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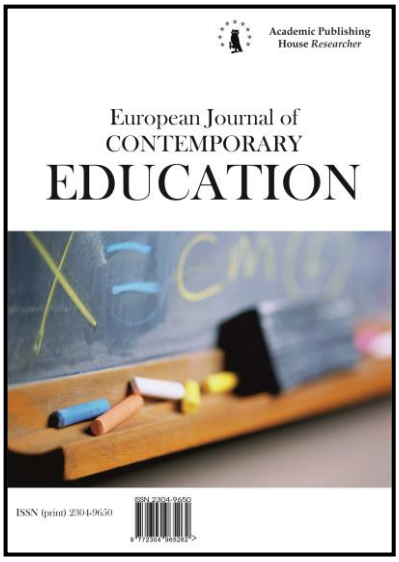

The Assessment of Student Learning Outcomes in Accordance with CDIO Model at the Vietnam National University Ho Chi Minh City

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Abstract

Student learning outcomes are a critical indicator of the quality of instruction and the competence of faculty members and students in higher education settings. This research explored the students' perceptions, the relationship of student individual characteristics and how educational environment at university influenced on the assessment of their learning outcomes in accordance with CDIO model. To acquire data, the research used questionnaire surveys and documentation. The data in this research was taken from a random sample of 1,107 students from the three member universities of the Vietnam National University Ho Chi Minh City, Vietnam. It was then analyzed by data processing, displaying to reach a conclusion. To obtain the results, methods such as descriptive analyses, independent *t*-test, the analysis of variance (ANOVA), and multiple regression analyses were used. Three things have come to light as a result of the study. First, the empirical results revealed that the majority of students have a favorable opinion of the assessment of their learning outcomes. In addition, there are variances in the assessment of students' learning results based on their individual characteristics. Finally, the factors associated with the educational environment at the university are significantly linked to the assessment of their learning outcomes under the CDIO model. The results of this study are the basis for stakeholders to develop scientific, accurate and logical sets of criteria for assessing student learning outcomes. The results from this research are to be discussed by managers.

Keywords: Vietnam, assessment of learning outcomes, CDIO model, individual characteristics of student, university academic learning, higher education.

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1. Introduction

Curriculum, instruction, and assessment are the three basic components of education, the use of assessment to identify a program's strengths and weaknesses allows faculty to work toward continuous improvement based on their articulation of learning and behavioral goals and outcomes for their graduates (Allen, 2004). Assessment is a process that requires principles, methods and tools of measurement to ensure reliability and objectivity, contributing to the improvement of teaching and learning activities for both faculty members and students in the universities. Black and William (1998) showed that the process of assessment improves learning and achievement in learning outcomes, and is an excellent means of improving student achievements; especially, those of students with poor academic results.

Assessment of educational outcomes plays an increasingly important role in higher education; in which accreditation organizations place growing importance on student academic learning (Allen, 2006; Bers, 2008) to prepare students for the labor force through development of relevant skills and competencies which are expected by the accreditors, governments and workforce representatives (Toutkoushian, 2005). Therefore, achievement of student academic learning outcomes needs to be appropriately documented through the process of assessment (Praslova, 2010).

Various previous studies demonstrated that assessment of students in the educational process is necessary to check the level of attaining the goals. According to Madaus (1989), through the results of the assessment of student learning outcomes, faculty members adjust the curriculum content and teaching methods accordingly to ensure teaching and learning effectiveness. The role of assessment of student learning outcomes is an important means, not only for students to avoid forgetting but also to acquire the knowledge more solidly (Savin, 1983). In addition, the study of Ornstein and Lasley (2000) mentioned the skills and techniques of teaching, in which the assessment of learning outcomes contributes to the improvement of teaching effectiveness. It affirmed that the assessment does not have the only purpose of grading students, but many different ones, including encouraging students' progress or helping student adjust their own learning. Furthermore, the study of Bloom, Madaus and Hastings (1971) identified that faculty members applying the right assessment methods help enhance students' learning ability. They aimed at perfecting and using the system of tests and questions properly, rather than focusing on solving problems related by selecting and using competencies and intellectuals in standardized tests.

