Future jobs: Indonesian Primary Students' Aspirations and Teachers' predictions

Stefanus Christian Relmasira
Universitas Kristen Satya Wacana, Indonesia

Yiu Chi Lai
The Education University of Hong Kong, China

Chi Fuk Henry So
The Education University of Hong Kong, China

Abstract: The transformation of occupations in Indonesia due to digital technologies, especially in Artificial Intelligence, becomes a challenge for current educators to prepare their students for future work skills. This research study seeks to understand what students' career aspirations are and their teachers' predictions about their students' future careers. There were 125 Indonesian primary school students and 141 teachers in Central Java province involved in this research. Students were asked to draw the aspiration of their future jobs when they grow up in the next 15-20 years, and teachers were asked to draw their predictions of their students' future careers. The results show some similarities and differences between students' aspirations and teachers' predictions. Both students and teachers have the same idea about the importance of jobs that emphasizing the use of creativity. However, students had a tendency to select their future careers related to creative and performing arts, whereas teachers predicted their students' future jobs as teachers and lecturers. The data also shows that students incline to draw the use of high-technology tools in their future jobs, whereas teachers tend to describe the use of conventional tools in their students' future careers. Further results are discussed in relation to the International Standard Classification of Occupations skill levels jobs.

Keywords: *Automation; Artificial intelligence; Future jobs; Indonesia; Primary School; ISCO-08*

Introduction

Developing countries' economy are currently in a phase of transition to the fourth industrial revolution. The evidence of digital technology improvement can be seen from the significant number increase of mobile broadband subscriptions and expantion of digital platforms in developing countries. This is in line with the global penetration of internet users from 17% in 2005 to 53% in 2019 (International Telecommunications Union, 2019). Specifically in Indonesia, the survey conducted by the Indonesia Internet Service Providers Association (APJII, 2019) shows that the penetration of Internet users in Indonesia is 64,8% of the total Indonesian population. The Indonesian government started to focus on technology advancement to support economic development as the president of Indonesia released the *Making Indonesia 4.0* road map as an industrial revolution strategy to anticipate global economic challenges in the future. Two of the ten priorities of the strategy are improving the national digital infrastructure and providing incentives for technology investment in Indonesia (Ministry of Industry, 2018, p.9). This policy will create opportunities for start-up businesses and e-commerce to grow. As a result, there will be a demand of future jobs skills. Advances in technology, especially in artificial intelligence (AI), will cause technology to replace manual workers who have predictable tasks. Therefore, education in this case is expected to fulfill the needs of skillful workers in the future. Preparation for the future education should start from the early stage. This study in this case has the focus on

primary school level. Therefore, this research focuses on answering 3 questions. First, what are the career aspirations drawn by the grade 5 and 6 primary students in Indonesia? Second, do the teachers have the same career aspirations of their own students? Third, how do these aspirations and predictions align with International Standard Classification of Occupations (ISCO-08) skill levels?

Future Jobs Demand and Skills

In Indonesia, with the significant growth of technology, many new companies which implement Artificial Intelligence technology have started to emerge and have become unicorn companies that use web based and/or location based digital platforms. For example, Gojek and Traveloka provides online transportation services and Tokopedia and Bukalapak facilitate e-commerce. According to Berg, Furrer, Harmon, Rani, & Silberman (2018) the concern of future work is whether or not technology will replace humans in the future and the world is not ready yet to give protection for the online labours. Thus, the current demand for decent works that implementing AI in Indonesia is increasing. The International Labour Organization (ILO), in Berg et al. (2018) define decent work as

> work that is productive; ensures equality of opportunity and treatment for all women and men; delivers a fair income, security in the workplace and social protection for families; provides prospects for personal development; and gives workers the freedom to express their concerns, organize and participate in decisions that affect their working lives. (Berg et al, 2018, p.1)

Thus, in the future, digital technology can cause major problems in the future workplace if countries and societies are not anticipating it. McKinsey & Company (2019) conducted research and analysis of automation in technology and its impact on Indonesian economic growth. They predicted that automation will increase productivity and foster the economic growth of Indonesia by boosting the global GPD to 1.2 percent growth per year or $13 trillion by the year 2030. Further, they concluded that automation in technology will replace 23 million jobs, and at the same time approximately 27 to 46 million new jobs will be created in Indonesia. Within those new jobs, 10 million of the new jobs created will be new types of jobs that do not exist today. Many jobs that will be replaced by automation are jobs that require physical activity and repetition. According to McKinsey & Company, those jobs could be legal support workers, mortgage originators, production workers, machine operators, payroll officers, and transaction processors. On the other hand, there will be still demand for workers in categories such as project manager, artist, scientist, personal caretaker, etc. As a result, in the future, there is a high likelihood of future work transformation and there are increasing demands for future skills required for future jobs in Indonesia.

