Promoting skills-based education in the 21st century: A dataset of Vietnamese secondary students

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ABSTRACT: *As the world has become more digitally interconnected than ever before in the 21st century, the next generation is required to possess various sets of new skills to succeed in their works and lives. The purpose of the article is to present a dataset of socio-demographic, in-school, out-of-school factors as well as the eight domains of 21st-century skills of Vietnamese secondary school students. A total of 1183 observations from 30 secondary schools in both rural and urban areas of Vietnam are introduced in this dataset. The linear regression analysis was also utilized as an analysis example for this dataset. The insights generated from the dataset are hoped to contribute to skills-based education and policy planning in Vietnam.*

1. Summary

The purpose of this dataset is to explore possible predictive factors and elements of the 21st-century skills as a significant capacity of global citizens. More than a thousand responses were collected from secondary school students, giving insights into eight domains of 21st-century skills and their potential associated factors, such as socioeconomic background, in-school factors (learning experience, infrastructure and facilities, and teaching techniques) and out-of-school factors (family lifestyle and participation in community activities).

Students' 21st-century skills have been widely studied in previous literature for their essential roles in the success of workers in the current era full of dynamics and complexity. However, most of the studies have only been conducted in developed-country contexts, while studies in developing countries, such as Vietnam, have been limited. This article, targeting secondary school students who are potentially a human resource for the country in the next stage of development, is the first to explore this research area in Vietnam. By mastering 21st- century skills, the youth would be able to solve today's complex problems, collaborate and exchange effectively with others, and cope with swiftly changing conditions of globalization (OECD, 2018). As Vietnam is not an exclusive case, insights from a nationwide dataset of student's 21st-century skill would contribute significantly to implications for policymakers and educators in Vietnam as well as other developing countries with similar context.

The next part of this paper provides a detailed description of all variables in the dataset, the research framework, and potential research questions. Then, data collection procedure and methodologies for possible statistical analyses are presented. Finally, scientific and practical implications drawn from the study would be discussed.

2. Data Description

The dataset comprises responses by 1182 students at grade 8, and 11 from 30 secondary schools in five provinces of Vietnam. The questionnaire is made up of 85 multiple-choice questions and divided into two main groups: 1) personal and contextual questions (personal information, family and school contexts); and 2) self-assessment questions of 8 domains of 21st-century skills. Group 1 consists of 62 items asking students about their living experiences, family background, and school activities. Group 2 encompasses 23 self-assessment items about eight domains of 21st-century skills.

2.1. Personal, contextual questions

Group 1 embraces 62 question items split into three parts: (1) personal background (29 items); (2) family context (9 items); and (3) school context (23 items).

2.1.1. Student personal background

In this part, the first five questions concern students' demographic information such as gender, ethnicity, current study grade level, year and order of birth, while the remaining questions are related to students' life activities, experiences and academic performance.

In general, there was 16.24% more female than male students taking part in the survey. In terms of ethnicity, the majority of respondents are Kinh students, with only 2.62% from other ethnic groups.

Regarding students' life activities, students often spent more than one hour on activities such as homework; extra academic classes; housework; and sports activities. Other activities that took students less time included attending non-academic classes (presentation skills, life skills, first aid skills), reading books (not including textbooks), participating in voluntary and extracurricular activities, discussing, chatting and working with parents and attempting artistic activities. In particular, more than half of the students never attend non-academic classes (53.72% on weekdays and 64.41% at weekends); nearly two-thirds never participate in voluntary and extracurricular activities (74.20% on weekdays and 66.41% at weekends).

As for traveling habits, most students reported that they had been out of their neighborhood and hometown/city, but over 80% had never traveled abroad. When students were asked about their leadership experience, 44.59% of the respondents reported having small group leader experience, while only a small percentage had been leaders in class or project.

For academic performance, students were asked to fill out their average scores in 9 subjects: Mathematics, Physics, Chemistry, Biology, Technology, IT, Vietnamese and literature, History and Geography in 2017 – 2018 school year. Since IT is an elective subject which students in some schools might not learn, so the missing values for this category are more common than other subjects (12.61%).The Likert scale for these question items provide 6 options based on a 10-point scale of Vietnamese general education: '< 5.0', '5.0-6.0'; '6.0-7.0', '7.0-8.0', '8.0-9.0', '>9.0'. The statistics indicate that the model values for average scores range from 6.0 to 8.0.