There are various models to measure student learning outcomes in higher education institutions. The study of Richard and Rodgers (2001) displayed that the CDIO model focuses on learning outcomes (what students are expected to be able to do, rather than what they need to study), and helps develop a common framework that combines teaching, learning, assessment, and feedback mechanisms to address academic disciples' demand for graduates with improved professional competencies (Karpe et al., 2011). Therefore, the assessment of learning outcomes is based on the performance of specific tasks, which helps students attain personal and professional skills. In addition, it also helps create products and processes necessary for good integration into labor activities. Furthermore, CDIO model provides a comprehensive and specific guide on how to develop learning outcomes and curriculum frameworks, how to create a convenient academic environment, how to demonstrate an effective teaching method, and how to assess teaching and learning (Mustapa et al., 2017).

There are many ways to classify forms of assessment in education, but, according to the CDIO model, the assessment of learning outcomes is often classified into two main types: formative assessment and summative assessment, also known as assessment of learning (Shute, Kim, 2014). Stiggins (2004) conducted a study on two forms of assessment, such as: 1) assessment for the progress of students (assessment for learning) and 2) assessment to confirm the results at the end of a studying period or program (assessment of learning). Based on these, faculty members can apply the suitable method of assessing students in a class. Many other studies also agreed that assessment of learning is a tool to help evaluate the effectiveness of a program, the teachers' goals of improvement, the suitability of the curriculum or the students' position in particular programs (Basta, 2013).

In addition, the study of Nitko (2004) also provided the theoretical basis on the content of the assessment of student learning outcomes, including: assessment of goals, effectiveness, designing of teaching plans combined with assessment activities. Furthermore, the standard-11 of

the CDIO model demonstrated that the assessment of students' learning is the measurement of the values of learning outcomes that student achieved in learning activities according to lecturers' requirements (CDIO, 2010). The CDIO model is essentially a solution to improve training quality to meet social requirements, on the basis of determining output standards to design effective training programs and plans. Thus, the approach of assessment of learning and designing of teaching plans chosen in this research is based on the research of Stiggins and Nitko and CDIO model with the purpose of creating assessment items for student learning outcomes that aligns with the CDIO model.

Vietnamese higher education institutions are carrying out the reform requirements of approaching to a modern and internationally integrated education with the trend of innovation in testing and assessment of student learning outcomes. This is to improve training quality and meet the human resource requirements for the national socio-economic development (Vu, 2018). However, evaluation methods implemented are different which resulted in a lack of synchronization. Thus, the effectiveness of testing and assessment of student learning outcomes does not live up to expectations in universities. According to Crawley, Malmqvist, Östlund, and Brodeur (2007), one of the approaches to improve the quality and standardization of the curriculum in the fields of engineering and technology is CDIO model. In this research, the application and implementation of the CDIO model, therefore, used to assess the learning outcomes of students at universities in the fields of science and technology in Vietnam.

Previous studies recognized the relationship between student learning outcomes and gender, race, ethnicity of engineering students (Ro, Loya, 2015; Ro, Knight, 2016); students' learning methods and quantitative learning outcomes (Gijbels et al., 2005); grading, classroom assessment techniques, and institutional assessment (Anderson et al., 2005); learning environment (Kember et al., 2010).

In view of aforesaid points, the purpose of this research is to explore the students' perceptions, and how students' personal characteristics and educational environment at university influenced on the assessment of their learning outcomes in accordance with CDIO model at the Vietnam National University Ho Chi Minh City (VNU-HCM). This research aims to answer the following research questions: 1) What is the general level of the assessment of student learning outcomes in accordance with CDIO model? 2) Are there any significant differences in the assessment of learning outcomes between various relevant personal characteristics and 3) How is the assessment of student learning outcomes affected by educational environment at university?

2. Materials and methods

2.1. Sample

The data in this research was investigated random sample of 1,200 students who are currently studying full-time from the three member universities of Vietnam National University – Ho Chi Minh City, which were 237 higher education institutes in Vietnam (General statistics office of Vietnam, 2019). Out of the 1,200 students, this research was conducted with 1,107 students whose were self-reported information in higher education research. It was 92.25 % return rate by their email which exceeded the 30 % response rate for analysis purpose (Dillman, 2000).

