Validation of Technopreneurship Skill Questionnaire: Vocational Students' Perspective in the COVID-19 Pandemic

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Abstract. Technopreneurship skills play a crucial role to develop technology-based entrepreneurs during the industrial revolution 4.0 era, especially for vocational students. There have been many studies with the theme of technopreneurship, but it is hard to reveal technopreneurship skills based on the perceptions of vocational students during the Covid-19 outbreak. This study aims at developing an instrument to measure technopreneurship skills among vocational students. This study involved 240 students from state and private vocational high schools in Yogyakarta, Indonesia. The data were collected through proportional random sampling with an online questionnaire. The questionnaire instrument was validated using Aiken's V analysis technique and confirmatory factor analysis with AMOS software. This study showed that vocational students' perceptions of technopreneurship skills were divided into five indicators, namely: entrepreneurial personal skills, technological adaptation skills, learning skills, business management skills, and collaborative and communication skills. The result of the Technopreneurship Skill Questionnaire consisted of 19 question items, i.e., entrepreneur personal skills (4 items), technological adaptation skills (5 items), learning skills (3 items), business management skills (4 items), and collaborative and communication skills (3 items). All items showed good validity and reliability results. These findings have implications for vocational education practitioners to make further improvements. The vocational practitioners, especially vocational entrepreneurship teachers, can utilize this questionnaire to evaluate students' competencies in the field of technology entrepreneurship.

Keywords: Technopreneurship skill · vocational students · entrepreneurship · confirmatory factor analysis

1 Introduction

It has been more than two years that the Covid-19 pandemic has plagued the world, including Indonesia. This outbreak first broke out in the city of Wuhan, China, on December 30, 2019. This information was conveyed by the Ministry of Health of the Republic of Indonesia which informed about an immediate notification on the pneumonia treatment

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due to an unknown cause [1]. UNESCO data (2020) reveals that 1.5 billion students and 63 million teachers at the primary to secondary levels in 191 countries affected by the COVID-19 pandemic and must make changes to something that has never happened before [2]. The virus has been spreading ultimately and bringing terrible risks to the world economy, including Indonesia, especially in tourism, trade, and investment.

The government through the Ministry of Health issued a Health Decree Number: HK.01.07/MENKES/382/2020 concerning Protocols for Public Health in Public Places and Facilities [3] as an effort to improve Indonesia's economy during the pandemic and make a new normal life. The Central Statistics Agency (2021) reports that the Indonesian economy in 2020 experiences a growth contraction of 2.07 percent (c-to-c) compared to 2019 [4]. In line with this, the Ministry of Economy of the Republic of Indonesia mentions that many economic sectors are experiencing negative impacts (potential losers) due to the pandemic including tourism, construction, and transportation [5]. Other impacts are community productive businesses such as Micro, Small, and Medium Enterprises (MSMEs). The new normal encourages MSME actors to shift both entrepreneur behaviors and business activities [6]. These changes are made so that MSMEs can survive. The businesses activities evolve from offline to online, and it goes hand in hand with the rapid development of digital technology which is becoming a current trend.

This condition also influences the entrepreneurship sector, which is divided into 3 types, traditional entrepreneurship, technology entrepreneurship (technopreneurship), and social entrepreneurship (sociopreneurship) [6]. Technopreneurship or often called technology-based entrepreneurship can potentially grow and thrive during the Covid-19 pandemic. The Ministry of Small and Medium Enterprises said that there was a 99% spike in the number of MSMEs connected to the digital ecosystem during the outbreak [7]. It proves that digital transformation is an important key to awakening and restoring MSMEs during the pandemic and post-pandemic in the future.

