A Measure of Engineering Students' Pro-industry Behavior Adjust Industry 4.0

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Abstract

This study describes the development and validation of the Pro-industry Behavior scale, a quantitative 24-item scale that measures an Asian country university students' behavior toward pro-industry. A total of 814 undergraduate engineering students completed the questionnaire. A pilot study (n= 154) was examined factorial validity and reliability of questionnaire and study objects (n= 658) used confirmatory factor analysis. The Pro-industry Behavior Measure (PBM) has three-factor model (Industry identity, Industry concern, and Industry regulator) was fit using maximum likelihood estimation (MLE). The Pro-Industry Behavior scale could be useful for understanding the ways in which students think about pro-industry issues and could be used to investigate the relationship between pro-industry behavior and other variables. The applications of the PBM were discussed.
Keywords: Pro-industry Behavior; Industry identity; Industry concern; Industry regulator

Introduction

In response to the rapidly growing global industry environment many call for changes in how individuals should deal with the industry 4.0. An important aspect of moving towards an industry sustainable development is to promote pro-industry behavior [1] [2] . Engineering students strengthen the practical skills is important who choose materials and compose ability of the industry practice course [3] [4]. In view of the practical needs, the engineering education curriculum content of the professional subjects is influenced by the industrial development trend. Engineering students' industry professional competence and specialized learning mechanism of pro-industry behavior will be emphasized of industry identity, industry concern, and industry regulator [6] [7].

Engineering students face two challenges of pro-industry behavior, there are: 1. To understand the impact of the pro-industry behaviors on employment abilities and seeking job of the career development, as well as to the industry practice abilities and preparation of industry practice, is very important. 2. The digitalization of work is not just something that lies ahead; it has already changed work more and more over the last few years, e.g. making it more mobile[8] [9]. In view of the industry practical needs of the engineering education contents of Industry 4.0, the content of professional subjects is influenced by the industrial development trend, and the industry practice competence of engineering students. In the face of the industry change, the industry employment ability of engineering students is challenged [6] [10] [11].
Students' pro-industry behavior was conducted in the industry practice specialization process of cognitive process, not only to participate in the common industry-oriented learning behavior, but also to practice quite personal characteristics [12]. The pro-industry behavior process is cognitive adjustment that to use knowledge and main contributions of this study and to set up the industry learning. It is important to understand students' views of pro-

industry behavior and learning in the vocation and technology education of human cultivation and industry connotation. The review of the literature reveals that the research studies conducted in the context of pro-industry learning and applications have measured attitudes and behavior of students regarding industry identity, industry concern, and industry regulator[12] [13]. The purpose of the study was to develop a valid and reliable instrument to be used for measuring engineering students' attitudes toward pro-industry behavior and its applications. With this instrument, it is believed that the gap in the professional literature indicated above will be partially met.

Method

A. Participants

(1) Pilot study : A total of 154 students that mean age of the participants was 21.3 (SD = 1.98) and there were 52 (33.8%) females in the sample.
(2) The present study: The participants in this study were 658 students from 20 engineering institutes in Asian countries [17]. The sample consisted of 322 women (48.9%), with a mean age of participants of 22.3 years (SD = 2.17). All participants are volunteers and receive no monetary or in-kind rewards. Participants in this study did not participate in the pilot study and collected data from the study within three months of the pilot study.

B. Measure

The purpose of this study was to evaluate the 24-PBM factorial validity. All participants were volunteers and they were briefed on the purpose of this study and informed of their rights not to participate and withdraw from completing the questionnaire at any time during or after the data have been collected [18] [19]. Participants took about 20 min to complete the questionnaire. This study aimed to test and refine the 28 items. These items were presented using a 5-point Likert response scale with 1 = strongly disagree and 5 = strongly agree. The principal component analysis with varimax-rotated see Table 1, and results of confirmatory factor analysis see Table 2.

Table 1 Principal component analysis with varimax-rotated

	II	IC	IR	H2
II 1	**.824**	.232	.342	.887
II 2	**.798**	.367	.268	.828
II 3	**.837**	.355	.289	.845
II 4	**.842**	.261	.389	.845
II 5	**.799**	.249	.243	.839
II 6	**.812**	.324	.317	.841
II 7	**.866**	.341	.216	.857
II 8	**.872**	.268	.311	.832
IC 1	.235	**.789**	.276	.824
IC 2	.341	**.823**	.312	.798
IC 3	.267	**.821**	.226	.891
IC 4	.289	**.869**	.317	.832
IC 5	.311	**.732**	.238	.819
IC 6	.243	**.796**	.326	.823
IC 7	.327	**.839**	.325	.856
IC 8	.345	**.823**	.210	.844
IC 9	.354	**.793**	.297	.865
IR 1	.288	.216	**.863**	.828
IR 2	.419	.329	**.782**	.867
IR 3	.234	.289	**.808**	.882
IR 4	.278	.390	**.833**	.878
IR 5	.342	.306	**.842**	.797
IR 6	.387	.398	**.794**	.874
IR 7	.279	.411	**.789**	.877
Eighenvalue	6.872	7.694	3.498	-
% of variance	32.56	39.34	17.56	-

