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### The Use of ChatGPT among Rural Youth in the STEM Field

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#### Abstract

The focus of global human resource development today is on the mastery of STEM and artificial intelligence (AI) technology. There is limited understanding of rural youth's perceptions related to this focus, especially the use of ChatGPT in STEM fields. Accordingly, the main objective of this study is to examine the use of ChatGPT in the field of STEM by rural youth. A survey design involving an online questionnaire on 75 respondents in a district was used. Cronbach's alpha for the scale was calculated to be 0.889.

The data of this study was analyzed using descriptive analysis and statistical tests including ANOVA and t-test. Most respondents have given a positive perception about the use of ChatGPT in the STEM field, while the information that has been generated from ChatGPT is fast and abundant. Based on these findings, ChatGPT should be exposed as early as possible to rural youth for their self-development in STEM fields.

**Keywords:** Human Resource Development, Artificial Intelligence, ChatGPT, Rural Youth, STEM

#### 1. Introduction

Rural youth often lag behind in Science, Technology, Engineering and Mathematics (STEM) compared to other youth groups, even though these youth are among the important human resources to meet the goals of the national STEM mission. Producing talent equipped with STEM knowledge and skills to maintain the country's global competitiveness is the STEM mission of most countries. However, limited access to quality education<sup>[1]</sup>, lack of exposure to STEM opportunities<sup>[2]</sup> and limited access to technology are among the challenges faced in deepening STEM by rural youth. All of these issues may cause many countries including Malaysia to struggle to meet the human capital required in the STEM field<sup>[3, 4]</sup>. Additionally, by 2025 most of the job roles in increasing demand are related to the STEM field<sup>[5]</sup> and Malaysia is reported to need eight million workers with STEM skills by 2050<sup>[6]</sup>. For this reason, rural youth should be empowered in STEM mastery along with other youth groups in line with the demands of this field in the future.

Exposure to STEM fields among rural youth needs to be changed with more creative methods in line with the growing transformation of education. One of the creative artificial intelligence (AI) technologies suitable for STEM mastery among rural youth is the use of ChatGPT. ChatGPT, short for Chat Generative Pre-trained Transformer, is a form of AI that can engage in conversational interactions with users. According to Baidoo-Anu and Owusu Ansah<sup>[7]</sup>, the use of ChatGPT has increased interest in STEM fields in recent years. It has great potential to bridge the gap between individuals by providing immediate access to information, resources and guidance in STEM education, while in STEM professions, it responds quickly and helps solve problems<sup>[8]</sup>. By integrating ChatGPT in STEM programs or education, rural youth can potentially enhance their learning experience, connect with experts and mentors, and develop essential skills in critical thinking, problem-solving and communication.

Despite the potential benefits of ChatGPT, research on its use in the STEM field is very limited. Therefore, this study aims to examine the use of ChatGPT in STEM fields by rural youth. Taking into account the conceptual framework of the study, the main variables are STEM fields, AI technology (ChatGPT), rural youth with their background including age, education level, gender and race and then dependent variables of ChatGPT use such as level of use, level of satisfaction, benefits gained and

challenges faced. The research questions to guide this study are: i) What is the perception of rural youth on the use of ChatGPT in the STEM field? ii) What are the benefits and challenges of using ChatGPT in the STEM field among rural youth? iii) Are there significant differences between gender among rural youth regarding the perception and benefits of using ChatGPT in the STEM field? and iv) Are there significant differences between current education level among rural youth regarding the perception and benefits of using ChatGPT in the STEM field? This study tests the following null hypotheses: i) There is no significant difference between gender among rural youth regarding the perception and benefits of using ChatGPT in the STEM field and ii) There is no significant difference between current education level among rural youth regarding the perception and benefits of using ChatGPT in the STEM field. By understanding the use of ChatGPT in this context, educators, employers and policymakers can better support rural youth in their STEM fields and career paths, reducing educational inequities and enhancing STEM education.