A multipart questionnaire was used to collect basic information about students and obtain data regarding their educational environment at university as well as the assessment of learning outcomes student perceptions. The demographics for this sample population were as follow female students (15 %) and male students (85 %); 22.1 %, 45.3 % and 32.5 % students of University of Technology, University of Information Technology and University of Science, respectively. Regarding accommodation, interestingly, the percentages of students living on campus (65 %) and off-campus away from their family (22 %) were higher. Of those who responded to the survey, only 16.7 % of graduating students ranked very good, while 62.4 % of students are ranked good and the average remaining.

2.2. Variables

The assessment of student learning outcomes in accordance with CDIO model was identified as the dependent variable of this research. As shown in Table 1, it was constructed based on five questionnaire items measuring the content of the assessment are suitable for students' ability. The criteria for assignments are clear, the exercises and tests are clearly commented and commented by the instructors, the instructors combine a variety of testing methods and forms to assess learners'

ability, and the instructors allows students to do a project/essay to evaluate the study plan. Factor loading, total variance explained, and internal consistency analysis (Cronbach's α) were conducted to assess the validity and reliability of this constructed measurement for the assessment of student learning outcomes in accordance with CDIO model factors at the VNU-HCM.

Values of factor loading for items of the assessment of student learning outcomes factor ranged from 0.739 to 0.834, which were higher than the threshold level of 0.6 (Hair et al., 2009). Total variance explained was 61.20 %, which was higher than the threshold level of 60 percent and meeting the requirement of a constructed variable for social science research (Hair et al., 2009). The findings of the internal consistency analysis revealed a Cronbach's α coefficient of 0.839, which was higher than the threshold level of 0.6 (Hair et al., 2006) and 0.7 (Nunnally, Bernstein, 1994), indicating satisfactory reliability. Based on the above findings, hence, five factors were acceptable for establishing the assessment of learning outcomes students in accordance with CDIO model in this research (see Table 1).

Table 1 shows the correlation among five dimensions of the assessment of learning outcomes in accordance with CDIO model at the VNU-HCM students. The value of correlation coefficient ranges from 0.366 to 0.633 was relatively high positive correlation between factors of the assessment of student learning outcomes. The relationship were highest associated between the content of the assessment are suitable for students' ability and the criteria for assignments are clear (r = .633). Other significant associations were lowest found between the exercises and tests are clearly commented and commented by the instructors and the instructors allows students to do a project/essay to evaluate the study plan (r = .366).

Table 1. The results of correlation between five dimensions of the assessment of learning outcomes in accordance with CDIO model at the VNU-HCM students

	1	2	3	4	5
1. The content of the assessment are suitable for students' ability	1				
2. The criteria for assignments are clear	.633**	1			
3. The exercises and tests are clearly commented and commented by the instructors	.434**	.597**	1		
4. The instructors combine a variety of testing methods and forms to assess learners' ability	.487**	.516**	.551**	1	
5. The instructors allows students to do a project/essay to evaluate the study plan	.483**	.486**	.366**	.580**	1

Note: ** Correlation is significant at the 0.01 level (2-tailed)

The independent variables of this research encompassed 2 categories: student individual characteristics and educational environment at university factors. Firstly, student individual characteristics consisted of gender, university studying, accommodation and grade description. Secondly, educational environment at university contained 4 factors, including evaluation methods, curriculum emphases, teaching approaches, and improvement activities. Table 2 shows the details of operational definitions, means (*M*), and standard deviations (*SD*) of the independent variables.

Table 2. Operational definitions, *M*, and *SD* of the independent variables

Individual characteristics
Gender: Female = *0*, Male = *1*
University studying: measured on a 3-point scale, where 1 = *University of Technology*, 2 = *University of Information Technology*, and 3 = *University of Science* (*M* = 2.10, *SD* = 0.73). Accommodation: measured on a 3-point scale, where 1 = *living with family*, 2 = *on campus*, and 3 = *off-campus* (*M* = 2.09, *SD* = 0.59).