In the future of Indonesian workers, there will be many jobs that could be replaced by AI technologies. Banking systems in Indonesia also have already started their transformation to shift from manual banking system to digital banking system. According to Wake & Suhenda, (2018) in PwC Indonesian Banking Survey, 84% of banks in Indonesia were likely to invest in technology transformation. Thus, technology is still the number one driver of business transformation. This digital transformation has already caused a reduction of workers. According to Bisnis.com (2020), there were decreasing numbers of bank employees in 9 major banks in Indonesia as a result of digital transformation. Those transformations, especially in AI technologies, in the banking system include the adoption of chatbots, fraud detection, and prevention, data analytics, etc. (Indriasari, 2019). Therefore, digital

transformation in Indonesian companies may cause a reduction of significant numbers of employees, an increasing amount of investment in AI technologies, and reallocation of human resources from predictable jobs to more unpredictable tasks. As a result, the future of jobs in the next 15-20 years will be changed because of AItechnologies. This future change must be anticipated by education in Indonesia to improve the quality of human resources. Schools in Indonesia need to prepare their students for the future change of occupations by improving their skills required.

The Role of Education: Narrowing the Gap

The demands in terms of future skills will increase a challenge for current education to provide teaching and learning processes to prepare the students for their future careers. Schools in this case will need to envision the future in order to prepare their students to survive and flourish in the future. Therefore, education has an important role in preparing human resources to meet the demands of future work skills. The challenge is larger in Indonesia as the demand for skilled workers is high. Allen (2016) in her analysis of the trend and challenges of the Indonesian labour market found that many job positions in Indonesia are occupied by less-skilled workers. The increasing demand for skilled workers is contributing to increasing unemployment. Data shows that in 2019, the highest numbers of unemployment in Indonesia based on their latest education are vocational high school graduates which are 10.42 percent of 7.05 million people who are unemployed (BPS, 2019). This is an irony that vocational schools which are supposed to produce graduates who are ready to work have a greater number of unemployed graduates than a normal senior high school. This suggests that the present education in vocational high schools in Indonesia is failing to meet the demand for skilled workers by most employers. It will be a bigger challenge when companies increase their recruitment standard in the future. Therefore, reducing the gap between theory and practice in schools will be important to connect the current learning at school with the practice for future careers.

Children's Aspiration of Future Career

In order to reduce the gap, early career planning is important to prepare students for their future. In this case, understanding children's career aspiration becomes the first important thing for parents and teachers to consider when preparing students for their future careers. Magnuson & Starr (2000) explains the importance of life career planning from infancy. In this case, life career planning involves life skills to be taught since children's early lives. Life-career development is a "life-long spiraling process," which includes subskills, increasing children's career awareness and explorations, the development of self-concept and world perceptions help young children to make a decision regarding their career in the future. Auger, Blackhurst, & Wahl (2005) conducted research to understand children's career aspirations and expectations through interviews of 123 primary students in grade one, three, and five in American schools. The results suggested that career exploration should start early to give children various kinds of information related to careers available in this world. A larger scale study with different data collection instruments was conducted by Chambers, Kashefpakdel, Rehill, & Percy (2018) involving primary school students in 20 countries including Indonesia. 7000 Children between 7 and 11 years old were asked to draw a picture of their future careers when they grow up. Their findings showed a tendency of STEM (Science Technology Engineering and Math) related career

aspirations. Gender differences also affected their preference of a career. For example, boys tended to choose to be engineers or scientists whereas girls preferred to work as teachers, doctors, nurses, or vets. In Indonesia, 61 students were involved in the study. They are from a rural area of Riau province. Although the numbers of respondents were small, the result showed differences of preference based on gender. Male Indonesian students preferred to be policemen whereas female students chose to be doctors or teachers.

Research in Children's Drawings

Using pictures in research has been implemented by numerous researchers for gathering data from children. The use of drawing to understand children's cognitive processes was conducted by Goodenough (1926) to measure intelligence through drawing. Some drawing related research involving children has also been conducted (e.g., Appleton, Heldsinger, & Thrupp, 2006; Hunt, 2015; Relmasira., Thrupp, Hunt, 2016; Chambers, Kashefpakdel, Rehill, & Percy, 2018). Brooks (2009) defines drawing as a visualization and representation of ideas whereas Cherney, Seiwert, Dickey, & Flichtbeil (2006) define children's drawings as "a mirror of a child's representational development" and argue that understanding children's representational development will provide insight into children's cognitive development. In their research, 109 drawings of children between 5 to 15 years old were collected. They were asked to draw about family and schools. The results showed that there are differences in their drawings based on gender and older children have a tendency to draw more essential and inessential details in their pictures than younger children. Another study on using drawing to find understanding of an idea was also conducted by Faccio et al. (2017), in which the goal of the research was to find the differences in results between using Drawing compared with questionnaires in improving primary school students' knowledge and habits in food handling and personal hygiene. The results showed that children could include all important elements in their drawings. These findings indicate that using drawing for children in making meaning is important. Cameron et al. (2020), in their research found out that drawing is also a social practice where toddlers have interaction with their peers and teachers at school and parents at home. In this case, children's drawings are commonly affected by their social lives. Therefore, using pictures to understand children's aspirations would be appropriate.

Teachers' Views on Students' Future Career

Understanding teachers' predictions regarding their own students' career aspirations also help us to see whether their views are reflecting their predictions of future changes in the workplace. In research conducted by Relmasira, Thrupp, & Hunt (2017) regarding Indonesian teachers' views towards the Internet, it was shown that teachers use technology mainly to make their job easier. However, limited evidence was shown regarding technological and pedagogical aspects in the classroom. Some misconceptions also appeared in their concept of the Internet. In this case, their understanding and experience of using the Internet may reflect their beliefs about utilizing technology in the classroom. A similar analogy could also be applied in understanding teachers' views of their students' future careers. Teachers' predictions of their students' future careers may reflect not just what teachers think about their students'

future jobs but also, their current beliefs and practices in teaching and learning to prepare their students for their future careers.

