THE WILLINGNESS OF MATHEMATICS TEACHERS IN FACING
21ST CENTURY SKILLS

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ABSTRACT
This study aims to examine inventive thinking, high productivity, effective communication and digital age literacy in measuring the 21st century skills among Mathematics teachers. The method used is survey using questionnaire as a research instrument. This study was conducted at the Universiti Pendidikan Sultan Idris which involved 80 students of Bachelor of Education (Mathematics) at the Faculty of Science and Mathematics. Data obtained through questionnaire instrument were analyzed using descriptive statistics involving mean and inferential statistics involving Pearson's correlation, multiple regression and ANOVA analysis. The findings show that correlation between inventive thinking and effective communication is strong with correlation value (r = 0.608, N = 80, p < 0.05), high productivity constructs and digital age literacy have weak relationships and positive correlation with effective communication (r = 0.349, N = 80, p < 0.05 and r = 0.329, N = 80, p < 0.05). The multiple regression analysis shows that effective communication becomes the key predictor in improving CGPA of mathematics teachers. This suggests that future mathematics teachers will be more likely to have effective communication skills than inventive thinking, high productivity and digital age literacy. While the 21st century skills with the CGPA of the mathematics teachers are not significant. In view of this, by reviewing these skills, teachers, educational organizations and policy makers, especially the Curriculum Development Division, can identify the weaknesses and shortcomings of 21st century skills among potential teachers. Teachers also need to diversify the more creative and innovative teaching methods and feature 21st century skills.

Keywords: 21st Century Skills, Teaching and learning

Introduction
In the 21st century, the entire world is expected to experience rapid and challenging developments especially in the economic, political and social sectors regardless of whether developed or developing countries (Azizah, 2015). According to him, the transition of transformation and revolution is a scenario in our education system today. All teaching and learning processes tend to require a change in knowledge and skills efficiency to address technological advances. With that, a lot of changes have taken place in our lives, especially in terms of technology that is rapidly developing and expanding. This is in line with 21st century skills such as digital age literacy, inventive thinking, effective communication, high productivity and the norms and spirituality found in the Malaysian Education Development Plan (PPPM) which make one of the key claims in adapting change in education (Preliminary Report of PPPM 2013-2025). This is to ensure the digital age generation is able to weather the problems and challenges that exist today.

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The Ministry of Education Malaysia (KPM) has launched a 21\textsuperscript{st} century learning initiative in 2014 and expanded its overall implementation from 2015. This is because the teacher's interest in understanding and willingness to make changes in teaching and learning is in line with the learning of the 21\textsuperscript{st} century In line with the transformation of education through the objectives of PPPM 2013-2025 (Ministry of Education Malaysia, 2012: Preliminary Report of PPPM 2013-2025). At the same time, the needs of 21\textsuperscript{st} century skills that are crucial to the practice of education are aligned with information and communication technology (ICT) skills. Hence, to create creative and innovative human capital, teachers' professionalism needs to be enhanced as they are the cornerstone of the 21\textsuperscript{st} century expertise. Thus, a study was conducted to assist teachers involved in the field of technical and vocational education especially in improving the skills of the 21\textsuperscript{st} century to meet the needs of changing students according to today's technological change (Siti Faizzatul & Razali, 2011).

To produce students with high-level thinking, teachers need to take steps to equip themselves to be seen as a leader who conveys current technology-based knowledge and be prepared to master and use information technology for various fields and conduct daily affairs. In addition, 21\textsuperscript{st} century teachers will need to master the knowledge and skills of the industry to produce generations of human capital for the ever-expanding industry work market. This effort is a contribution to the human resource that contributes to the highly skilled, quality, versatile, and responsive workforce of the current industry. In this regard, the 21\textsuperscript{st} century teaching and learning environment emphasizes on learning and innovation skills that creates creativity and innovation, critical thinking and problem solving, communication and collaboration of basic needs for human capital and development for students (Ismail, 2013).

Claims in applying technology effectively and meaningfully in the classroom have led to the readiness of teachers to become increasingly important in tandem with the increasing challenge of using technology for Teaching and learning processes that are an alternative to 21\textsuperscript{st} century skills integration. But with this growing communication technology and communication becomes a burden for teachers when they are not able to master the skills in using the latest technology for Teaching and learning processes. It is supported by Siti Faizzatul Aqmal et al. (2011) stating that without a high readiness in the teacher, all education reforms carried out to produce a young generation in line with world development will fail. Hence, quality teachers are one of the aspirations to boost the education system and become a catalyst towards achieving the goals of the nation. Therefore, these teachers will be valuable human capital to produce quality teachers and need to be applied from the beginning in order to create a strong, competent, knowledgeable and highly self-respecting individual in fulfilling the needs of the 21\textsuperscript{st} century (Noziati & Siti Mistima, 2015). According to Masyuniza (2015), with its 21\textsuperscript{st} century skills can prepare young generation to face industrial, global, high-tech and sophisticated industries for daily living needs. This is a huge impact on human life especially in the field of education with the development of information technology.