Digital technology is developing very quickly, especially among the younger generation which is in line with the demographic bonus of Indonesia in 2045. The application of digital technology and technopreneur in Indonesia has its characteristics compared to other countries. In addition to the creative destruction and disruption of traditional business models, digital technology also raises the issue of what is called 'digital resource nationalism' [8]. Industrial and economic reforms in Indonesia cannot be separated from the development of new technologies and the massive knowledge-based sector. This phenomenon opens a wide opportunity among the millennial to develop skills in various fields for being creative individuals [9]. This condition has also changed the focus from traditional entrepreneurship to technology-based entrepreneurship or known as technopreneurship [9]. It seems that the development of the business world, especially in the industrial sector, will be closely related to technopreneurship [10]. This concept combines technology with entrepreneurial skills. Put simply, a technopreneur is an entrepreneur who understands technology and uses technology for entrepreneurial purposes [11]. It has two aspects as part of technology and entrepreneurship [12]. Thus, these two aspects are synthesized into entrepreneurial abilities by utilizing technology and creative resources to compete in the business market.

Currently, vocational high schools (VHS) are encouraged to equip their graduates with entrepreneurship skills based on their field of expertise. As stated in the revitalization

of vocational graduates compiled by BNSP in 2016, entrepreneurial vocational graduates can be a driver of industrial and economic growth in Indonesia during the pandemic and in the future. To enhance the technopreneurship skills, there are at least 5 skills that must be owned by students including (1) personal skills; (2) technological skills; (3) learning skills; (4) business management skills; and (5) collaborative and communication skills.

Many efforts have been made to produce VHS graduates who are ready to work and to become entrepreneurs. One of them is the application of the technopreneurship learning model by synergizing entrepreneurship skills and productive subjects. However, the output of students who take the technopreneurship model is quite difficult to measure in terms of technopreneurship ability in their respective fields.

This research can be considered as a development of research that has been done before. Similar research that has been carried out is on the development of intention instruments in vocational high schools conducted by Husna [13]. In this study, technopreneurship intentions can be measured using 15 instruments which are in line with the research conducted by Nguyen [14]. The measurement of technopreneurship intention is done with 3 indicators, namely attitudes towards behavior, subjective norms, and perceptions of behavioral control. The subject indicators on behavior measure individual beliefs from the emotional aspect and individual beliefs about the desired outcome. Indicators of subjective norms reveal the condition of the surrounding environment and how much influence the environment has on a person's behavior. Meanwhile, the behavioral control perception indicator determines a person's belief to succeed in doing something. Therefore, by using this instrument, it is expected to provide knowledge to educators about students' technopreneurship intentions so that they can become a benchmark to provide supplies to students regarding technopreneurship that can be developed.

Other similar studies have also been conducted by Cárdenas [15], Selladurai [16], and Adhikara [8]. Those studies prove the validity and reliability of the basic entrepreneurial knowledge scale for vocational students. This scale, besides being useful for the contribution of the matrix in the field of entrepreneurship, is also an appropriate tool for diagnosing and evaluating the basic entrepreneurial knowledge among students. This instrument measures students' knowledge in management, law, and strategy in doing business. It is supported by Kamil [9] who examines the technopreneur talent of students related to technological innovation: agricultural engineering and information technology. Technopreneurial talent is assessed based on three criteria: (1) technology absorption, (2) knowledge and learning skills, (3) business and communication skills. This instrument can find out the extent to which a student's technopreneurship talent.

Based on the above-mentioned studies, several instruments are functioned to measure the students' entrepreneurial skills. However, another instrument is still needed to measure and evaluate the technopreneurship skills based on students' perspectives in VHS during the Covid-19 pandemic as the goal of this study. This instrument is expected to be able to measure the students' readiness to compete in the world of work, particularly the technopreneurship field. In addition, the instrument is created to determine the extent of the effectiveness of the technopreneurship learning model carried out by VHS during the outbreak.

Table 1. The Respondents' Demographic Data

Attribute	Category	Frequency (N = 240)	%
Gender	Mele	174	72.5
	Female	66	27.5
School status	State	137	57.0
	Private	103	43.0
Department	Automotive	130	54.0
	Electronic	110	46.0

2 Method

The respondents in this study were the third-grade students from the department of automotive and electronics engineering in the state and private vocational schools in the Special Region of Yogyakarta. The demographic data of the respondents is presented in Table 1.