Figure 1displays the frequency distribution of students' performance in two core school subjects (Math and Vietnamese and Literature). It can be seen that most of the students obtaining the average scores between 6.0 to 9.0 for Math. The number of students whose average scores are between8.0 – 9.0take up the largest share (26.57%). Different from Math, Vietnamese, and Literature scores between 7.0 – 8.0 were achieved by most of the surveyed students.

2.1.2. Family Context

Questions in this part aim to collect information about students' socioeconomic background, including parental educational level, household economic status, and family lifestyle. The bar charts in figure2 below illustrate the distribution of students' paternal and maternal education attainment levels. It can be observed that most parents are qualified for secondary education, and approximately a quarter possess an undergraduate degree. Very few parents were reported not to have access to school education, nor do they have masters or doctorate level of training. Fathers are, as can be seen, slightly more qualified than mothers.

As for economic status, given question asks students to report on their home facilities such as digital devices, Internet connection, means of transport and sanitary equipment. The results suggest that the surveyed students generally come from middle-income households with over 90% have Internet coverage, and a bathroom, about 60% own a laptop/computer at home, and only roughly one-fifth of the families possess a car.

Two next questions ask students to describe their students' family lifestyle, particularly their joined activities with parents, including daily talking, traveling, entertaining, playing sports, and volunteering. The results point out that over half of the students never join their parents in volunteer or sports activities, and about 25% never spend weekends traveling or entertaining with their parents.

2.1.3. School context

In part 3, questions focus on students' academic environment, namely school activities, facilities, infrastructure, and pedagogical methods with responses for questions only yield two values: Yes/No.

In consideration of school activities, picnics, excursions, and sports are among the most common activities to students with the participation rates of about 65% and 76% respectively. Activities such as eloquence contests, academic competitions, and International exchanges, on the other hand, seem to be less popular with participation rates all below 20%.

Additionally, two another questions introduced with the aim to explore school infrastructure, facilities, technological equipment, and students' learning activities. Descriptive statistics of the responses suggest that although most schools are only equipped with necessary facilities and lacking in specialized on-site amenities such as exhibition hall, studios, and gym, students still reported diverse learning experiences with a wide range of pedagogical techniques and teaching tools.

2.2. Questions addressing students' self-assessment of skills

Group 2 consists of self-assessment questions addressing 21st-century skills using a five-point Likert scale as follows:

Almost never true for me – I rarely feel that.

Usually not true for me – More than half of the time I don't often feel that.

Sometimes true for me – I feel that half of the time.

Usually true for me – More than half of the time I feel that.

Almost true for me – I rarely feel that.

The questions encompass eight skills domains: Critical thinking skills, Collaboration skills, Communication skills, Creativity skills, Self-direction skills, Global connections, Local connections, and Using technology as a tool for learning (see the dataset).

The 5 question items in the Critical thinking skills domain examine how well students could use, analyze, evaluate different sources of information and draw conclusions, compare and contrast different perspectives or solutions, as well as attempt to solve complex problems with more than one answer. Figure 3 shows that the mean score and the highest value of male students are higher than those of their female counterparts.
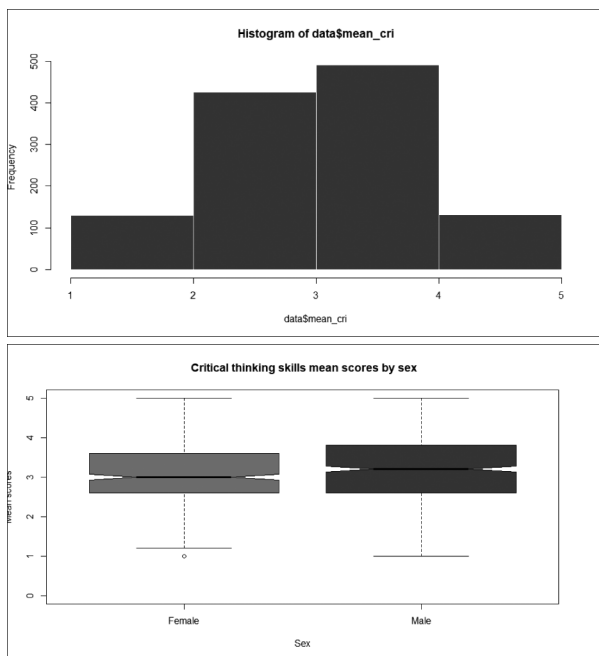