What has become of this issue is the extent to which the 21\textsuperscript{st} century proficiency level of Mathematics in Teaching and learning is at school? Thus, this study wants to see the willingness of future teachers in the 21\textsuperscript{st} century Teaching and learning.

**Methodology**

This study using survey methods to investigate inventive thinking, effective communication, high productivity and digital age literacy in measuring the 21\textsuperscript{st} century skills among potential mathematics teachers. The target respondents are students of the Bachelor of Education (Mathematics) program involving 80 people from the Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris. The instrument used is a set of questionnaire to get the study data.

This study uses simple random sampling techniques to investigate inventive thinking, effective communication, high productivity and digital age literacy in measuring the 21\textsuperscript{st} Century Skills among potential mathematics teachers. Since the total population of ISMP (Mathematics) students is 100, the number of sample study required is 80 students from the whole population. The total number of samples is determined based on the sample size determination table by Krejcie and Morgan.
In this study, the questionnaire was used as a research instrument. Respondents were given a questionnaire consisting of a set of questionnaires that had been modified from the previous researcher, Siti Fazidah (2015). The questionnaire is divided into two sections, part A focuses on respondent background information such as gender, race and student CGPA. This section uses the question of Thurston type where respondents only need to provide answers by marking one of the answer options. While Section B contains 38 items with a breakdown of 21st Century Skills constructs namely inventive thinking (13 items), effective communication (12 items), high productivity (8 items) and digital age literacy (5 items). This section is a Likert scale that provides five choice options: Strong Disagree (STS), Disagree (KS), Disagree (TS), Agree (S) and Strongly Agree (SS).

Results and Discussion

The level of mastering of the 21st Century Skills among future mathematics teachers

In the measurement of the 21st century skills the students have used the mean interpretation that is divided into three levels, namely low, medium and high. The findings show that there are mean differences between the four constructs in 21st century skills. The results showed that the mean of inventive inventories (min = 4.16, SP = 0.447), effective communication (min = 3.78, SP = 0.476), high productivity (mean = 4.30, SP = 0.531) 4.26, SP = 0.550. Overall, it can be concluded that each of the 21st century skills constructs is at a high level. This finding is different from the results of the study conducted by Tuan Mastura et al. (2010) showing that the level of mastering of the 21st century skills and the generic skills of science students is at a medium level.

The findings of the study in terms of effective communication are parallel to the study conducted by Nurul Salmi and Mohd Isha (2014) stating that communication skills are essential elements that must exist and should be mastered by each student whether to meet their needs during the learning process, preparation to meet workplace or social interaction. Based on the findings of the study, teachers’ communication skills are at a high level.

The findings of Nuradiwati, Kamisah, Tuan Mastura and Nur Suhaidah (2012) have concluded that the level of literacy in the digital age of students are moderate. Whereas the findings from inventive thinking differ from the findings of Siti Rahayah et al. (2008) who reported that critical skills and problem-solving among science students were at moderate level.

In addition, prospective teachers are encouraged to actively participate in various activities conducted at the university and take all the opportunities provided as a platform to enhance and empower the 21st century skills that must be present in each future teacher. Therefore, 21st century skills need to be set up and nurtured as early as possible so that students or potential teachers will not miss out on entering a fierce and competitive career. Therefore, teachers are the main leaders in personality towards 21st century skills.

The relationship between inventive thinking, effective communication, high productivity and digital age literacy in measuring 21st century skills

In this study, the correlation test was conducted to identify the relationship between all the constructs in 21st century skills. Based on Table 1, the value of p = 0.000 is less than p <0.01 which shows that there is a significant relationship between 21st century skills for inventive thinking constructs with effective communication. The correlation value r = 0.608 shows a strong relationship. For inventive thinking constructs, the value of p = 0.000 is smaller than p <0.01 which shows that there is a significant difference between the inventive and constructive productive thinking constructs. The correlation value r = 0.411 expresses a medium relationship. While the constructs of thinking also indicate that the value of p = 0.000 is smaller than p <0.01 which shows a significant difference between the inventive thinking construct and the digital age literacy. The correlation value r = 0.416 shows a medium relationship.