Job Classifications Based on Skills

Classifications of jobs are essential to see common types of jobs based on certain categorizations. Job categories can be classified using the international standard classification of occupations published by the International Labour Organization (ILO). According to ILO (International Labour Organization, 2012), there are two distinctions between jobs and occupations. A job is a set of tasks, whereas an occupation is a set of jobs. Table 1. shows the ISCO-08 job classification classified occupations based on 4 levels of skills from International Labour Organization (2012).

Table 1

ISCO-08

ISCO-08 SKILL LEVELS	CHARACTERISTICS	EXAMPLE OF OCCUPATIONS
Level 1	• Manual tasks that require physical activities. • Require physical strength • Minimum education accomplishment is primary school	Cleaning service officers, freight handlers, garden workers, and kitchen assistants
Level 2	• Operators or maintenance of machinery or electronic equipment or vehicles • Many require advanced level of literacy and numeracy. • Minimum education accomplishment is secondary school.	Butchers, bus drivers, secretaries, account clerks, sewing machinists, dressmakers, shop sales assistants, police officers, hairdressers, building electricians and motor vehicle mechanics.
Level 3	• Complex technical and practical tasks in a specialized field. • Commonly require high level of literacy and numeracy and interpersonal communication skills. • Minimum education accomplishment is 1-3 years in higher education	Shop managers, medical lab technician, legal secretaries, sales representatives, medical radiographers, computer technicians, broadcasting and recording technicians.
Level 4	• Complex problem solvers • Decision makers • Creativity • Requires extended level of literacy and numeracy in specialized field • Minimum education accomplishment is 3-6 years in higher education	Marketing managers, civil engineers, teachers, medical practitioners, musicians, operating theatre nurses, and computer system analysts.

Some groups of occupations may have variations of skill levels required. For example, armed forced occupations may include jobs with skill requirements at level 1, level 2, or level 4.
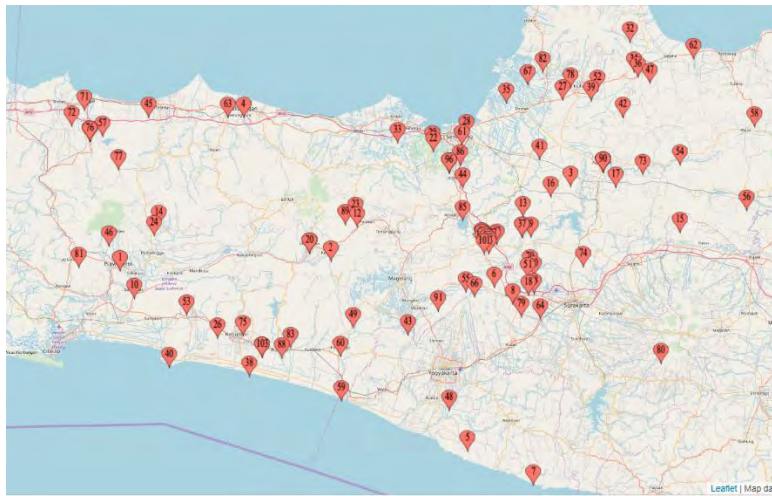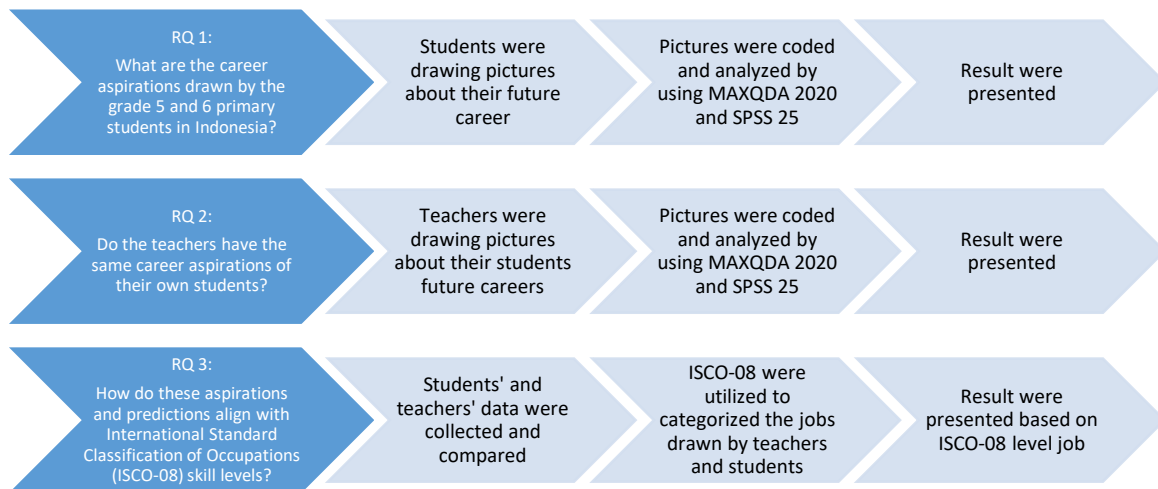
Method

This research was carried out to help Indonesian primary school teachers to prepare their students for their future. The study investigated primary school students' job aspirations and teachers' prediction of their students' future jobs in the next 10 or 15 years. The career aspirations of students become important for them in making decision about their future careers. It is also important for teachers to prepare the students to answer the needs of the skillful workforce in the future. In this study, a survey was conducted of 125 students. The participants consisted of 67 female students and 58 male students in two schools who were selected based on the area of demographic. One school is in suburban area and another is in urban area. Each student drew their own future job on a piece of paper. The same method was used to ask 141 teachers' predictions regarding their own students' future careers.