Grade description: measured on a 3-point scale, where 1 = *Average*, 2 = *Good*, and 3 = *Very good* (*M* = 1.96, *SD* = 0.61).

Educational environment at university

Evaluation methods: measured on a 5-point scale, where 1 = *never* and 5 = *always* (*M* = 3.73, *SD* = .72).

Curriculum emphasizes: measured on a 5-point scale, where 1 = *strongly disagree* and 5 = *strongly agree* (*M* = 4.01, *SD* = .70).

Teaching approaches: measured on the same scale as that for curriculum emphasizes (*M* = 4.00, *SD* = .64).

Improvement activities: measured on the same scale as that for curriculum emphasizes (*M* = 4.01, *SD* = .76).

Note: Every variable is measured with one question item

2.3. Procedure

This research employed the following data analysis procedure: descriptive analyses, independent *t*-test, the analysis of variance (ANOVA), and multiple regression analyses. Descriptive analysis is conducted to understand the general level of the assessment of learning outcomes. The independent *t*-test and ANOVA were performed to see whether significant differences existed between individual characteristics and the assessment of learning outcomes. A series of separate stepwise multiple regression analyses were conducted to investigate the influences of educational environment at university on the assessment of learning outcomes in accordance with CDIO model at the VNU-HCM students.

3. Results

3.1. Level of the assessment of learning outcomes in accordance with CDIO model at the VNU-HCM students

Table 3 presents the descriptive statistics for the dependent variable – the assessment of student learning outcomes in accordance with CDIO model – based on the results from the five questionnaire items. In this research, the survey used a 5-point scale with responses ranging from 1 = strongly disagree to 5 = strongly agree. With the overall *M* and *SD* for each value, the findings reveal that most students at the VNU-HCM hold fairly high opinion of the assessment of their learning outcomes (*M* = 3.86, *SD* = 0.71).

Table 3. Results of *M*, *SD*, factor analysis and reliability of the dependent variable

Factors	***M(SD)***	**Range of score**	**Factor loading**
The content of the assessment are suitable for students' ability	3.91(.86)	1 - 5	.834
The criteria for assignments are clear	3.92(.91)		.803
The exercises and tests are clearly commented and commented by the instructors	3.79(1.02)		.778
The instructors combine a variety of testing methods and forms to assess learners' ability	3.85(.93)		.752
The instructors allows students to do a project/essay to evaluate the study plan	3.85(.85)		.739
Total variance explained (%)		61.20	
Cronbach's α		.839	
Total *M(SD)*		3.86 (.71)	

Note: Data were analyzed with principle component analysis

For the five dimensions of the assessment of learning outcomes in accordance with CDIO model at the VNU-HCM students, the findings of Table 1 also show that students were agreed with the criteria for assignments are clear (M = 3.92, SD = 0.91), followed by the content of the assessment are suitable for students' ability (M = 3.91, SD = 0.86), the instructors combine a variety of testing methods and forms to assess learners' ability (M = 3.85, SD = 0.93), and the instructors allows students to do a project/essay to evaluate the study plan (M = 3.85, SD = 0.85). Students were least agreed with the exercises and tests are clearly commented and commented by the instructors (M = 3.79, SD = 1.02).

3.2. Comparison between individual characteristics and the assessment of learning outcomes in conformity with CDIO model at the VNU-HCM students

Table 4 shows that, overall, student individual characteristics difference exist regarding the assessment of their learning outcomes in conformity with CDIO model. Regarding the relationship in the assessment of their learning outcomes between male (M = 3.81, SD = 0.72) and female students (M = 4.12, SD = 0.61) at the VNU-HCM, the t-test findings reveal that the female students were significantly higher than those of the male counterparts (t = - 5.706, p < 0.001).