For effective communication constructs, the value of p = 0.001 is smaller than p <0.01 which
shows that there is a significant difference between the effective communication and high productivity constructs. The value of \( r = 0.349 \) indicates a weak relationship. The effective communication constructs show that the value of \( p = 0.003 \) is smaller than \( p < 0.01 \) which shows that there is a significant difference between the effective communication constructs with the digital age literacy. The value of \( r = 0.329 \) indicates a weak relationship. Whereas the high productivity contract, the value of \( p = 0.000 \) is smaller than \( p < 0.01 \) which shows that there is a significant difference between high productivity constructs with digital age literacy. The value of \( r = 0.410 \) shows a medium relationship. Hence, based on the results of the study, there is a connection between each construct in 21st century skills. first is the size of the sample, to ensure the analysis carried out appropriately, then measurement of the size of sample is sufficient to be taken into account. According to Tabachnick and Fidell (2001), \( N > 50 + 4m \) (m is the number of independent variables) then the sample size of 80 people with 4 independent variables is eligible for this analysis.

**Table 1:** The relationship between inventive thinking, effective communication, high productivity and digital age literacy

<table>
<thead>
<tr>
<th>Variable</th>
<th>( r )</th>
<th>Sig.</th>
<th>The strength of the colleration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventory thinking with effective communication</td>
<td>0.6</td>
<td>0.0</td>
<td>Strong</td>
</tr>
<tr>
<td>Highly productive with inventive thinking</td>
<td>0.4</td>
<td>0.0</td>
<td>Medium</td>
</tr>
<tr>
<td>Inventive thinking with digital age literacy</td>
<td>0.4</td>
<td>0.0</td>
<td>Medium</td>
</tr>
<tr>
<td>Effective communication with high productivity</td>
<td>0.3</td>
<td>0.0</td>
<td>Weak</td>
</tr>
<tr>
<td>Effective communication with digital age literacy</td>
<td>0.3</td>
<td>0.0</td>
<td>Weak</td>
</tr>
<tr>
<td>High productivity with digital era literacy</td>
<td>0.4</td>
<td>0.0</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Furthermore, multicollinearity is a condition that needs to be observed in the regression analysis. Multicollinearity occurs when there is a high correlation value between the independent variables. To ensure multicollinearity does not interfere with the results of the analysis, the diagnostic test has been conducted. Table 2 shows the results of tolerance values for all independent variables involved. This is to ensure there are no interruptions during the analysis of collinearity diagnostic tests are run.

**Table 2:** Tolerance Collinearity Diagnosis value

<table>
<thead>
<tr>
<th>Predictor variables</th>
<th>Tolerance</th>
<th>( VIF )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventive thinking</td>
<td>0.558</td>
<td>1.794</td>
</tr>
<tr>
<td>Effective Communication</td>
<td>0.616</td>
<td>1.624</td>
</tr>
<tr>
<td>High productivity</td>
<td>0.752</td>
<td>1.330</td>
</tr>
<tr>
<td>Digital age literacy</td>
<td>0.755</td>
<td>1.325</td>
</tr>
</tbody>
</table>

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All tolerance values show values below 1.00 and no values approaching 0.01. While the value of Variance Inflation Factor (VIF) is smaller than 10. So the study data has no problem to analyze.

In this analysis there are four constructs of 21st century skills that are inventive thinking, effective communication, high productivity and digital age literacy that are used as predictor variables against dependent variables is CGPA of mathematics teachers.

The result of multiple regression model analysis shows that only one of the four independent variables is effective communication is based as a predictor variable for achievement at significant level p <0.05.

**Contribution between inventive thinking, effective communication, high productivity and digital age literacy based on CGPA of Mathematics teachers**

There are several conditions that need to be followed before the regression analysis is conducted. The Based on Table 3, the value of $R^2 = 0.083$ indicates that communication constructively affects or contributes 8.3% to the CGPA mathematics teachers. Meanwhile, showing a positive value, meaning the higher the mastery of effective communication the higher CGPA will be for future Mathematics teacher. Whereas, the significant value indicates $p = 0.049$, $p <0.05$ indicating that there is a positive relationship between effective communication and CGPA.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>B</th>
<th>t</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td></td>
<td>2.065</td>
<td>2.101</td>
<td>0.390</td>
</tr>
<tr>
<td>Effective communication</td>
<td>0.083</td>
<td>0.482</td>
<td>1.999</td>
<td>0.049</td>
</tr>
</tbody>
</table>

The overall result of the analysis shows that only one 21st century skills development is effective communication as a major predictor in improving the CGPA of mathematics teachers. Therefore, this study finds that the future of mathematics teachers will be more likely to be effective communication skills to improve CGPA in their academic achievement. Therefore, a regression equation has been set up to demonstrate the effective communication contribution towards the CGPA of mathematics teachers.