The data were collected in primary schools in Central Java, Indonesia. In order to gather students' data, two schools in Central Java gave consent for the research to be conducted: one school is in an urban area of Salatiga and another school in a suburban area of Purworejo district. Grade 5 and 6 students from both schools were involved in the research. The total number of students from whom data were collected was 125. Students were asked to draw on a blank sheet of paper about their future dream job in the next 10 or 15 years when they grow up. They were given 45 minutes to finish their drawings. To gather data about students' gender, they were asked to write down their gender on the top right of the paper.

In order to gather teachers' data, 91 schools in Central Java province were involved. The distribution of the schools involved in Central Java is described in Figure 1. Not all teachers in the schools were included in the research. The selections of the participants were not randomly selected. The teachers involved in this study were the teachers from Central Java province who joined the professional program held by the Indonesian government in Satya Wacana Christian University. 141 Teachers (62 female and 79 male) who were willing to be involved in the research were given instructions to draw on a piece of paper about their predictions of their students' future jobs after 15-20 years from the time of data collection. Because of time limitations, no interviews were conducted with students and teachers.

In the process of data analysis, all picture data collected were coded by using MAXQDA 2020 Analytic Pro. The codes created were based on the occupations drawn by students and the tools they described in their pictures. Then, quantitative data in the form of frequencies were analyzed by using SPSS 25. In this case, Fisher's exact test and Cramer's V test were conducted in the analysis to find differences between variables. The explanation about the process in answering the research questions was presented in figure 2.

Figure 1

Respondents' Schools Distributions in Central Java

Figure 2

Process of Answering Research Questions

RQ 1: What are the career aspirations drawn by the grade 5 and 6 primary students in Indonesia?	Students were drawing pictures about their future career	Pictures were coded and analyzed by using MAXQDA 2020 and SPSS 25	Result were presented
RQ 2: Do the teachers have the same career aspirations of their own students?	Teachers were drawing pictures about their students future careers	Pictures were coded and analyzed by using MAXQDA 2020 and SPSS 25	Result were presented
RQ 3: How do these aspirations and predictions align with International Standard Classification of Occupations (ISCO-08) skill levels?	Students' and teachers' data were collected and compared	ISCO-08 were utilized to categorized the jobs drawn by teachers and students	Result were presented based on ISCO-08 level job

Results

Students' Career Aspiration Based on Gender

Fisher's exact test was used in this research as more than 20% of the expected values or frequencies in the occupation variables are less than 5. The p-value showed significant differences ($p<.001$) between female and male students in their future career aspirations. Male and female elementary students in Indonesia are significantly different in making choices regarding future careers. The following figure (Figure 2) shows the percentage of future occupations selected and drawn by students based on gender.
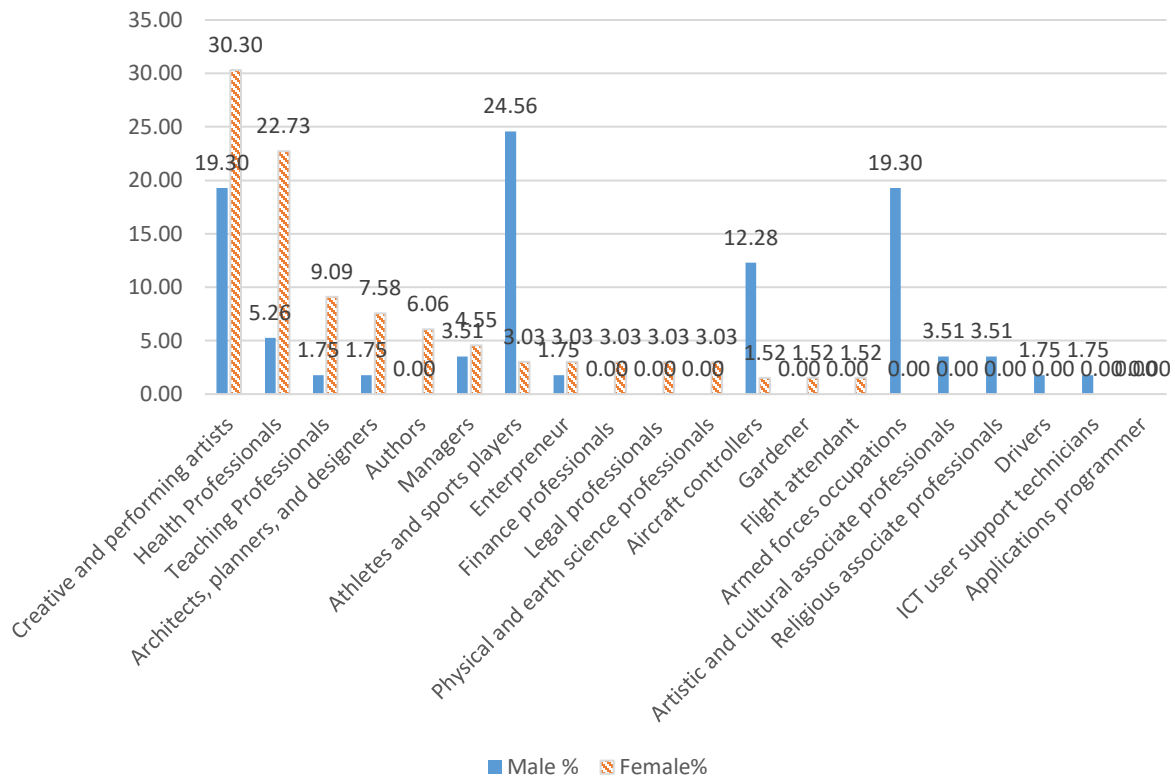
Figure 3