### 1.1 Literature review

Rural youth face educational inequality compared to their urban peers. In STEM fields, previous studies have shown that there are many issues in rural areas such as the weakness of STEM applications<sup>[9]</sup>, insufficient equipment<sup>[10]</sup>, lack of sufficient equipment in school laboratories<sup>[11]</sup> and teacher issues including teacher competency discrepancies in STEM<sup>[12]</sup>, lack of teacher understanding of STEM<sup>[13]</sup>, teacher attitudes towards STEM<sup>[14]</sup>, low and basic knowledge and skills of weak teachers<sup>[15]</sup>. The findings of this study are consistent with Rajak *et al.*<sup>[16]</sup> who found that STEM education faces problems being adapted in rural schools. In addition, rural youth also show lower academic performance, limited access to advanced coursework and fewer extracurricular opportunities<sup>[17]</sup>. The introduction of AI could potentially mitigate these challenges and issues by offering scalable and flexible educational resources. AI technologies have been increasingly utilized in educational settings to enhance learning outcomes. Studies indicate that AI such as ChatGPT can provide personalized learning paths, real-time feedback, and interactive learning experiences, thereby improving student engagement and comprehension<sup>[18]</sup>. ChatGPT, with its ability to understand and process human language very well<sup>[19]</sup>, can act as a virtual tutor, providing explanations, answering questions and facilitating discussions<sup>[20]</sup> including on complex STEM topics. While research on the use of ChatGPT's specific impact on rural youth in the STEM field is limited, existing studies in STEM education suggest positive outcomes. Holmes *et al.*<sup>[21]</sup> found that ChatGPT has been shown to help students better understand abstract concepts, develop computational thinking skills and increase interest in STEM careers.

In science alone, ChatGPT has the potential to revolutionize science learning. Zhai<sup>[22]</sup> reported that ChatGPT could tackle the challenging part of science teaching and learning by automatic assessment development, grading, learning guidance and recommendation of learning materials. A study in which ChatGPT was used to simplify radiology reports for non-experts found that most radiologists agreed that the simplified reports were correct<sup>[23]</sup>. Engineering students found ChatGPT helpful in a design project for a college engineering course<sup>[24]</sup> and believe that ChatGPT can

change education for the better<sup>[25]</sup>. Wardat *et al.*<sup>[26]</sup> showed that ChatGPT provides immediate assistance and personalized support in mathematics. However, the integration of ChatGPT into specific concepts of mathematics teaching and its effectiveness in problem-solving remain unclear. Other studies in STEM subject groups related to the use of ChatGPT have shown good learning support in physics<sup>[27]</sup>, mathematics<sup>[28]</sup>, design<sup>[24]</sup> and engineering<sup>[29]</sup>. Following the findings of this study, educators have suggested that ChatGPT can be used as a tool to support teaching across a wide range of subjects<sup>[30]</sup>. Given the capabilities of ChatGPT, it is reasonable to expect similar benefits for rural youth engaging with this technology.

Since ChatGPT is a relatively new AI technology, it may lead to a lack of research related to respondent variables in the use of ChatGPT among rural youth in STEM fields. A few studies on respondent variables about ChatGPT use were found, but those studies were not specific to rural youth and STEM fields. Araujo *et al.*<sup>[31]</sup> found gender significantly influenced perceptions of usefulness, with females perceiving automated decision-making by AI as significantly less useful than males. Lozano, Molina and Gijón<sup>[32]</sup> revealed that men exhibited a higher interest in technological developments compared to women. Mozilla<sup>[33]</sup> found that men (41%) expressed a higher inclination compared to women (31%) in desiring AI to surpass their own intelligence. A previous study by Daud *et al.*<sup>[34]</sup> also found similar results but their study used teaching staff in the field of science-biology as a sample where men still showed a more positive attitude towards computer information technology than women. In addition to gender, another variable studied is college major and experience, which usually has a close relationship with the respondent's level of education. Yeh *et al.*<sup>[35]</sup> found that perceptions of AI were observed to have significant differences among different college major groups. Their study revealed that business majors perceived AI as more virtuous compared to humanities majors and engineering majors expressed greater concern about the possibility of human lives being monitored by AI compared to business majors. Additionally, significant differences were observed among groups based on their prior experience using artificial intelligence (AI)<sup>[36]</sup>. All these results show the influence of gender, college major and experience on the perception of AI by the respondents, which shows the need to consider the background of the respondents when studying their perception of AI.