Table 4. Statistical analysis for student individual characteristics at the VNU-HCM and the assessment of their learning outcomes in conformity with CDIO model

Factor		N	*M(SD)*	*t-test / F*	*post hoc*
Gender	Male	941	3.81(.72)	-5.706***	-
	Female	166	4.12(.61)		
University studying	UoT(A)	245	3.94(.64)	10.775***	A,B > C
	UoIT (B)	502	3.93(.71)		
	UoS (C)	360	3.72(.83)		
Accommodation	Living w/ family (A)	145	3.72(.70)	3.511*	A < B
	On campus (B)	719	3.88(.69)		
	Off-campus (C)	243	3.89(.78)		
Grade description	Average (A)	231	3.73(.85)	5.165**	A < B
	Good (B)	691	3.91(.68)		
	Very good (C)	185	3.86(.64)		

Note: UoT: University of Technology; UoIT: University of Information Technology; UoS: University of Science.
* p < .05, ** p < .01, *** p < .001

As shown in Table 4, the ANOVA findings demonstrate that there were significant differences among the assessment of learning outcomes in conformity with CDIO model and universities where the student is studying (F = 10.775, p < 0.001), accommodation of respondents (F = 3.511, p < 0.05), and grade description of students (F = 5.165, p < 0.01). Specifically, the findings of post-hoc explained that the University of Technology (M = 3.94, SD = 0.64) and the University of Information Technology (M = 3.93, SD = 0.71) students had higher score in the assessment of their learning outcomes than their colleagues in the University of Science (M = 3.72, SD = 0.83). The findings also indicate that students who are living with their family (M = 3.72, SD = 0.70) had lower satisfaction in the assessment of learning outcomes than those living on campus (M = 3.88, SD = 0.69). Finally, participants holding good of grade description (M = 3.91, SD = 0.68) had higher motivation in the assessment of learning outcomes than those holding average rank (M = 3.73, SD = 0.85). Unfortunately, there were no significantly different between the assessment of learning outcomes and factors of students who living off-campus and ranking of very good well in their results study.

3.3. Effects of educational environment at university on the assessment of learning outcomes in conformity with CDIO model at the VNU-HCM students

Table 5 suggests five models of logistic regressions, which analyze the effects of educational environment at university (such as evaluation methods, curriculum emphases, teaching approaches, and improvement activities) on the assessment of learning outcomes in conformity with CDIO model at the VNU-HCM students. Models 1 through 4 present the separate effects of

these factors on the assessment of student learning outcomes, and Model 5 present the combined effects. These models explained 63.6 % of the variance of the assessment of student learning outcomes of educational environment at university (Adj. R^2 =.636). Multicollinearity diagnosis yielded no value of variance inflation factor (VIF) in the regression models higher than 10 (in this research VIF = 1.850 to 3.395), indicating no risk of serious multicollinearity of the models (Hair et al., 2009; StataCorp, 1997). The regression models also exhibit the Beta coefficient (β) of attaining the assessment of student learning outcomes compared with not attaining such ones, with $\beta > 0$ indicates a positive effect, and $\beta < 0$ indicates a negative effect.

Table 5. Stepwise and regression analyses of independent variables effects on the assessment of learning outcomes at the VNU-HCM students

Factor	Model 1	Model 2	Model 3	Model 4	Model 5	VIF
			β			
Evaluation methods						
Based on products	.115***				.017	1.957
Academic portfolio	.192***				.072**	2.034
Judging by the situation	.220***				.081**	2.339
Question and answer	-.014				-.022	2.346
Writing exam	.199***				-.063*	2.074
Students' performance	.134***				.114***	2.481
Curriculum emphasizes						
Accord with the vision and mission		.139***			.011	2.420
Objectives are clear and feasible		.166***			.052	2.322
Rate of knowledge blocks is appropriate		.077*			.075*	3.395
Learning outcomes are feasible		.109***			-.006	2.080
Subjects are closely related		.056			.029	2.733
Curricula is periodically adjusted		.346***			.242***	2.980
Teaching approaches						
Introduces objectives of the course			.246***		.138***	2.273
Provide the criteria, evaluation methods			.150***		.001	1.850
Use the grading scale and other forms of evaluation			.143***		.001	2.215
Use a variety of teaching methods			.051		-.008	2.462
Organize experiential learning activities			.235***		.130***	2.533
Have improvements in the teaching activities			.083**		.015	2.431
Improvement activities						
Participate in the adjustment of curriculum				.387***	.176***	2.193
Physical facilities meet the requirements				.087**	-.015	2.340