Students' Future Jobs based on Gender

Figure 3 shows that female students tended to choose creative, performing artist, and health professional occupations more than male students. Types of aspirational occupations for females in descending order from the highest numbers to the lower numbers were dancers, singers, pianists, actresses, and doctors. On the other hand, male students had a tendency to aspire to athletic and armed forces occupations. In descending order, the jobs included in the male aspirational occupations were football athlete, e-sport player, and firefighter.

Job Preferences Based ISCO-08 Classifications of Skill Levels

The analysis of students' career aspirations was also conducted based on ISCO-08 classifications of occupations. Specifically, the selections of future jobs were analysed according to the level of the skills. The skill levels are shown in Table 2. The Analysis showed that male and female students chose level 2-4 jobs according to ISCO-08 occupations' classification based on skill levels. In this case, none of the students chose level 1 skill jobs. Fisher's Exact Test was used to analyse the differences in future career choices based on ISCO-08 skill levels. The results showed that there was a significant difference between female and male students in selecting jobs based on ISCO-8 skill levels ($p < 001$). In this case, male students had a tendency to choose level 2 jobs, whereas female students had a tendency to choose level 4 jobs. In order to see the strength of the association between the two categorical variables, Cramer's V test was conducted. The result found a p-value of 0.392. Because this was more than 0.25, there was a

moderate association between gender and the skill levels of the future occupations selected. There was also a moderate association that female students tend to choose jobs with a higher level of skills than male students.

Similar to the process of analysing students' data, in analysing Indonesian teachers' data, Fisher's exact test was implemented because of data limitation. The following figure shows the percentage of the teachers' predictions of their own students' future jobs.

Table 2

ISCO-08 Skill Levels

		Level 2	Level 3	Level 4	Total
Gender	Female	16	5	46	67
	Male	31	10	17	58
Total		47	15	63	125

Teachers' predictions of students' future career

Similar to the process of analysing students' data, in analysing Indonesian teachers' data, Fisher's exact test was implemented because of data limitation. The following figure shows the percentage of the teachers' predictions of their own students' future jobs.