### 2. Materials and Methods

In this study, the sample consisted of 75 rural youth who are currently living in one of the rural districts. These youths are the first group of students who have taken the lower secondary assessment with various changes towards higher-level thinking skills and student performance have been assessed as not entirely dependent on the exam. Thirty-eight were male while 37 were female. All the youths involved were Malays with various levels of education, namely Diploma (22 respondents), Degree (43 respondents) and Master's (10 respondents). Their age range was between 18 and 25 years. This age range indicates that rural youth are mostly Generation Z (Gen Z). Table 1 shows the respondent variables.

**Table 1:** Respondent variables

| Variables               | Information |             |             |             |            |
|-------------------------|-------------|-------------|-------------|-------------|------------|
|                         | < 18 years  | 18-24 years | 25-30 years | 31-35 years | ≥ 36 years |
| Age                     | -           | 75 (100%)   | -           | -           | -          |
| Gender                  | Male        | Female      |             |             |            |
|                         | 38 (50.7%)  | 37 (49.3%)  |             |             |            |
| Race                    | Malay       | Chinese     | Indian      | Others      |            |
|                         | 75 (100%)   | -           | -           | -           |            |
| Current education level | School      | Diploma     | Degree      | Masters     | PhD        |
|                         | -           | 22 (29.3%)  | 43 (57.3%)  | 10 (13.4%)  | -          |

A survey approach using an online questionnaire was used as a data collection tool in this study. The questionnaire was adapted from AI Survey Creator-Startquestion [37] and Alrishan [38]. The questionnaire was divided into two parts. In the first part, there is an introductory text, followed by demographic variables of the respondents, namely, age, gender, race and current level of education. The second part contains 12 items. Item 1 is about the knowledge of the existence of ChatGPT, Item 2 is about initial learning of ChatGPT, Item 3 is about subjects of interest in the STEM field, Item 4 is about consent to use ChatGPT in STEM field, Item 5 is about the frequency of using ChatGPT, Item 6 is about the satisfaction of using ChatGPT in the STEM field, Item 7 is about the rate of using ChatGPT in STEM, Item 8 is about the challenges in using ChatGPT, Item 9 is about ChatGPT improving the understanding of STEM subjects, Item 10 is about the impact of ChatGPT in the STEM field learning experience, Item 11 is about using ChatGPT in the STEM field in the future and Item 12 is about introducing ChatGPT to peers in the STEM field.

The questionnaire items 4, 5, 6, 7, 8, 9 and 10 measure the use and benefits of ChatGPT using a five point Likert scale; (1) Strongly disagree (2) Disagree (3) Neither disagree (4) Agree and (5) Strongly agree have been used. The five point interpretation was as follows: Very positive (4.20-5.00), Positive (3.40-4.19), Moderate (2.60-3.39), Negative (1.80-2.59) and Very negative (1.00-1.79). Cronbach’s alpha for the scale was calculated to be 0.889. Data analysis was done with ANOVA and t-test. The significance level was taken at 0.05. All data were analyzed using the SPSS 22.0 package program.

**3. Results and Discussion**

The results and discussion of this study are presented based on the objectives and research questions that cover three subtopics, namely the perception of rural youth towards the use of ChatGPT in the STEM field, the benefits and challenges of using ChatGPT in the STEM field.

**3.1 Perception of rural youth on the use of ChatGPT in the STEM field**

All respondents (100%) who have been surveyed know about ChatGPT technology. This finding may indicate that

rural youth have been exposed to ChatGPT during their studies either at the diploma level or other levels. A total of 44 (58.7%) respondents have learned ChatGPT from friends followed by 16 (21.3%) through social media and the rest have learned through online searches (Table 2). This finding has shown the importance of friends and social media including internet access to rural youth in obtaining information, as well as learning technology. The absence of rural youth learning ChatGPT from their teachers or lecturers suggests that the traditional role of these instructors may shrink in the future as technology advances. Altarawneh [8] also stated that AI can change the role of teachers and the way they teach. Here, the development of human resources through the implementation of flexible education according to the needs of the youth and the role of the instructor as a learning partner can be developed accordingly to face this challenge. This is in line with the essence of Saat and Fadzil [39] and Yang *et al.* [40] views that learning partners and flexible education have the potential to improve student ability. Similarly, to AI, Mollick [41] has stated that the most effective way to learn with AI is to treat it as a partner and teacher.