Provide feedback to students				.132***	.161***	3.055
Change appropriate assessment methods and forms				.045	-.098**	2.706
Train skills meet the outcomes of program				.099**	-.060	3.125
Adjust the procedures and regulations on examination				.058	.124***	3.243
Adj. R^2	.368	.509	.423	.433	.636	-

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

The findings of this research demonstrate that educational environment at university factors persisted to have significant relationships with the assessment of learning outcomes in conformity with CDIO model at the VNU-HCM students. Model 1 indicates that the most items of evaluation methods factor, except item of question and answer, exerted a substantial influence on the assessment of student learning outcomes of the Vietnamese university. All items of based on products, academic portfolio, judging by the situation, writing exam, and students' performance, thereby, yielded positive effects on the assessment of student learning outcomes (β = .115, .192, .220, .199 and .134, $p < 0.001$, respectively). Similarly, five out of six items of curriculum emphases factor in Model 2 were positively associated with the assessment of student learning outcomes (β =.139, $p < 0.001$ for accord with the vision and mission, β =.166, $p < 0.001$ for objectives are clear and feasible, β =.077, $p < 0.05$ for rate of knowledge blocks is appropriate, β =.109, $p < 0.001$ for learning outcomes are feasible, and β =.346, $p < 0.001$ for curricula is periodically adjusted).

As for teaching approaches factor, Model 3 also identifies that there were five out of six items yielded positive effects on the assessment of learning outcomes similar to Model 1 and 2. They included items of introduces objectives of the course (β =.246, $p < 0.001$), provide the criteria, evaluation methods (β =.150, $p < 0.001$), use the grading scale and other forms of evaluation (β =.143, $p < 0.001$), organize experiential learning activities (β =.235, $p < 0.001$), and have improvements in the teaching activities (β =.083, $p < 0.01$). In Model 4, improvement activities factor had four items which found a positive relationship with the assessment of learning outcomes at the VNU-HCM students, namely participate in the adjustment of curriculum (β =.387, $p < 0.001$), physical facilities meet the requirements (β =.087, $p < 0.01$), provide feedback to students (β =.123, $p < 0.001$), and train skills meet the outcomes of program (β =.099, $p < 0.01$).

Overall, 50.9 %, of curriculum emphases for university students yielded the largest explanatory power (Adj. R^2 = .509) in the assessment of learning outcomes at the VNU-HCM students, compared with evaluation methods (Adj. R^2 = .368), teaching approaches (Adj. R^2 = .423), and improvement activities (Adj. R^2 = .433) among Models 1-4. However, all the items of educational environment at university factors persistently indicated significant difference on the assessment of student learning outcomes in Model 5.

In the combined Model 5, twelve out of twenty-four items significantly affected on the assessment of student learning outcomes. Only items of academic portfolio (β =.072, $p < 0.01$), judging by the situation (β =.081, $p < 0.01$), and students' performance (β =.114, $p < 0.001$) of evaluation methods factor steadily maintained their significant benefit effects on the assessment of student learning outcomes cross models. These results were similar to items of rate of knowledge blocks is appropriate and curricula is periodically adjusted of curriculum emphases factor, items of introduces objectives of the course and organize experiential learning activities of teaching approaches factor, and items of participate in the adjustment of curriculum and provide feedback to students of improvement activities factor. However, writing exam item of evaluation methods factor robustly persisted with significant effects on the assessment of student learning outcomes cross models, but, there had negative effects (β = -.063, $p < 0.05$). In addition, two items of change appropriate assessment methods and forms (β = -.098, $p < 0.01$) and adjust the procedures and regulations on examination (β = .124, $p < 0.001$) of improvement activities factor yielded negative and positive effects on the assessment of student learning outcomes in Model 5, respectively.

