VALIDATING A GENERIC MEASUREMENT TO ASSESS CASE-BASED LEARNING AMONG HALLIWICK FOUNDATION COURSE STUDENTS

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Abstract - A concern of many educators and managers is students' inability to transfer concepts and procedures learned in school to the work environment. Case-based Learning (CBL) is a pedagogy that offers experiences which engage students in authentic problem solving thus helps to improve students' ability to transfer knowledge, concepts, and skills learned in schools to real-life contexts. Case studies are written summaries of real-life cases that require students to identify appropriate strategies for the resolution of the 'case'. Due to the scant work done thus far to assess CBL, this study was aimed at designing and validating a generic scale to assess perceptions of certificate program students (Halliwick foundation course) regarding the various lifelong learning skills linked to CBL effective implementation.

Index Terms - Case-based Learning, Real-Life Context, Constructivism, Peer Assessment

I. INTRODUCTION

A growing concern shared by many educators and researchers (Dixon & Brown, 2012; Johnson et al., 2011) is that the school experience does not provide enough authentic activities for students to be mentally prepared for the types of problems they will have to solve in the real world, or at their place of employment. Their findings demonstrate the inability of students to recognize the transferability of concepts learned from solving well-structured problems in the classroom to ill-structured problems faced outside of the classroom. Educators thus should strive to facilitate new learning environments in which students are able to transfer their knowledge to new situations quickly and efficiently and urgently change the way in which students are taught in order to address their inability to effectively transfer concepts.

Case-based Learning (CBL) is perceived as an effective pedagogical approach to improve students' ability to transfer knowledge, concepts, and skills learned in schools to real-life contexts (Baeten, Dochy, & Struyven, 2013). Case studies are written summaries or syntheses of real-life cases that require students to tease out the key issues involved and to identify appropriate strategies for the resolution of the 'case'. Case studies are most often used in law, social work, psychology, management, medicine and education.

A case study is composed of an engaging and/or controversial story, usually a dilemma that requires a basic understanding of scientific principles (Shulmam, 1992). A 'case' should be a complex problem written to stimulate classroom discussion and collaborative analysis, a student-centered exploration of realistic and specific situations. CBL is the modern way of using narratives developed to provide authentic learning for students (Shulman, 1992). CBL is described as the catalyst for class discussions and lectures as it is carefully implemented by the teachers and enthusiastically engaged by the students (Blackmon, Hong, & Choi, 2007).

The case study is in a sense a kind of simulation of a real-life situation in which the experience is secondhand and probably condensed. The important merit of the case study is that it allows a problem to be studied in a complex form, including elements of real-life events which it might be impossible to reproduce in the classroom (Ha & Lopez, 2014). Typically the students are provided with case notes in advance and are expected to prepare their own solution to the problem or problems presented. CBL is deemed to provide opportunities for profound exploration of concepts and ideas through which learners obtain experience with analyzing ideas and solving problems rather than acquiring abstract knowledge (Baeten, Struyven, & Dochy, 2013**)**. Informed by the above theory, the current study sought to design and validate a new scale to assess effective uses of CBL. To do so, three sub-objectives were listed and carried out in three phases:

Phase 1: Mapping the CBL main objectives and learning outcomes and designing a new scale to assess CBL perceived learning outcomes.
Phase 2: Piloting a CBL in a selected certificate program; assessing the piloted CBL by using the newly designed scale and evaluating its factor validity by using exploratory factor analysis.
Phase 3: Constructing a model by using Partial Least Squares Structural Equation Modeling (PLS-SEM) to identify the most effective constructs that might explain

1) Students' perceived ability to identify, understand and apply new knowledge to ill-structured problem (case) solving

2) Students' perceptions of their ability to transfer concepts and procedures learned in the course to the work environment.

II. METHODOLOGY

The first step used a qualitative methodology and the inductive approach to map the CBL main objectives and learning outcomes. Next, quantitative data were collected and analyzed to assess factor structure validity of the new scale and to indentify the most effective constructs that might explain student thinking skills in CBL and students' perceptions of their transferability competencies.

Phase 1

This phase used the inductive approach to analyze the theoretical materials in order to identify meaningful categories. Inter-rater Cohen's Kappa (k) reliability was used (> .60). Three CBL experts were asked to categorize the CBL theoretical objectives and learning outcomes. The categories were detailed and formulated as short items by the experts.

Phase 2

Phase 2 was used to assess factor structure validity and internal consistency of the developed questionnaire (hereinafter: The CBL scale [CBLs]).

Participants

Data for the analysis were gathered from 58 hydrotherapy students enrolled in a certificate program (Halliwick foundation course, Fons et al., 2010; Garcia et al., 2012), of whom 45% males and 55% females with a mean age of 35 (SD=10.01) years. Halliwick method is an approach to teaching all people, in particular focusing on those with physical and/or learning difficulties, to participate in water activities, to move independently in water, and to swim.

The course structure

The course included the following two major activities:

1. Acquiring general concepts (about 34 hours) - focused on the theoretical concept of Halliwick and its implementations; the Halliwick ten-point methodology, physical properties of the water. This stage used lectures, demonstrations, and student involvement in in-water exercises.
2. A summing-up project (about 6 hours) including the integration of the first 34-hour activity and application of knowledge and skills gathered in the first step on new cases provided to the students (CBL). The following is a short exemplary version of a case:

You are given a group of five children aged 4-5 years, with an initial level of adaptation to water activity. Your assignment is to create five games / activities in the water corresponding to the Mental Adjustment, Transversal Rotation Control, and Sagittal Rotation Control (points from the 10-point program of Halliwick Approach). Make sure that the games / activities you design are appropriate for the group age and the level of ability determined. Link the various activities to a specific topic. All games / activities must be original.