For STEM subjects, this study found that the majority of respondents were interested in Science (38.7%), followed by other subjects (21.3%), Technology (20%) and Engineering (20%). None of the respondents were interested in Mathematics. This may provide an overview of their field of study at diploma, degree or master's level. However, according to Palmer, Burke and Aubusson [42] the most important factors in choosing or rejecting STEM subjects among students are fun, interest and ability, and perceived need in their future study or career plans. To find out in depth and precisely the reasons why youth choose other subjects and are not interested in Mathematics, further research is still needed. All respondents also think that STEM subjects including Mathematics can be improved with the help of ChatGPT. This opinion is consistent with the findings of the study where the use of ChatGPT has shown good learning support in the STEM subject group [22, 24, 27, 28, 29]. The perception of rural youth towards ChatGPT and STEM subjects is shown in Table 2.

**Table 2:** Perception on ChatGPT and STEM subjects among rural youth

| Items  | Respond    |             |               |             |           |
|--|------------|-------------|---------------|-------------|-----------|
|  | No         | Yes         |               |             |           |
| 1. Have you ever heard of ChatGPT (AI) technology?                       | 0 (0%)     | 75 (100%)   |               |             |           |
| 2. How did you first learn about ChatGPT?                                | Friends    | Soial media | Online search | Teachers    | Others    |
|  | 44 (58.7%) | 16 (21.3%)  | 15 (20%)      | 0 (0%)      | 0 (0%)    |
| 3. Which STEM fields are you interested in?                              | Science    | Technology  | Engineering   | Mathematics | Others    |
|  | 29 (38.7%) | 15 (20%)    | 15 (20%)      | 0(0%)       | 16(21.3%) |
| 4. Do you think ChatGPT can improve your understanding of STEM subjects? | No         | Yes         |               |             |           |
|  | 0(0%)      | 75 (100%)   |               |             |           |

**Table 3:** Perception of ChatGPT use in the STEM field among rural youth

| Items  | Respond                |               |                       |               |                     | Mean   | Level    |
|--|------------------------|---------------|-----------------------|---------------|---------------------|--|----------|
|  | 1<br>Strongly disagree | 2<br>Disagree | 3<br>Neither disagree | 4<br>Agree    | 5<br>Strongly agree |  |          |
| 1. The impact of ChatGPT on your learning experience in the STEM field is very good. | 0<br>(0%)              | 0<br>(0%)     | 8<br>(10.7%)          | 52 (69.3%)    | 15<br>(20%)         | 4.093±0.459*b<br>(F <sub>2,72</sub> =5.423)                | Positive |
| 2. You strongly agree to use ChatGPT in the STEM field                               | 7<br>(9.3%)            | 0<br>(0%)     | 8<br>(10.7%)          | 30<br>(40%)   | 30<br>(40%)         | 4.013 ±1.168   | Positive |
| 3. You highly recommend ChatGPT to your peers in STEM fields                         | 0<br>(0%)              | 0<br>(0%)     | 23<br>(30.7%)         | 30<br>(40%)   | 22 (29.3%)          | 3.987±0.780*a<br>(t=3.779)                                 | Positive |
| 4. You are very satisfied with the use of ChatGPT in the STEM field                  | 0<br>(0%)              | 0<br>(0%)     | 22<br>(29.3%)         | 38<br>(50.7%) | 15<br>(20%)         | 3.907±0.701*b<br>(F <sub>2,72</sub> =6.696)                | Positive |
| 5. You will continue to use ChatGPT in STEM fields in the future                     | 0<br>(0%)              | 0<br>(0%)     | 15<br>(30%)           | 45<br>(60%)   | 15 (30%)            | 3.706±0.785*a<br>(t=6.770)                                 | Positive |
| 6. You often use ChatGPT related with STEM Field                                     | 0<br>(0%)              | 30<br>(40%)   | 0<br>(0%)             | 30<br>(40%)   | 15<br>(20%)         | 3.400 ±1.208   | Positive |
| Total  |                        |               |                       |               |                     | 3.851±0.924*a,b<br>(t=2.449)<br>(F <sub>2,72</sub> =4.709) | Positive |

\*Statistical significance:  $p < 0.05$  (\*a-gender using t-test; \*b-current education level using ANOVA)

