable scaling. The constants in the mean structure models have no variance, no covariance, and remained fixed at a value of 1. Figure 1 displays the mean structure models for both genders.

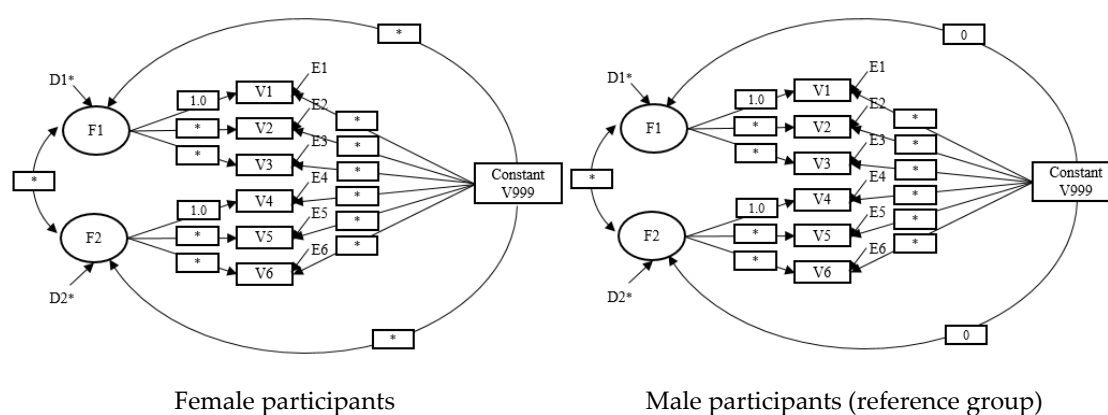


Figure 1. Mean structure models for latent factor mean differences.

Each of the models had six observed variables and two factors, which were regressed onto the constant. Each coefficient associated with the regression one-way arrows means an intercept expressing mean values. Regressions of the two factors to the constant implies intercepts that represent the latent factor means.

Construct equations were examined to address the third research question (i.e., whether the latent factor means for the two gender groups were statistically different). Since the male group was designated as the reference group, the estimates related to the female group were interpreted. Furthermore, since the analyses were based on robust statistics, the estimates were robust standard errors and the resulting z-statistics. As shown in Table 4, all means of the two factors for the female group were found to be significantly different from those for the male group.

Table 4. Results for latent mean differences.

Construct Equations	S. E.	Z
F1 = 1.760*V999 + 1.000D1	0.043	41.368 *
F2 = 1.724*V999 + 1.000D2	0.022	79.325 *

V999 = constant; D = disturbance. * $p < 0.05$.

Specifically, the findings showed that females' perceptions of both personal and career competency were more positive than males' perceptions, as indicated by the z-scores of 41.368 and 79.325, respectively. This suggests that female students viewed the competency certification program more favorably.

The results from the latent mean differences showed that female college students were more favorable to the program. This indicated that universities have lacked preparation for enhancing students' practical competencies through traditional curricula, especially for females. Furthermore, the results suggested the universities' need to make an effort to bridge the gender issue as well as help graduates' competency by providing relevant policies such as the competency certification program.

In sum, the overall results implied that female and male groups both believed that the certification program contributed to improving personal and career competencies. Furthermore, structural relations between the two competencies were shown to be invariant across genders. Lastly, the testing for latent mean differences revealed that females had more positive perceptions of the competencies than males.

5. Discussion and Conclusions

This study began with the question of what strategies and policies universities should implement to be sustainable in a rapidly changing era. Particularly because the population is decreasing in countries such as Korea, universities are facing the issue of survival, and more active student support efforts should be made to overcome it. From this point of view, universities have established programs to enhance students' competencies. Given this context, this study conducted structural analyses related to gender differences, a major issue in the college student competency enhancement programs. Through this, we suggested policies to support sustainable education in higher education.

In order to examine the objectives of the research, the baseline factorial structures of the perceptions of the competency certification policy among female and male Korean college students were tested to check for equivalence between the two groups and to compare the differences in the latent factor means. The findings from the results indicate that while both females and males believed the program improved their personal and career competencies, females had statistically higher expectations regarding the program's effectiveness.

The following critical issues can be inferred from the results. Also, suggestions made from the issues are essential for sustainable development in higher education in this rapidly changing and uncertain society. First, the finding that both females and males expected the certification program to improve their personal and career competencies implies that the program responds to the needs of society. Since it was found that students recognized the importance of the program, universities should develop optimal curricula that effectively foster competencies for work readiness [8]. Experts have proposed developing the program in two directions: identifying specific competencies that should be improved and designing effective competency certification strategies [31,36]. For future

development, programs should have systematic features that will help students improve their competencies in practical ways [39].

Second, another significant finding was that female students showed more interest in the program. This was likely because female graduates have been historically disadvantaged in the job market. Ironically, this unbalanced reality has driven women to consider certification programs as complements to their narrow job prospects, which is similar to the reason for which women have devoted so much time to competency enhancement activities [42,43]. Therefore, university policymakers should have the understanding that competency certification programs can contribute to not only improving employment but also addressing gender gap issues. Accordingly, it is also required to develop competency-based learning content and strategies that help female students overcome gender inequality in the job market.

Third, since certification itself is related to learning results and administrative procedures, it is important to develop substantive curricula, designs, and instructional strategies to build the expected competencies [33,47–49]. The issues at hand include whether to teach competency programs in regular or non-regular subjects, what content to include, and how to implement learner-centered instruction. Once the specifics are worked out, a certification program that satisfies students' interests can be systematically conducted within the ecosystem of the university.

To train students to become professionals who can meet the needs of society, universities have implemented competency-based educational policies. In this context, various areas of student-related administrative and academic activities—such as graduate preparation programs, curriculum development, and job creation—should be carefully developed to enhance students' competencies [4]. In line with the global trend toward competency enhancement, Korean universities have developed competency certification programs with unique backgrounds. Competency certification programs have sought to strategically educate students and certify their acquired competencies.

In conclusion, female college students are aware of the unfavorable conditions in the job market and they are willing to actively participate in competency certification programs provided by the universities. As long as the programs are carried out effectively, universities will serve quality education programs for students to successfully graduate and be fully equipped to enter society. Ultimately, the program will enhance the sustainability of universities in times of crisis, such as the rapidly changing world and decreasing school-age population in some countries.

Despite increasing interest, we still do not have enough empirical data on competency certification policies in higher education. To address this gap, this study conducted baseline research for further development directions. The results suggest that competency certification is interrelated with complicated issues such as curriculum development, employment, and gender equity. Universities have a responsibility to help their students become competitive and address the related social issues. Additional practice and research are needed to fuel such changes.

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