Table 2 Result of confirmatory factor analysis

Item	Understandardized esitmate	Standardtized estimate	*t* value	R^2	α
Industry Identity					.921
II 1	.984	.8783	65.783	.789	
II 2	.955	.874	48.327	.765	
II 3	.992	.891	34.461	.740	
II 4	1.137	.992	24.043	.987	
II 5	1.109	.993	23.093	.935	
II 6	1.056	.992	21.434	.972	
II 7	1.104	.984	22.319	.925	
II 8	1.108	.992	22.378	.943	
Industry Concern					.919
IC 1	1.022	.973	27.389	.589	
IC 2	1.052	.983	26.359	.578	
IC 3	.993	.882	23.598	.542	
IC 4	1.018	.972	39.873	.923	
IC 5	1.361	.992	13.367	.962	
IC 6	1.388	.996	13.024	.938	
IC 7	1.403	.987	13.209	.942	
IC 8	1.387	.978	13.478	.956	
IC 9	1.484	.993	13.459	.971	
Industry Regulator					.934
IR 1	.969	.895	78.256	.965	
IR 2	1.022	.984	89.356	.978	
IR 3	1.001	.985	70.984	.958	
IR 4	.992	.895	79.320	.978	

explained				

Note. II=Industry identity; IC=Industry concern; IR=Industry regulator. All factor loadings=.74 or greater are underlined. H2=communality.

IR 5	1.022	.921	78.934	.967	
IR 6	.982	.899	78.544	.958	
IR 7	.965	.917	76.953	.944	

Conclusion

The purpose of this study was to test pro-industry awareness among engineering students using the newly developed Pro-industry Behavior Measure (PBM). The tool provides an alternative to existing measures where engineering students support industrial behavior, with a focus on student industry recognition, industry concerns and industry regulators' views on employment [20] [21]. The consisting of three factors, the PBM measures user perceptions of the industry, industry concerns, and industry regulators' views on using pro-business learning. Pro-business behavior measurement (PBM) is developed and validated through research using separate samples [22] [23].

In general, the validity of this study was found to support PBM as a measure of the utility of industrial students in supporting industry behavior. The results of the CFA show that the data for the third model is the best compared to the two alternative models and that these items have good normalized loading for the hypothetical underlying factors constructs, which are less highly correlated between them (see figure 1). These results provide evidence of the molecular structure of PBM and may be useful to educational researchers. A better understanding of students' understanding of the industry will increase their awareness of industry-related behaviors and will make teaching more meaningful in the field of education.
Several researchers have demonstrated a positive relationship between student "pro-industry" awareness and their "pro-industry" behavior and career development. As part of supporting industries as part of teacher education, PBM allows researchers to measure and understand how users respond to instruction [23] [24]. In doing so, the usefulness of PBM can be expanded to further inform researchers about the factors that affect user behavior. Such future research may be based on user demographics, such as the level of industry development, the level of industry experience, and attitudes toward industrial learning.

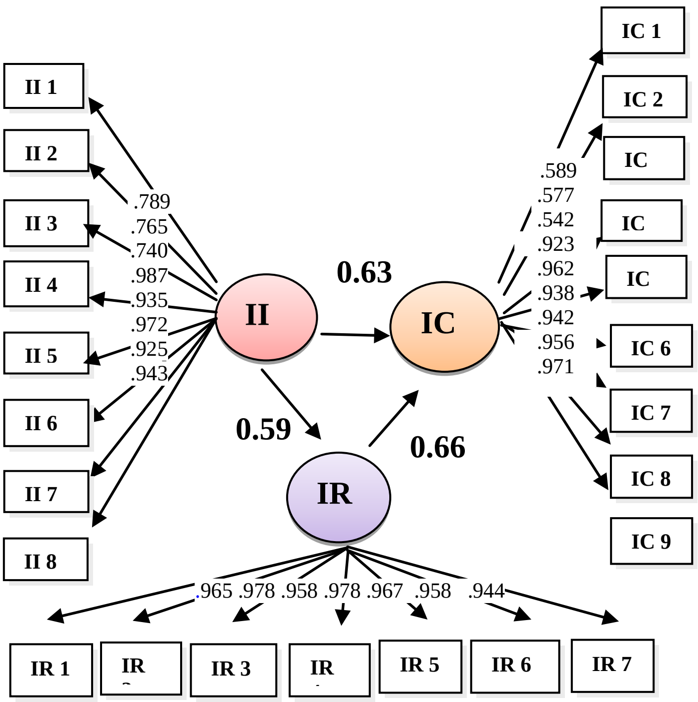

Figure 1 The PBM measures users’ perception

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