Figure 3: Mean scores in the Critical thinking skills domain

The Collaboration skills domain consists of 4 items assessing students' group workability to such as planning, assigning and fulfilling tasks, sharing and accepting ideas, as well as instructing and assisting others. Figure 4 demonstrates a clear gender gap in this domain.
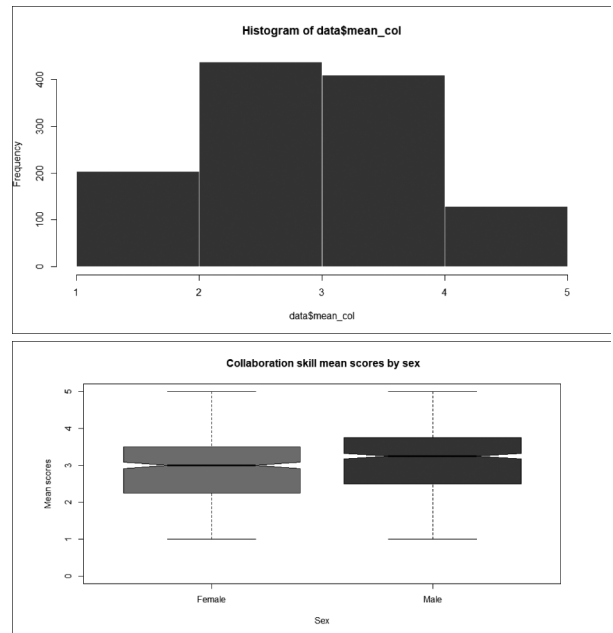

Figure 4: Mean scores in Collaboration skills domain

Concerning Communication skills, students were asked to evaluate their ability to handle conversations with others and participate in group discussion, respect and understand others' feeling, ask for clarification of information, treat friends fairly regardless of their gender. The mean score of this domain is 3.67, which means that most of the responses are in the range of "sometimes true for me/ I feel that half of the time" to "usually true for me/ more than half of the time I feel that." Figure 5 presents the distribution of responses by gender in this domain.
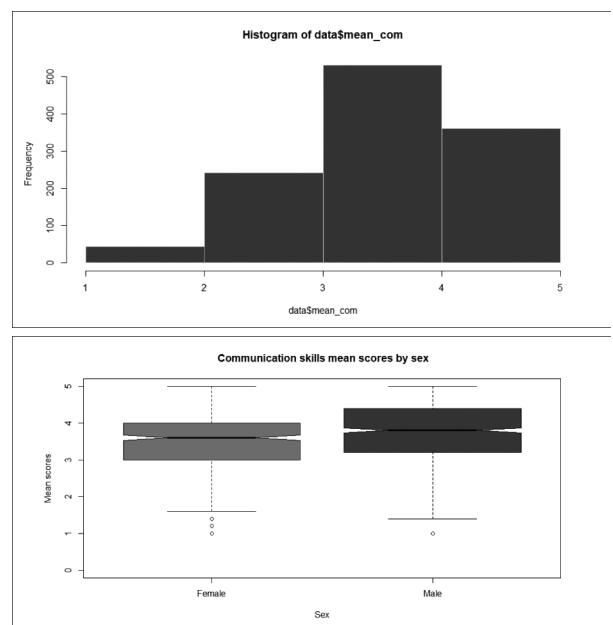