The perception of rural youth towards the use of ChatGPT in the STEM field is shown in Table 3. The two highest perceptions were found on items related to the effects of using ChatGPT (4.093±0.459) and agreement to use ChatGPT in the STEM field (4.013±1.168). ChatGPT has the potential to improve students' educational experience<sup>[43]</sup>, meaningful and valuable learning experiences<sup>[44]</sup>, improve student achievement<sup>[45]</sup> and other benefits may be among the reasons why rural youth gave the highest feedback for those items. This finding is consistent with Hakiki *et al.*<sup>[46]</sup> who found that the use of ChatGPT had a positive effect on student learning. The item about the frequency of using ChatGPT was found to be at the lowest level (3.400 ±1.208), even close to a moderate level. This low frequency of use of ChatGPT is inconsistent with the agreement for its use in the STEM field (4.013 ±1.168). This finding is also inconsistent with a study by Altarawneh<sup>[8]</sup> where his study found strongly agree (73%), agree (12%), neither disagree (10%) and never (5%), on the other hand this study found strongly agree (20%), agree (40%) and disagree (40%) (Table 3). Inconsistent findings may be due to the use of ChatGPT depending on the type of task to be completed and different study factors such as sample, age, gender, race and location. Three other items, “you highly recommend ChatGPT to your peers in STEM fields (3.987±0.780)”, “you are very satisfied with the use of ChatGPT in the STEM field (3.907±0.701)” and “you will continue to use ChatGPT in STEM fields in the future (3.706±0.785)” were found to be in almost the same level of agreement (Table 3). The positive perception about the impact of ChatGPT in learning and the agreement to use it as in the two earlier items may have increased the respondents' motivation to study STEM fields through ChatGPT. This situation may have also encouraged respondents to give a positive perception in recommending the use of ChatGPT to friends, their satisfaction, their recommendations for future use and other items. The overall average perception of rural youth towards the use of ChatGPT in the STEM field which was found to be positive (3.851±0.924) (Table 3) can be explained from this level. This also indicates that rural youth are more likely to be involved and motivated to study STEM fields, which

can lead to better academic results. Nevertheless, the significant differences in the perception of the use of ChatGPT in the STEM field between gender and current education level of respondents through t-test analysis and one-way ANOVA are shown in Table 3.

Overall statistical analysis using t-test and ANOVA for this study found that the background of respondents, namely gender (t=2.449,  $p < 0.05$ ) and current education level (F(2,72)=4.709,  $p = 0.02$ ) showed significant differences in the use of ChatGPT in the STEM field. The findings of this study are similar to Yeh *et al.*<sup>[35]</sup> where their study also found a significant difference between males and females (t=-6.294,  $p < 0.001$ ). So far no studies have been found on the differences in the use of ChatGPT in the STEM field between the current level of education. However, the study of the use of ChatGPT on the college major group<sup>[35]</sup> and the experience group<sup>[36]</sup> that is closely related to the current level of education shows a significant difference. This statement is supported by Demir and Guraksin<sup>[47]</sup>, who stated that students' academic background may influence their acceptance of educational technology. These results highlight the importance of considering gender dynamics and current education levels in understanding perceptions of using ChatGPT in STEM fields.

### 3.2 Benefits and challenges of using ChatGPT in the STEM field among rural youth

The benefits of using ChatGPT in STEM fields among rural youth are shown in Table 4. The eight benefits listed have received varying responses from rural youth. The overall average benefit of using ChatGPT in the STEM field according to the perception of rural youth is at a very positive level (4.265±0.846). “Fast responses to information” (4.813±0.586), “abundant/wide range of topics” (4.500±0.493) and “ease of use” (4.493±0.685) were the top three preferences of rural youth. In this study, 90.7% of respondents agreed that ChatGPT is a fast response to information. The findings of this study exceed the findings of Hakiki *et al.*<sup>[46]</sup> by 19.4%. This difference in findings may be due to the use of the old and latest version of ChatGPT. The GPT-4.0 is the latest flagship model that

provides GPT-4 level intelligence but is much faster and improves on its capabilities across text, voice, and vision. For “ease of use” only 79% of respondents agreed. This equalled the highest score recorded for the “perceived ease of use” dimension with a perception of 74% by Yilmaz *et al.* [36]. This is also in line with Guleryuz [48] who stated that one of the biggest advantages of ChatGPT is ease of use and saving time. For “abundant/wide range of topics”, all respondents agreed (100%). Two other benefits of using ChatGPT that are perceived at a very positive level are “language processing capabilities” (4.413±0.660) and “helpfulness” (4.400±0.805). Meanwhile, three other benefits namely “collaboration and communication” (3.907±0.947), “continuous learning and development” (3.787±0.874) and “accuracy” (3.707±0.897) have been perceived at a positive level only. The lowest perception of ChatGPT benefits by rural youth is “accuracy” (3.707±0.897) but still at a positive level. This finding is better than the findings of Shoufian [24] which are