Figure 4

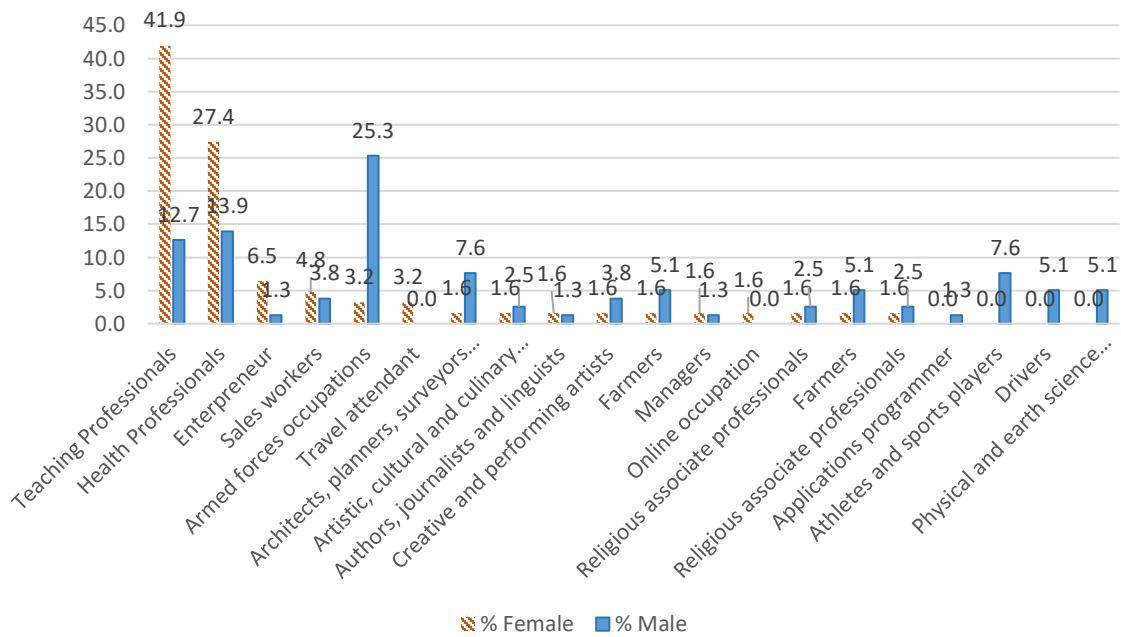Indonesian teachers' predictions of students' future jobs
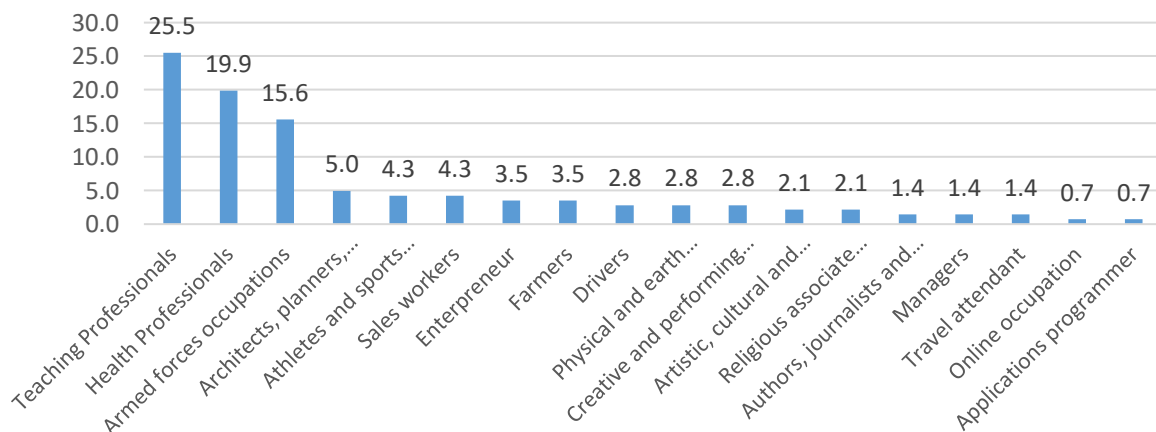
In Figure 4, 25.5% of teachers predicted that their students' future jobs would be teachers. 19.9% of teachers predicted health professionals, and 15.6% predicted armed forces occupations. Online occupations and applications programmers were predicted with the least percentage of 0.7%.

Teachers' Predictions Based on Gender

Based on the graph below, we can see that male and female teachers have different ideas about the future jobs of students. The Fisher's exact test indicates that there are 141 valid cases with p-value less than .001. There were significant differences between male and female teachers' predictions about their students' future jobs. If we look further in Figure 5, the graph shows that 41.9 % of female teachers predicted that most students chose to become educators, whereas 25.3% of male teachers think that students' future jobs are in armed forces occupations.

Figure 5

Teachers' Predictions Based on Gender

Teachers' Predictions Based on ISCO-08 Classifications of Skill Levels

Based on the ISCO-8 classification of skill levels, male and female teachers had different results in predicting students' future jobs. The following crosstab of the skills levels shows the differences between male and female teachers predicting the skill levels.

Table 3 shows that female teachers had a tendency to predict their students would have level 4 future jobs. Those jobs included teachers, doctors, and nurses. On the other hand, although male teachers also had a tendency to predict level 4 students' future jobs, the percentage was lower than female teachers.

Table 3

Teachers' Predications Based on ISCO-08 Skill Levels

		Level 1	Level 2	Level 3	Level 4	Total
Gender	Female teacher	0	7	3	52	62
	Male teacher	2	17	22	38	79
Total		2	24	25	90	141

Figure 6

Percentage of Teachers' Predications Based on ISCO-08 Skill Levels
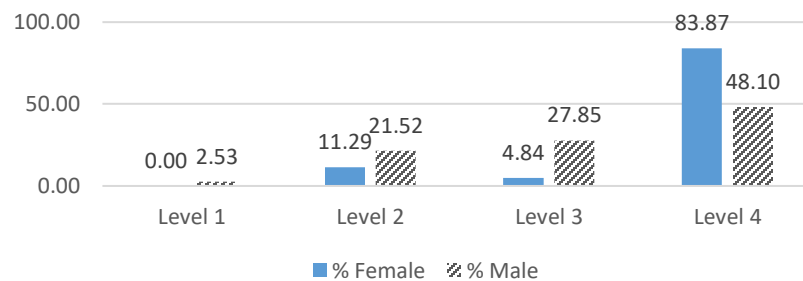
In Figure 6, we can see that female teachers had the highest percentage of predictions of level 4 jobs, 83.87%, whereas male teachers were only 48.1%. The Fisher's Exact test result showed that there was a significant difference (p<.001) between male and female teachers in making predictions of future students' jobs based on ISCO-08 skill levels. The Cramer's V test indicated the relationship between gender and predictions of the students' skill levels of future jobs. The value of the test was .386, which is above 0.25 showing a moderate level of the relationship.

Comparison Between Students' and Teachers' Data on Future Jobs

In order to see the comparison between teachers' and students' data, the combination of diagrams is presented in Figure 7. It indicates differences between students' aspirations of their future jobs and teachers' prediction of their students' future jobs. In the diagram most teachers (25.5%) think that their students will prefer to be educators, but most students (17.6%) think they want to have jobs in creative and performing arts.