Figure 5: Mean scores in the Communication skills domain

The mean scores by gender in the Creativity skills domain are displayed in Figure 6. This domain examines students' ability to address problems or phenomena from various dimensions, develop new ideas or new ways of doing things, make use of creative techniques such as mind-map, design products to express their views, and critically evaluate and expand others' ideas.
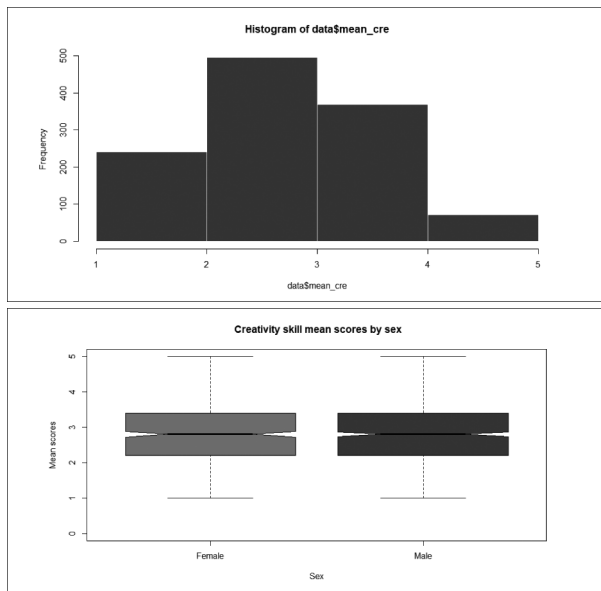

Figure 6: Mean scores in the Creativity skills domain

Self-direction skills domain incorporates four questions assessing the degree to which students could take responsibility for their learning by identifying the topics, subjects or skills they would like to learn, choosing appropriate learning methods and self-assessing their learning outcomes. Figure 7 demonstrates that mean scores by gender are not too discrepant even though boys still scored slightly higher than girls in this domain. Self-direction is also one of the domains with the highest mean scores, 3.71.

Mean scores by gender for the Global connections domain are displayed in Figure 8. This domain comprises four questions to measure students' awareness of global issues such as environment and climate change,
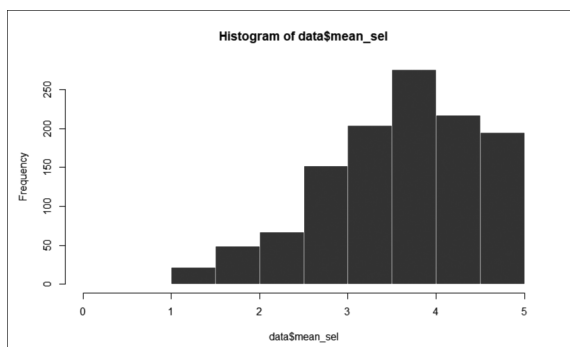
world economy, gender equality, equity in education, and cultural diversity. There are insignificant gender differences between the mean scores in this domain (see Figure 8).
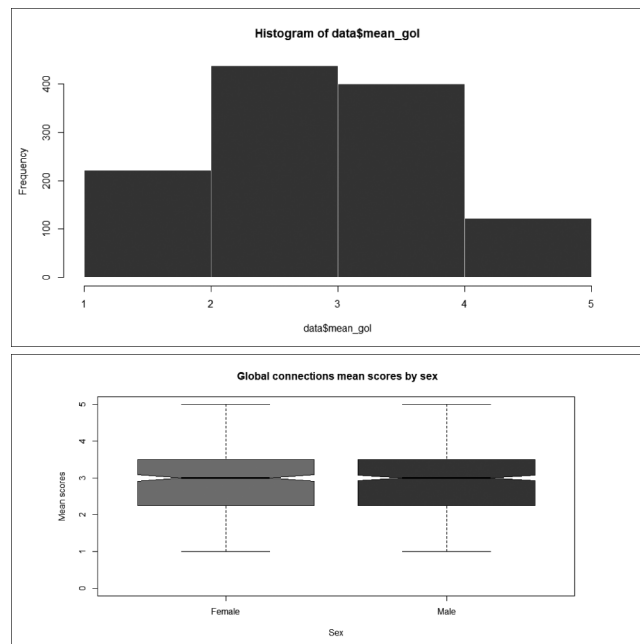

Figure 8: Mean scores by sex in the Global connections domain

The Local connections domain comprises four questions evaluating students' awareness of local issues and application of learned knowledge to solve local problems as well as the ability to connect and disseminate information in their communities. As shown in Figure 9, male students yielded slightly higher scores than their female peers.