perceived at a moderate level. Similarly, the findings of Sila *et al.* [49] are perceived as uncertain (3.31). The requirement by Malaysia Qualification Agency (MQA) [50] that requires verification of sources may also affect the perception of rural youth towards the accuracy of information. In order to ensure the reliability and appropriateness of the information it is appropriate to critically evaluate the information obtained from any source including ChatGPT. The overall statistical analysis using t-test and ANOVA for this study, found that only the current level of education showed a significant difference in the benefits of using ChatGPT in the STEM field (F(2,72)=5.376, p <0.05). Therefore, it is important to consider the background of the respondents, especially their level of education in understanding the benefits of using ChatGPT in the STEM field. ChatGPT can be used across all levels of students, from elementary grades to higher education [51] so the target of rural youth success in STEM fields with the help of ChatGPT can be well planned.

**Table 4:** Benefits of using ChatGPT in the STEM field among rural youth

| Items  | Respond             |            |                    |            |                  | Mean  | Level         |
|--|---------------------|------------|--------------------|------------|------------------|---|---------------|
|  | 1 Strongly disagree | 2 Disagree | 3 Neither disagree | 4 Agree    | 5 Strongly agree |   |               |
| The use of ChatGPT is very beneficial in the field of STEM related to the following aspects: |                     |            |                    |            |                  |   |               |
| 1. Fast responses to information   | 0 (0%)              | 0 (0%)     | 7 (9.3%)           | 0 (0%)     | 68 (90.7%)       | 4.813±0.586   | Very positive |
| 2. Abundant/wide range of topics   | 0 (0%)              | 0 (0%)     | 0 (0%)             | 30 (40%)   | 45 (60%)         | 4.500±0.493*a,b (t=2.723) (F <sub>2,72</sub> =4.476)  | Very positive |
| 3. Ease of Use   | 0 (0%)              | 0 (0%)     | 8 (10.7%)          | 22 (29.3%) | 45 (60%)         | 4.493±0.685   | Very positive |
| 4. Language processing capabilities  | 0 (0%)              | 0 (0%)     | 7 (9.3%)           | 30 (40%)   | 38 (50.7%)       | 4.413±0.660   | Very positive |
| 5. Helpfulness   | 0 (0%)              | 0 (0%)     | 15 (20%)           | 15 (20%)   | 45 (60%)         | 4.400±0.805   | Very positive |
| 6. Collaboration and communication   | 0 (0%)              | 0 (0%)     | 37 (49.3%)         | 8 (10.7%)  | 30 (40%)         | 3.907±0.947*a (t=2.265)                               | Positive      |
| 7. Continuous learning and development   | 0 (0%)              | 0 (0%)     | 38 (50.7%)         | 15 (20%)   | 22 (29.3%)       | 3.787±0.874*a,b (t=2.938) (F <sub>2,72</sub> =11.445) | Positive      |
| 8. Accuracy  | 0 (0%)              | 7 (9.3%)   | 23 (30.7%)         | 30 (40%)   | 15 (20%)         | 3.707±0.897*b (F <sub>2,72</sub> =4.968)              | Positive      |
| Total  |                     |            |                    |            |                  | 4.265±0.846*b (F <sub>2,72</sub> =5.376)              | Very positive |

\*Statistical significance: p<0.05 (\*a-gender using t-test; \*b-current education level using ANOVA)

The challenges of using ChatGPT in STEM fields among rural youth are shown in Table 5. Respondents stated only 7 challenges in using ChatGPT in the STEM field. The highest challenge of 60% was lack of specialized knowledge followed by understanding complex concepts (50.7%), lack of real-time updates (40%), accuracy and precision (38.7%), handling technical jargon (30.7%), ethical considerations (29.3%) and lastly, limited context understanding (10.7%). The findings of this study show that the knowledge of rural youth is quite limited in determining aspects of challenges. Nah *et al.* [52] stated that there are many more challenges in the use of ChatGPT, which they categorized into ethical, technological, regulatory, policy and economic. Zhu *et al.* [53] in a qualitative analysis of student reflections have categorized the challenges of using ChatGPT into two groups of themes, which are eight positive themes, covering competence, dealing with knowledge gaps, and generating human-like responses, and eight negative themes, including generic responses, lack of innovation, and counterproductive

to self-discipline and thinking. Although the findings of challenges in this study are not consistent with the findings of other researchers which may be caused by various factors such as differences in sample variables, field focus and version of ChatGPT, but challenges in the use of ChatGPT in the STEM field still exist and have been identified.