4. Discussion

Although there are many previous studies on the assessment of student learning outcomes and this topic is not new; however, little is known about the relationship between the assessment of student learning outcomes in conformity with CDIO model and other factors (such as individual characteristics and educational environments) in Vietnamese higher education institutions. The findings of this research contribute to fill the critical gaps in theory and practice regarding to this topic. Based on the results of this research, there are some major points as follows:

Firstly, as the studies utilized different methods, approaches and instruments to measure student learning outcomes in higher education institutions, the results vary. This study showed that students have fairly high opinion of the assessment of their learning outcomes in conformity with CDIO model. In addition, there is still much room for managers to improve the effectiveness of the assessment through the development of curriculum. Therefore, the findings are comparable to those of previous studies. Nevertheless, the limit of this study is that there is insufficient empirical evidence to compare these findings with other studies.

Secondly, female students appreciate the assessment used in this study significantly more than their male peers. The relationship between student learning outcomes assessment and gender is supported by the study of Ro and Loya (2015). Their study found that although female students do not rate their own engineering learning outcomes as highly as males do, they have better self-assessment of their professional learning outcomes than their counterparts. However, studies on the relationships between other factors of student individual characteristics (such as university studying, accommodation and grade description) and the assessment of student learning outcomes in accordance with CDIO model are relatively sparse.

Finally, the results of this study are similar to those of Kember, Ho and Hong (2010). The findings demonstrated that there is a relationship between educational environment at universities and the assessment of student learning outcomes. The study of Kember, Ho and Hong found that a favorable learning environment promotes the assessment in higher education institutions. Jimaa (2011) stated that assessment of learning plays an import role in a program's success, which can affect a program's reputation, enrollment, funding, and even its existence. Therefore, the assessment of student learning outcomes usually focuses on improving students' learning. Apart from that, it is also an opportunity to showcase what aspects that involved departments or programs are doing well, which can help improve students' learning as well as learning opportunities and promote the programs to incoming students.

There are many methods to assess learners' learning outcomes. Each of these methods possesses a wide range of assessment types that can be used flexibly. Assessing student learning outcomes necessitates the use of various methods to gather evidence before, during, and after learning activities (Boden, Gray, 2007). The study of Crawley, Malmqvist, Östlund and Brodeur (2007) made use of typical methods in accordance to CDIO model such as observation, written and oral questions, product review, technical diary and personal record of achievements, other self-report tools, self-assessment and peer-assessment in training engineers. Furthermore, the study of Baartman (2008) argued that faculty members' feedback for their students is the key in assessing their learning capability and can help them to participate more actively. The assessment of learning outcomes in agreement with the CDIO model is closely linked to teaching and learning activities, based on the philosophy of assessment for learning and assessment as a learning activity.

5. Conclusion

This study explored the students' perceptions of VNU-HCM of the assessment of their learning outcomes in accordance with CDIO model, and the relationship of student individual characteristics and educational environment at university factors to ones were examined.

The results revealed that most students at the VNU-HCM have fairly high opinion of the assessment of their learning outcomes. In addition, the findings of study indicated that the differences in student individual characteristics (such as gender, university studying, accommodation and grade description) exist in the assessment of their learning outcomes. Finally, factors of academic environment at universities (including evaluation methods, curriculum emphases, teaching approaches, and improvement activities) are proved to have significant relationships with the assessment of learning outcomes in accordance with CDIO model in students at the VNU-HCM.

Although this research contributes to filling the gap in the literature of students' leadership capacity in both theory and practice, it has some limitations. The primary limitation is that all the three universities of the VNU-HCM sampled in this research are in the fields of sciences and technology. Further research, thus, should collect samples from various higher education levels, disciples and other factors to obtain more sufficient empirical evidence on the assessment of student learning outcomes of university students in Vietnam. It is hoped that the barrier against the assessment of student learning outcomes found in this research might be useful for policy makers, experts and managers at the VNU-HCM to improve the level of the assessment in the process of designing training programs or curriculum. In addition, it is recommended that the improvement of items which have positive effects on the assessment of student learning outcomes based on CDIO model should be focused.

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