The learning activity included:

a. Identifying and understanding the case.

b. Applying the knowledge and skills gained in the previous activity on the new case, and designing a relevant activity based on the case.

c. Engaging in a group-work.

d. Presenting the activity.

e. Engaging in a self - and peer - assessment work

Procedure

Prior to obtaining participants' consent it was specified that the questionnaire was anonymous and that no pressure would be applied should they choose to return the questionnaire unfilled or incomplete. The participants were assured that no specific identifying information about them would be processed.

Data Analysis

The data were analyzed by using a principal component analysis followed by a varimax rotation to corroborate the stability of the CBLs structure, as found in Phase 1 (eigenvalue > 1.00; item loadings > .40).

Phase 3

In this phase, a model was designed by using Partial Least Squares Structural Equation Modeling (PLS-SEM Hair et al., 2017). PLS-SEM is advised to be applied in situations where theory is less developed, and if the primary objective of applying structural equation modeling is prediction of target constructs. This analysis was aimed at indentify the most effective constructs that might explain students' students' perceived ability to identify, understand and apply new knowledge to ill-structured problem (case) solving, and to transfer concepts and procedures learned in the course to the work environment.

III. RESULTS

Phase 1

Seven meaningful categories have emerged from the analysis:

1. Thinking skills: students' perceived ability to identify, understand and apply new knowledge to ill-structured problem (case) solving

2. Transferability: students' perceived ability to recognize the transferability of concepts learned from solving ill-structured problems in the learning environment to ill-structured problems (cases) faced in the working environment.

3. Prior knowledge: students' perceived ability to relate to their own background knowledge**.**

4. Collaboration: students' perceived ability to engage in group work.

5. Alternative assessment: students' perceived ability to use alternative assessment approaches.

6. Multiple perspectives: students' perceived ability to raise points and questions, and propose different solutions to the problem.

7. Self-regulation: students' perceived ability to actively engage in self-regulated learning processes.

Altogether the original scale included 36 items. The scale was designed to capture certificate program students' perceptions of the CBL skills they have gained in the Halliwick foundation course. All items were scored on a Likert-type score ranging from 1 = not true at all to 5 = completely true.

Phase 2

The principal component analysis solution accounted for 67.62% of the variance and yielded seven categories. Three items were excluded from the scale (A1, A26 and A30). These items demonstrate salient factor loadings, however, based on the content analysis (Phase 1), their contents pertinent to other realm of contents. As for A18 and A19, these items were initially related to the Alternative assessment factor, however, their contents seem to be more related to student ability to recognize the transferability of the assessment tools used in the classroom to the workplace, therefore it was decided to relate these items to the Transferability factor. Cronbach's alpha results ranged from .73 - to .92. The between factor correlations ranged from $r = .052$, $p > .50$ to $r = .520$, $p < .01$. Factor convergent validity was shown by high (> .40) factor loadings within each of the seven factors. Factor discriminant validity was also obtained as the correlations between the factors have not exceeded .70.

Phase 3

In line with the above-mentioned Phase 3 objectives, a path model was constructed. This analysis was based on two prior linear regression analyses: in the first analysis Thinking skills was entered as the dependent variable (all other factors excluding Transferability were the independent variables); in the second analysis Transferability was identified as a dependent variable and all other as independent variables.

The model included six constructs: Thinking skills, Transferability, Prior knowledge, Alternative assessment, Multiple perspectives, and Self-regulation. Paths were specified in accordance with the linear regression analysis results. All the direct effects found in the analysis were found significant ($.00 < p < .05$).

The model evaluation included the followings: Collinearity was examined by Variance Inflation Factor (VIF) and pointed to sufficient results ($1.009 \leq VFI \leq 1.391$). The coefficient of determination (R^2) values for the Thinking skills (0.34) and Transferability (0.46) can be considered moderate to high. The change in the R^2 value when a specified exogenous construct is omitted from the model (i.e., the f^2 effect size), was used to evaluate its impact on the endogenous constructs. According to the results, Multiple perspectives had a large effect size of 0.287 on Thinking skills; all other effects can be considered medium ($0.113 \leq f^2 \leq 0.176$). Although Collaboration was not entered into the model, based on the linear regression results, it had significantly correlated with Self-regulation and Alternative assessment.

DISCUSSION

This study offers a new measurement that captures students' perceptions of CBL skills. Factor convergent and discriminant validity was shown, however, future studies should examine the construct validity of the scale. More specifically, how it converges with scores from an instrument designed to assess a construct it would theoretically be related to, for example, deep approaches to learning. Surface approaches to learning might be useful to examine discriminant validity (Baeten et al., 2013).

The structural model implies that Thinking skills, Prior knowledge, and Self-regulation are the most effective factors that might directly enhance Transferability, whereas Alternative assessment and Multiple perspectives are more effective in enhancing students' perceived ability to identify, understand and apply new knowledge to case solving during the course. Yet, a result that warrants mentioning is the Collaboration ill-capacity to explain other variables. This construct, however, significantly correlated with Self-regulation and Alternative assessment. This result might be explained by the small sample size used in this study. Using the current scale in different applied fields might contribute to its validation and development and to the improvement of CBL implementation and assessment.

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