**Table 5:** Challenges of using ChatGPT in the STEM field among rural youth

| Item  | Respond   |                |
|---|-----------|----------------|
|   | Frequency | Percentage (%) |
| What challenges do you face in using ChatGPT? |           |                |
| 1. Lack of specialized knowledge              | 45        | 60.0           |
| 2. Understanding complex concept              | 38        | 50.7           |
| 3. Lack of real-time updates                  | 30        | 40.0           |
| 4. Accuracy and precision                     | 29        | 38.7           |
| 5. Handling technical jargon                  | 23        | 30.7           |
| 6. Ethical considerations                     | 22        | 29.3           |
| 7. Limited context understanding              | 8         | 10.7           |

#### 4. Conclusion and Recommendations

From this study, it can be concluded that the overall average perception of rural youth towards the use of ChatGPT in the STEM field is at a positive level ( $3.851 \pm 0.924$ ), while the overall average benefit is at a very positive level ( $4.265 \pm 0.846$ ). Respondents stated that the two highest benefits of using ChatGPT in the STEM field are fast and abundant information. Rural youth expressed only 7 challenges in using ChatGPT in STEM fields namely lack of specialized knowledge, understanding complex concepts, lack of real-time updates, accuracy and precision, handling technical jargon, ethical considerations and limited context understanding. Gender and different current education levels showed a significant difference in the use of ChatGPT with values of ( $t=2.449; P<0.05$ ) and ( $F_{2,72}=4.70; P<0.05$ ), respectively. However, different current education levels only showed a significant difference to the benefits of ChatGPT ( $F_{2,72}=5.376; P<0.05$ ).

Based on the results and discussion above, these findings have implications for educators, policymakers and other responsible agencies to support rural youth in their STEM fields and career paths, reducing educational inequities and enhancing STEM education. Several important implications can be suggested from this study.

**First;** opens up opportunities and encourages rural populations to use ChatGPT in mastering the STEM field. This is based on the result that rural youth gave a positive and very positive perception of the use and the benefits of ChatGPT in their respective STEM fields. This reflects that they have become interested in STEM which can be the driving force and the main factor in making successful decisions<sup>[54]</sup>. The number of students interested in STEM is decreasing from year to year, so early exposure to ChatGPT is expected to help increase interest in STEM among the national population. In addition, individual backgrounds need to be taken into account in achieving STEM mastery following this study also found that different genders and different levels of education show significant differences in the use of ChatGPT.

**Second;** Educators need to adapt their roles according to the latest technological developments. This suggestion is based on the findings of this study wherein using ChatGPT no students learn ChatGPT from their teachers or lecturers. Accordingly, empowering instructional leadership is the first step to simultaneously change the role of educators in order to form students who are relevant and suitable for global development in the 21st century<sup>[55]</sup>. Effective leadership will mobilize the institution to succeed in the STEM mission. For educators and administrators, although ChatGPT has many benefits in STEM education, they are still fully responsible for ensuring that children receive a well-rounded education.

**Third;** Facing the challenges of technological development. This suggestion is based on the findings of seven challenges in using ChatGPT in the field of STEM among rural youth. The approach to facing the challenges of using ChatGPT generally depends on the issues involved whether issues related to ChatGPT technology, user issues or support issues such as facilities and services. In order to address the challenges, efforts need to be intensified to improve the use of ChatGPT more effectively in making the STEM field successful among rural youth. ChatGPT instructors can also be developed to help students master ChatGPT and related technologies in the STEM field.

**Last,** the findings of this study show that the rural youth were exposed to ChatGPT while they were studying. Accordingly, the focus of future studies can be set to explore rural youth who are left behind or unable to continue their studies. The difference in findings can be used as a basis for strengthening human resource development programs, especially for rural youth in the STEM field.

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