The instrument of technopreneurship skill questionnaire (TSQ) is developed by referring to literature reviews and previous studies [8, 9, 13, 15]. Based on previous research, there are five basic skills of a technopreneur, namely entrepreneur personal skills (EPS), technological adaptation skills (TS), learning skills (LS), business management skills (BMS), collaborative and communication skills (CCS). These five skills were used in the study and added with several items by adjusting the conditions of the Covid-19 pandemic. The TSQ consists of 24 question items with the details of EPS (6 items), TS (6 items), LS (3 items), BMS (5 items), and CCS (4 items). The TSQ instrument uses a Likert scale of 5 alternative answers with the given scores: strongly agree = 5, agree = 4, neutral = 3, disagree = 2, strongly disagree = 1.

The procedure for developing the TSQ instrument goes through two stages. The first stage is to measure content validity by asking for expert opinion to provide an assessment of the instrument. The expert judgment consists of three people including experts in the field of psychometry, vocational education, and technopreneur practitioners. The expert gave an assessment of the TSQ instrument with 5 rating scales, namely: very irrelevant = 1, irrelevant = 2, quite relevant = 3, relevant = 4, very relevant = 5. The data obtained were then analyzed using Aiken's V method [17]. In addition, experts also provided suggestions for improving the editorial instruments.

The next step is to measure the construct validity of the TSQ instrument using the Confirmatory Factor Analysis (CFA) method. This phase is to know whether the indicator variables can be used to confirm a factor. This analysis was carried out using Amos 22 software for windows. The results of the CFA are done by looking at the loading factor and the model fit criteria. The loading factor limit is 0.5, meaning that items with a loading factor of less than 0.5 are removed and not included in the next calculation. Meanwhile, the fit model criteria used were chi-square, GFI, AGFI, RMSEA, TLI, NFI, and CFI. If the model is not fit, it is necessary to delete items that have a low loading factor value and make modifications according to the suggestions in the Amos 22 software for windows.

Table 2. The Content Validity Results with Aiken's V

Items	Aiken Index	Validity
EPS1-EPS6	0.70–0.85	Moderate – strong
TS1-TS6	0.73–0.80	Moderate – strong
LS1-LS6	0.70–0.78	Moderate – strong
BMS1-BMS5	0.68–0.80	Moderate – strong
CCS1-CCS4	0.58–0.85	Moderate – strong

The instrument reliability test in the CFA analysis according to Hair [20] consisted of Construct Reliability (CR) and Variance Extracted (AVE). The recommended CR value is ≥ 0.7, while the AVE value is ≥ 0.5, respectively.

3 Results

The validation of the technopreneurship skill questionnaire (TSQ) instrument used relevant theoretical references and previous studies. After obtaining the technopreneurship skill questionnaire draft, the validity and reliability of the questionnaire were tested using the content validity test with Aiken's V, construct validity with CFA and construct reliability test with CR and AVE calculations.

The results of the content validity analysis using Aiken's V showed that the coefficients from the 24 items of the TSQ instrument ranged from 0.58 to 0.85 (see Table 2). Based on Aiken's V Index, it indicates that all technopreneurship skill items in the developed instrument gain medium to high validity [18].

After the content validity test with Aiken's V, the instrument was tested among 240 students of VHS to examine the validity and reliability of the instrument. The results of the initial CFA or before the modification of the TSQ instrument can be seen in Fig. 1. It is known that there is 1 instrument item that has a loading factor below 0.5, i.e., the CCS4 item (0.40) so this item was removed. Meanwhile, the other items obtained a loading factor value above 0.5.

The results of the fit model on the initial TSQ instruments can be seen in Table 3. It shows that the model has not been fit based on the existing criteria. To obtain a fit model, it is necessary to modify the model.

The results of model modification were by removing items with a loading factor below 0.5 and making modifications based on the suggestions. The results of the CFA model towards the TSQ instrument can be seen in Fig. 2. Meanwhile, the measurement results on the TSQ instrument fit model can be found in Table 4. Based on the presented table, the CFA model of the TSQ instrument is fit by looking at the criteria for GFI, AGFI, RMSEA, TLI, NFI, and CFI.