Comparison in the Technologies Drawn

In relation to the use of technologies drawn in students' and teachers' data of students' future careers, some technological evidence is shown as follows.

Figure 7

Diagram of Comparison of Teachers' and Students' Data on Future Occupations
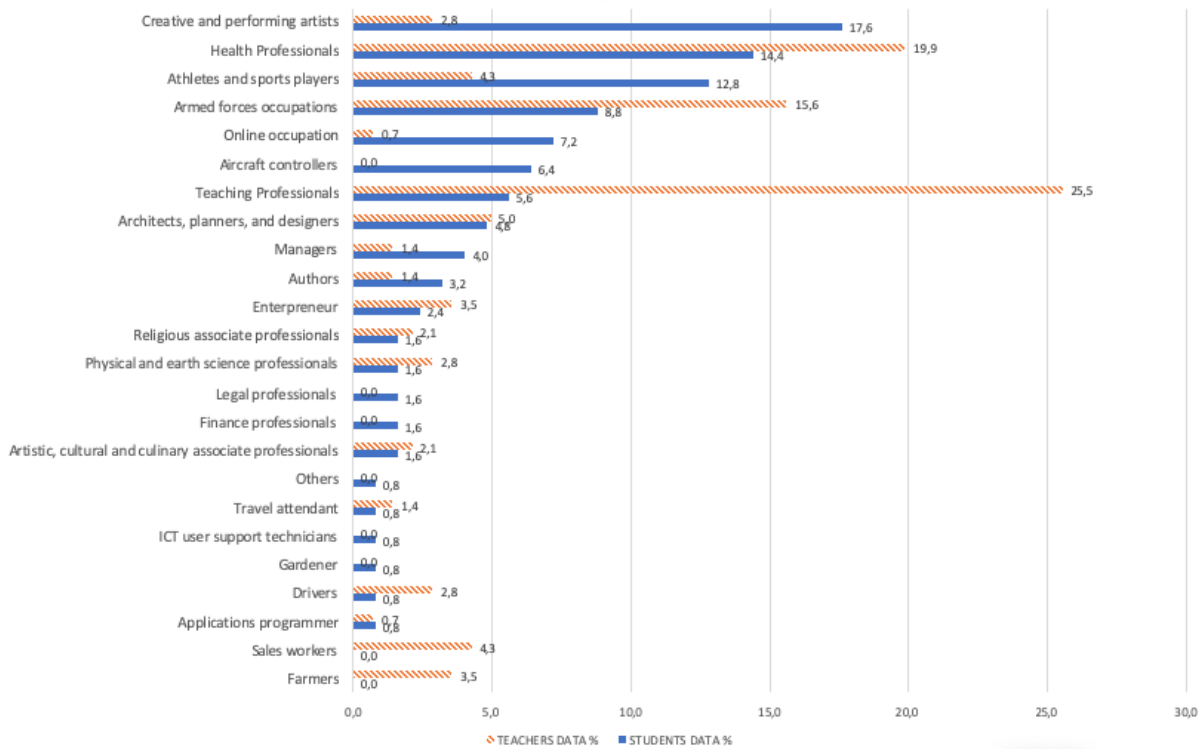
Picture 1

Students' Drawings

If we examine one example of a student's picture, it shows emphasise of the tools used in a career as an animator. The tools drawn were a tablet, smartphone, webcam, and computer. It indicates the usage of high technology in her future career.

Compare to teachers' drawings, picture 2 is an example of their drawing. We can see the evidence of the conventional tools drawn by teachers in students' future careers. The tools drawn were rulers, blackboard, marker, chalk, etc.
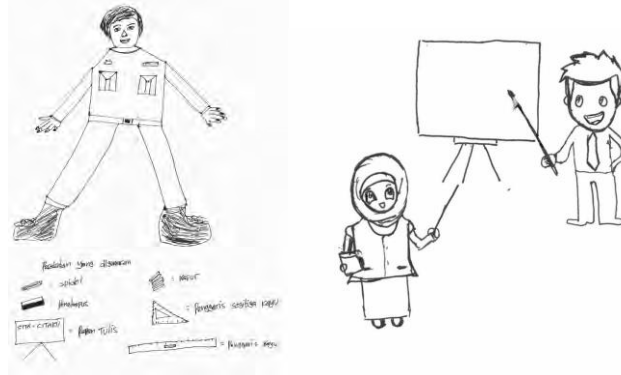
Picture 2

Teachers' Drawings

Comparison Between Students' and Teachers' Data on ISCO-08 Skill Levels

Table 5 shows the comparison between the teachers' and students' data based on ISCO-08 skill levels.