Nurul Salmi et al. (2014) who report that effective communication is an important element that needs to exist and needs to be controlled by each student whether to meet their needs during the educational process or to prepare for the work environment and in social interaction. This is supported by a study conducted by Ismail (2012) found that many graduates who have good academic records but are still unemployed for failing in the interview session due to lack of communication skills.

Hence, it can be concluded that respondents comprising students of ISMP (Mathematics) of various demographic backgrounds are more likely to use effective communication constructs. So it is predictable that effective communication plays an important role in the Teaching and learning process that is parallel to the respondent's self as the future of mathematics teachers.

**The 21st century proficiency level of proficiency based on the CGPA of mathematics teacher**

In this study, ANOVA analysis was conducted to identify the difference in the 21st century proficiency level of CGPA of mathematics teachers. Based on Table 4, the difference in the level of inventories of inventive thinking based on CGPA of mathematics teachers is not significant $[F (2,77)$
= 0.527, p = 0.592 value p> 0.05. For the difference of effective communication level is not significant [F (2,77) = 1.403, p = 0.252 value p> 0.05. While for high productivity, it was not significant [F (2,77) = 0.230, p = 0.795 value p> 0.05 and digital age literacy was not significant and F (2,77) = 0.651, p = 0.524 p> 0.05. This clearly demonstrates that there is no difference in the level of 21st century proficiency of inventiveness, effective communication, high productivity and digital era literacy based on the CGPA of mathematics teachers.

Table 4: The 21st century proficiency grade level difference based on the CGPA of mathematics Teacher's

<table>
<thead>
<tr>
<th>Construct</th>
<th>Sum of square</th>
<th>DK</th>
<th>Mean square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventory thinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between group Within</td>
<td>0.232</td>
<td>2</td>
<td>0.116</td>
<td>0.527</td>
<td>0.592</td>
</tr>
<tr>
<td></td>
<td>16.967</td>
<td>77</td>
<td>0.220</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>17.200</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between group Within</td>
<td>0.628</td>
<td>2</td>
<td>0.314</td>
<td>1.403</td>
<td>0.252</td>
</tr>
<tr>
<td></td>
<td>17.238</td>
<td>77</td>
<td>0.224</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>17.867</td>
<td>76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High productivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between group Within</td>
<td>0.132</td>
<td>2</td>
<td>0.660</td>
<td>0.230</td>
<td>0.795</td>
</tr>
<tr>
<td></td>
<td>22.175</td>
<td>77</td>
<td>0.288</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>22.308</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital age literacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between group Within</td>
<td>0.399</td>
<td>2</td>
<td>0.199</td>
<td>0.651</td>
<td>0.524</td>
</tr>
<tr>
<td></td>
<td>23.560</td>
<td>77</td>
<td>0.306</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>23.959</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This finding is consistent with the study of Mohd Najib and Nor Shafrin (2008) that there are differences in learning skills among students on academic achievement. This study demonstrates that 21st century skills have a strong relationship with the CGPA of mathematics teachers. Thus, each of the 21st century skills constructs has its own strengths in determining the academic achievement of the students.

However, this study is contrary to the study of Mohd Najib and Nor Shafrin (2008) which found that there is a mean difference between learning skill and academic achievement. It is further explained that each student has different learning skills. This can be further proven in this study when there is a difference in the mean of 21st century skills of students.

Conclusions
The high level of student proficiency in 21st century skills is a good indicator of current needs that require competitive human capital and are able to face the challenges of the future. Each teacher should always be prepared to provide effective teaching results in producing outstanding students not only in the examination but successfully putting themselves alongside with competitors from within and outside the country.

In other words, by looking at these skills, educators, educational organizations and policy makers, especially the Curriculum Development Division, can identify the weaknesses and lack of skills of the 21st century among students. Teachers also need to diversify the more creative and innovative teaching methods and feature 21st century skills. Hence, the 21st century skills are expected to be further developed and enhanced in providing high-value human capital to compete in the global tech world.

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