The construct validity test was followed by the construct reliability test using the CR and AVE formulas. The criteria for the acceptance of construct reliability are if CR 0.7, and AVE 0.5. The calculation results of the CR and AVE towards the TSQ instrument can be seen in Table 5 which is shown that the TSQ instrument has good construct reliability.

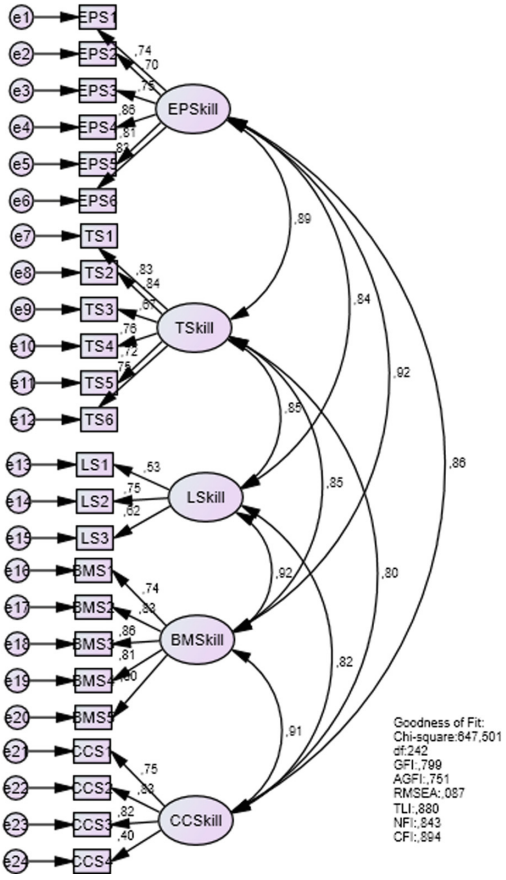

Fig. 1. CFA Model on the initial TSQ instrument

Based on Table 5, it is known that the lowest construct reliability value was the learning skill indicator (0.70) while the technological skill indicator (0.87) was considered as the highest. The conclusion of the development of the TSQ instrument based on the perception of VHS students is that technopreneurship skills can be measured through the indicators of entrepreneurial personal skills, technological skills, learning skills, business management skills and collaborative communication skills.

4 Discussion

VHS plays a role to produce graduates who can work, continue their studies or become entrepreneurs. Nowadays, entrepreneurship can be the best alternative for VHS graduates. Various efforts have been made to improve the entrepreneurial skills of vocational students, such as revitalizing the entrepreneurship curriculum and developing entrepreneurial interests, as well as teaching factories [21, 22].

Table 3. The results of the initial TSQ instrument fit model

The GoF measure	Index value	Cut Off-value	Note
df	242		
Chi-square	647.501	$<$ 2 df	Not fit
GFI	0.799	GFI $\geq$ 0.9 (good fit) 0.8 $\leq$ GFI $<$ 0.9 (marginal fit)	Not fit
AGFI	0.751	AGFI $\geq$ 0.9 (good fit) 0.8 $\leq$ AGFI $<$ 0.9 (marginal fit)	Not fit
RMSEA	0.087	$\leq$ 0.08	Not fit
TLI	0.880	TLI $\geq$ 0.9 (good fit) 0.8 $\leq$ TLI $<$ 0.9 (marginal fit)	Marginal fit
NFI	0.843	NFI $\geq$ 0.9 (good fit) 0.8 $\leq$ NFI $<$ 0.9 (marginal fit)	Marginal fit
CFI	0.894	CFI $\geq$ 0.9 (good fit) 0.8 $\leq$ CFI $<$ 0.9 (marginal fit)	Marginal fit

Technology-based entrepreneurship or technopreneurship is the best choice for vocational students, especially VHS of technology and engineering fields. It is seen as a business sector that is not significantly affected by the covid-19 pandemic. Even during this outbreak, many young technopreneurs can take opportunities and grow their businesses, especially those who have good technopreneurship skills. This technopreneurship skill needs to be measured, evaluated, and optimally developed in VHS.