The last domain is Using technology as a tool for learning with five questions aiming to measure how well students could exploit technology for learning purposes: self-studying, analyzing data and information, a group working, sharing knowledge and creating websites or personal pages. Figure 10 illustrates the mean scores by
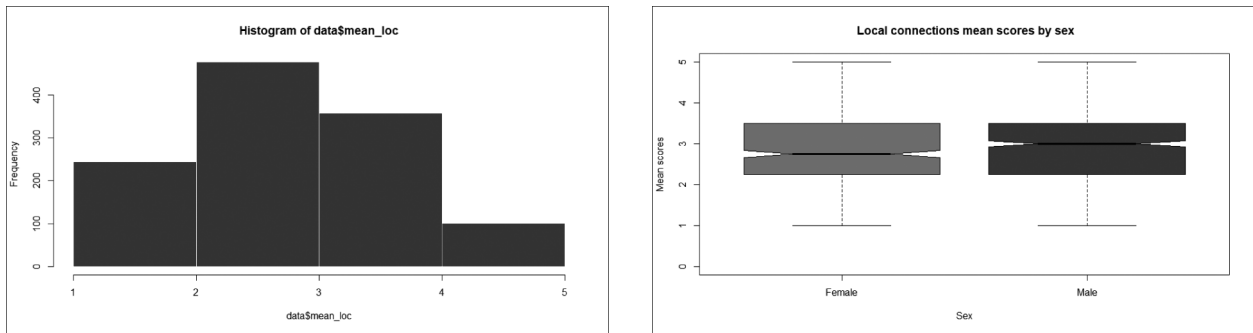

Figure 7: Mean scores in the Self-direction skills domain
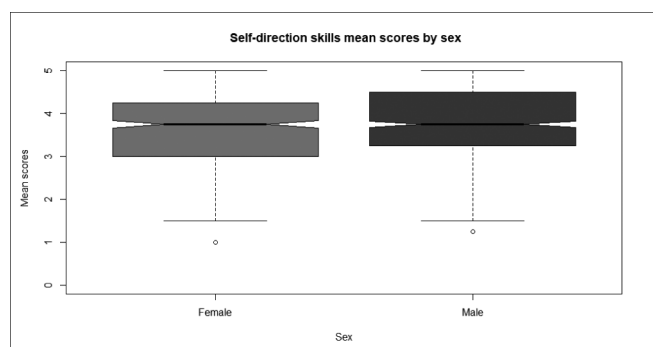
Figure 9: Mean scores in the Local connections domain

gender in this domain. Despite the generally comparable mean scores between the two genders, there were more male students with mean scores self-assessed skills towards the higher end of the spectrum.

Figure 10: Mean scores in using technology as a tool for learning

Figure 11: Distribution of the mean scores of the 21st-century skills

Figure 11 shows the mean scores of surveyed the 21st-century skills of Vietnamese secondary school students.

Comparison of mean scores across the eight domains of 21st-century skills is shown in figure 11. Overall, students' self-assessment is fairly even without any remarkable skew in any of the domains. Self-direction, communication and technology use skills are among the domains with highest mean scores (3.71, 3.67, and 3.60 respectively). The Creativity skills domain's mean score is the lowest in the cohort with only 2.82.
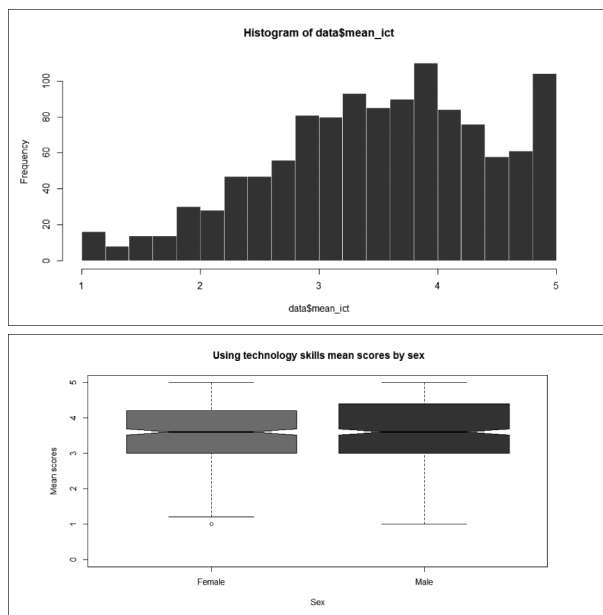
2.3. Potential research questions