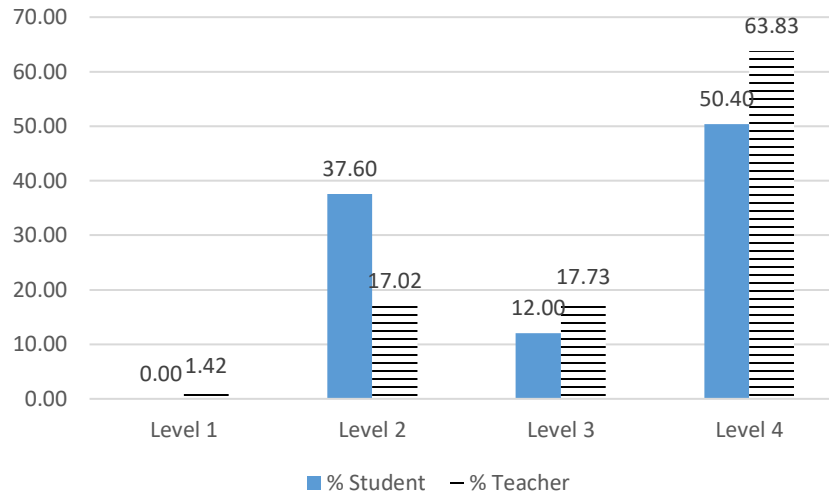**Table 5**

The Comparison Based on ISCO-08 Skill Level

		Level 1	Level 2	Level 3	Level 4	Total
Gender	Student	0	47	15	63	125
	Teacher	2	24	25	90	141
Total		2	71	40	153	266

There were 266 individuals represented, where 125 are students and 141 are teachers. Both sets of data show high numbers of on the level 4 skills job and level 2.

Figure 8 indicates that 63.83% of the teachers and 50.4% of students described level 4 jobs. The Fisher's exact test showed significant differences between the two (p=.001).

Discussion

The findings of this research lead to the understanding of the career aspirations of the Indonesian Primary students and their teachers' predictions of their students' future careers.

Figure 8

ISCO-08 Skill Level Comparison Diagram of Students' and Teachers' Data

Comparing Teachers and Students Result

Table 2 & Table 6 indicate that there are significant differences between male and female students and teachers in describing their aspirations and predictions. The result is significant, with the p-value equals .000. In this case, students and teachers have different ideas of future jobs. 30.3% of female students preferred to have future jobs in creative and performing arts, whereas 24.56% of male students preferred to have future jobs as athletes and sports players. Overall, regardless of their gender, the highest percentage of the aspirations (17.6%) were jobs related to creative and performing arts, and 14.4% of students wanted to have occupations as health professionals. On the other hand, 25.5% of teachers had a tendency to think that their students' future jobs will be as teaching professionals. However, both students and teachers have similar ideas about health professionals as the second favourite occupation. This study showed differences in the needs of students to use creativity and high technologies or digital technologies more in their career aspirations than what teachers predicted. Most teachers described the use of low technologies included in traditional writing tools such as pen, chalkboard, paper, etc in students' future careers, but students imagined the use of smartphones, computers or laptops, and tablets in their future work.

Differences in ISCO-08 skill Levels

If we look at teachers' and students' data based on ISCO-08 skill levels of occupation, level 4 jobs were the jobs chosen by most of the students and also predicted by teachers. Types of jobs that were included in level 4 jobs chosen by the students are firstly creative and performing arts and secondly health professionals, whereas teachers had predictions that the level 4 jobs are firstly teaching professionals and secondly health professionals. Although the predictions from the teachers were different from the students, both teachers and students thought that level 4 jobs

would be the most relevant job in the future. The majority of the teachers in this study may prepare their students to achieve the expectation.

AI technologies and Students Career Aspirations

In relation to the era of automation, the findings in this research show that there are some predictable physical jobs chosen by the students. Those jobs are drivers and technicians or mechanics. The rapid advance of technology, especially in AI technologies, will be a future threat for students' future careers if not anticipated well. Therefore, special attention from teachers to encourage those students by helping them recognizing various kinds of level 4 jobs and enhancing creativity, critical thinking, collaboration, and utilizing digital technology in learning are vital. On the other hand, teachers also need to realize that not all teachers have prepared their students to be ready for integrating technologies in their future careers. This study showed that many teachers described the use of conventional working tools, whereas the students had a tendency to describe the use of digital technologies in their future careers.

Research Limitations and Contribution

This research was conducted in the Indonesian context in Central Java province. Samples collected may not representing all provinces in Indonesia or developing countries as a whole. Thus, further study needed to be conducted to gather students' and teachers' views of future work from other provinces in Indonesia. This research is expected to be a reference for conducting similar study in wider scope in Indonesia or in developing countries.

Conclusion

Digital transformation, especially in Artificial Intelligence (AI) technologies, in most occupations in Indonesia may transform future careers. The findings of this study demonstrated that Indonesian teachers' predictions of their students' future jobs are different than students' aspirations of their future careers in the next 15-20 years. Students tended to imagine future jobs that use more creativity and high technologies, whereas teachers tended to predict the use of low technologies or conventional tools in their students' future jobs. However, both teachers and students had a tendency to think that jobs in skill Level 4 occupations are the most relevant jobs for the students' future careers. Those occupations are creative and performing arts occupations and educators. Schools in Indonesia need to narrow the gap between theory and practice to answer the learning needs of students in order to prepare them to be ready for a significant change in their future careers due to transformations in technologies.

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Corresponding Author Contact Information:

Author name: Stefanus Christian Relmasira

Department: Primary Teacher Education Program

Faculty: Teacher Education

University, Country: Universitas Kristen Satya Wacana, Indonesia

Email: srelmasira@uksw.edu