As mentioned earlier, this study is developing the technopreneurship skill instrument among VHS students. With this instrument, it can be revealed the technological entrepreneurial skills owned by students and their career opportunities to be an entrepreneur. This instrument was developed based on the previous studies [8, 9, 11, 13], and [14]. Some of these studies were elaborated so that the TSQ instrument model was developed and tested among VHS students. The instrument was produced by considering the conditions of the COVID-19 pandemic in each indicator.

This instrument consists of five indicators of technopreneurship skills, namely entrepreneurial personal skills, technological skills, learning skills, business management skills, and collaborative and communication skills. The indicators with a loading factor below 0.5 are CCS for the items of foreign language skills in entrepreneurial activities. It means that this item requires a concern from the teachers to enhance foreign language skills among students. The learning skill indicator also obtains a low construct validity value. It relates to the students' skills to take part in entrepreneurship training and the need for entrepreneurial practitioners as their coaches or models.

The ability to seize opportunities, to do business pivoting/shifting in all conditions is a must-have skill so that students can survive in any conditions including the Covid-19 pandemic. Rapid technological developments require students to make comprehensive

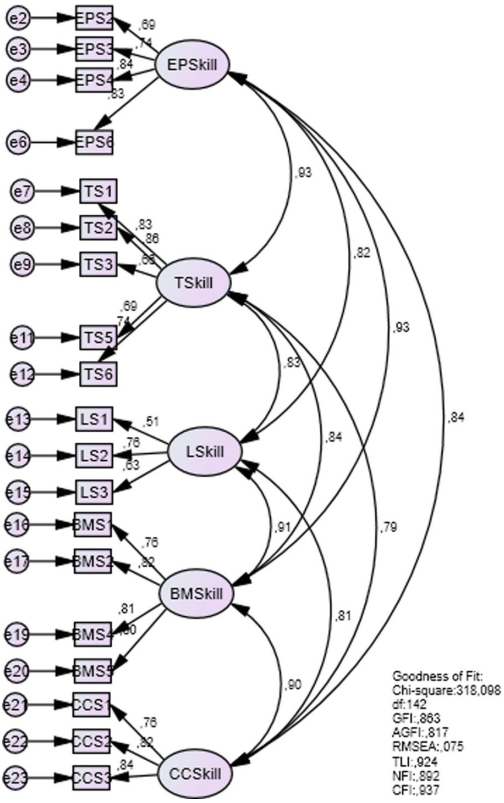

Fig. 2. CFA Model on the final TSQ instrument

adaptations to run entrepreneurial activities. The ability to upgrade technological awareness, digital transactions, and digital marketing is truly needed in shaping students' technopreneurship skills.

This research resulted in the instrument of the TSQ consisting of 5 indicators and 19 question items. The instrument has been proven valid and reliable to be used to measure the technopreneurship skills among VHS students. The TSQ can be used in vocational schools, especially the technology and engineering fields. Finally, this instrument should be developed in subsequent studies to make it more applicable for various majors of VHS.

Table 4. The Results of the Final TSQ instrument fit model

The GoF measure	Index value	Cut Off-value	Note
df	142		
Chi-square	318.098	< 2 df	Not fit
GFI	0.863	GFI ≥ 0.9 (good fit) 0.8 ≤ GFI < 0.9 (marginal fit)	Marginal fit
AGFI	0.817	AGFI ≥ 0.9 (good fit) 0.8 ≤ AGFI < 0.9 (marginal fit)	Marginal fit
RMSEA	0.075	≤ 0.08	Good fit
TLI	0.924	TLI ≥ 0.9 (good fit) 0.8 ≤ TLI < 0.9 (marginal fit)	Good fit
NFI	0.992	NFI ≥ 0.9 (good fit) 0.8 ≤ NFI < 0.9 (marginal fit)	Good fit
CFI	0.937	CFI ≥ 0.9 (good fit) 0.8 ≤ CFI < 0.9 (marginal fit)	Good fit

Table 5. The Construct Reliability Results on the TSQ instrument

Indicators	CR	AVE	Note
EP skill	0.86	0.60	Reliable
TS skill	0.87	0.57	Reliable
Learning skill	0.70	0.54	Reliable
BM skill	0.87	0.64	Reliable
CC skill	0.85	0.65	Reliable

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