The mission of formal education in equipping a new generation of labors with high-level skills set, including 21st-century skills, has been recognized globally. The issue of which21st-century skills should be focused on and their significance inthe school contexthas been discussed in previous literature (Bialik, Fadel, Trilling, Nilsson, & Groff, 2015). There has been evidence suggesting possible affecting factors on students' acquisition of skills such as quality of home life and time spent with parents(Bailey, 2017) and parental educational level(Khan, Iqbal, & Tasneem, 2015). Non-formal learning through out of school activities could also relate to students' engagement in 21st-century skills such as Innovation Skills, Life and Career Skills, and Socio-Cultural Skills(Moyer, 2016). School-related factors, including teacher professional development, and their effects on education of 21st-century skills has also been examined in details (Ravitz, 2012).The problems of integrating 21st-century skills into school subjects, as well as the relationship between academic performances, including achievement in STEM domains, are also concerned by many scholars (Reimers & Chung, 2019).

Based on the dataset, there are potential research questions suggested as follows:

1. What is the relationship between students' socioeconomic background and their perceived level of 21st-century skills acquisition?

2. Is there any effect of school-related factors on students' 21st-century skills?

3. Do out-of-school factors influence students' creativity skills domain?

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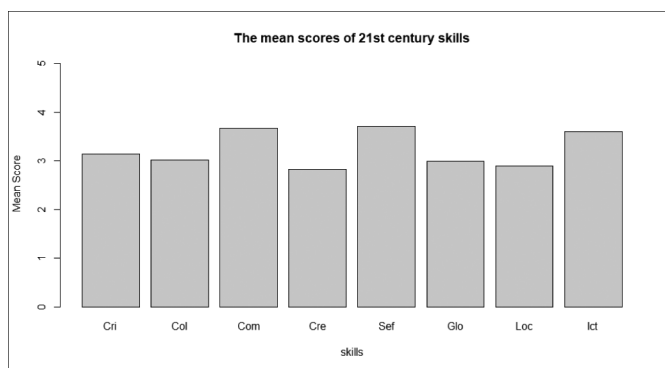
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3. Methods

3.1. Research design

The extant literature provides a wide variety of 21st-century skills' definitions. While these can be defined as the knowledge, skills, and dispositions that enable citizens to develop modern society (Voogt & Roblin, 2010), other educationalists would focus on the way students' capability of knowing, doing and applying learned materials in authentic contexts. 21st-century skills can also be viewed as cognitive, intrapersonal, and interpersonal skills (Council, 2013) or essential skills for navigating education and the workplace in the current age (Griffin & Care, 2014) which are categorized into W*ays of Thinking; Ways of Working*; *Tools for Working,* and *Living in the World* (Binkley et al., 2012). While there is no unified definition of 21st century skills and their domains, theoretical models such as NCREL's enGauge 21st century skills, ATC21, NETS (Education, 2007) as well as research studies by the European Union (Commission, 2018), OECD (OECD, 2018) and UNESCO (UNESCO, 2017) have all focused on

some common skills sets, including collaboration, communication, ICT literacy, social and cultural skills, citizenship Creativity, critical thinking, and problem solving skills, etc.

In this investigation, eight domains of 21st-century skills were selected to be assessed in the questionnaires for the following reasons. Firstly, critical thinking, collaboration, communication, creativity, and self-direction skills are considered significant in determining future citizens' ability to adapt to the fast-changing environment in this coming age. Secondly, Global and Local connections domains were chosen to investigate students' awareness of their position and roles in the community and the world of global citizenship. This is critical for future labors not only to apply their knowledge and skills to solve real-life problems but also to maximize and optimize opportunities from surroundings to develop personally and professionally. Last, using technology as a tool for learning domain was examined since ICT skills are becoming more important in the new era of Industry 4.0 and computational entrepreneurship (Vuong, 2019).

3.2. Data collection

The procedure for the survey is as following: 1) Organising seminars and developing the survey questionnaire; 2) Contacting the target school administrators and coordinators and carrying out administrative work for the investigation; 3) Implementing the survey in May 2019 with the support of school coordinators from at 30 secondary schools across provinces in Vietnam.

In total, the dataset consists of 1183 response of students in 8th, 9th and 11th grade from 30 secondary schools located in five provinces and cities of Vietnam (Hanoi, Nam Dinh, Quang Binh, Ho Chi Minh City, and Can Tho).

3.3. Data analysis

3.3.1. Frequentist analysis

For the numerical variables in the data we can use linear regression model to analyse. The following equation represents the linear equation:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k$$

Y is a continuous variable; the independent variables Xi can be concrete, categorical or continuous.

In the data, the application of Linear regression method would be exampled with the outcome variable being 'critical thinking skill' ('B1_1' to 'B1_5'), the father's highest level of education ('A2.11'), the mother's highest level of education ('A2.12') as predictor variables. Using the model, the following regression coefficients are shown in Table 4a and Table 4b

Table 4a: **Estimating of independent variable 'father's level of education', against outcome variable 'critical thinking skill'**

	Estimate	Std. Error	t value	Pr(> |t|)
(Intercept)	2.3500	0.4096	5.738	1.22e-08 ***
factor(A2.11)2	0.6959	0.4205	1.655	0.0982
factor(A2.11)3	0.7750	0.4122	1.880	0.0603
factor(A2.11)4	0.8327	0.4125	2.019	0.0437 *
factor(A2.11)5	0.8527	0.4123	2.068	0.0388 *
factor(A2.11)6	0.8548	0.4286	1.994	0.0464 *
factor(A2.11)7	0.6270	0.4142	1.514	0.1304

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1; Residual standard error: 0.8191 on 1175 degrees of freedom; Multiple R-squared: 0.01205, Adjusted R-squared: 0.007005; F-statistic: 2.389 on 6 and 1175 DF, p-value: 0.02677

Table 4b: **Estimating of independent variable 'mother's level of education' against outcome variable 'critical thinking skill'**

	Estimate	Std. Error	t value	Pr(> |t|)
(Intercept)	2.6364	0.2470	10.674	<2e-16 ***
factor(A2.12)2	0.4335	0.2628	1.649	0.0993 .
factor(A2.12)3	0.4837	0.2507	1.929	0.0539 .
factor(A2.12)4	0.5140	0.2521	2.039	0.0417 *
factor(A2.12)5	0.5999	0.2515	2.385	0.0172 *
factor(A2.12)6	0.4798	0.2875	1.669	0.0954 .
factor(A2.12)7	0.3449	0.2566	1.344	0.1791

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1; Residual standard error: 0.8191 on 1175 degrees of freedom; Multiple R-squared: 0.01199, Adjusted R-squared: 0.00694; F-statistic: 2.376 on 6 and 1175 DF, p-value: 0.02756

4. Discussion

The dataset provides a landscape view on eight domains of 21st-century skills of Vietnamese secondary school students. In-depth investigations utilizing this dataset are encouraged to generate insights into the impact of school components such as curriculum, teaching practices or infrastructure and facilities, as well as out of school elements concerning the socioeconomic background and family lifestyle on 21st-century skills. Even though various instruments investigating the 21st-century skills of school learners have been introduced by many scientists(Chu, Reynolds, Tavares, Notari, & Lee, 2017).The current dataset, with high versatility of aspects, allows other scientists to explore the issue through multiple approaches, which in turns contributes to broadening the existing literature(Ball, Joyce, & Anderson-Butcher, 2016).

From a practical point of view, the results from this study would benefit educators and policymakers with insights into the current state of skill-based education in general and 21st-century skills in particular of developing the country with a distinct culture like Vietnam(Vuong et al., 2018). Research-based findings are vital to helping construct educational policy and guidelines on the designation of the school curriculum(Vuong, 2018),

investment on school infrastructure and facilities as well as teacher professional development to bridge the possible socioeconomic gap in students' mastering of skills. Besides, the examination of out of school elements could also help raise social awareness of skills education for youths which involves support from family and community in terms of the level of interactions with parents and participation in community activities and service. Further studies could also be conducted to complement and extend findings from this study by examining different subject groups by age, ethnicity, and other stakeholders such as parents, teachers, school managers, and authorized representatives. We recommend other scientists to utilize not only the frequentist approach but also the latest update of Bayesian approach techniques for social science research to analyze this dataset(La & Vuong, 2019).

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