Android-based Assessment Tool for Technology and Livelihood Education

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Abstract-This study aimed to develop an Android-based mobile application in Technology and Livelihood Education (TLE) subject for incoming Grade 9 students to determine their preferred specialization based on their skills and interests to address the mismatch of skills acquired which is required in the job market. The application underwent validation by 18 experts using ISO 9621-1 and Learning Resource Management and Development System (LRMDS) standards and was found to be 100% compliant with the set guidelines. The study also determined the significant difference between the respondents' (223) pre-preferred and post-preferred TLE specializations. It was noted that there was a significant difference in the preferred specializations employing t-test which was found at (t=3.894**, p<0.01) with 99% significance level. Though it appeared that upon using the pre-preferred compared with the developed application TLE-Z, no changes had been observed in their preferred specializations (CSS, Technical Drafting and Food Processing), however, it could be noted that the inclination of students were evidently more spread across the 8 specializations. It was recommended that the developed application must be adopted in the entire division for the greater benefit of the intended users upon approval of the experts.

Indexed Terms: Android-based mobile application, Assessment Tool, Technology and Livelihood Education

I. INTRODUCTION

The implementation of Republic Act 10533 otherwise known as the Enhanced Basic Education Act of 2013 tremendously transformed the landscape of basic education in the country. As the Department of Education started the implementation of the K to 12 Program for the School Year 2012-2013, it has strengthened the implementation of the Technical Vocational Education Program (STVEP) and Technology and Livelihood Education (TLE) curriculum. The TechVoc-based TLE is designed based on the training regulation (TR) of the Technical Education and Skills Development Authority (TESDA) which focuses on the development of technical skills and competencies in mensuration and calculation, technical drafting, use of tools and equipment, maintenance of tools and equipment, and occupational health and safety during the exploratory phase in Grades 7 and 8 which the learners need to develop and apply in any of the areas of specialization that they want to pursue in Grades 9 and 10.

Meanwhile, several studies revealed that there is a skill mismatch among the graduates and what is required of the job market. In the study conducted by Asian Development Bank (ADB) in the Philippines published in March 2021, findings imply that completing a TVET program does not always result in employment for TVET graduates. However, the school has no standardized or at least available assessment tool which can properly assign the learners to their appropriate TLE course, unlike in the transition of learners from Junior to Senior High School which learners are guided by their National Career Assessment Examination (NCAE) and is usually administered to Grade 9 or Grade 10 in choosing their Track and Strands. This was one of the issues and challenges in choosing of specialization in Grade 9 usually brought a negative impact on the academic and personal lives of the learners aside from it is not in conformity with the principles of TLE implementation where learners must be given the opportunity to take the course aligned to their skills and aptitudes.

It is within these ideas and principles that the researcher proposed, developed, and utilized an

Android-based Assessment Tool for incoming Grade 9 students and to help other TLE teachers address similar issues.

II. METHOD OF RESEARCH

The research employed a descriptive-developmental-evaluative and inferential approach. The survey checklist, evaluation checklist, and experts' evaluation checklist were the research instruments. The data had been analyzed using descriptive statistics to determine the percentage compliance. In determining the significant difference between the pre-preferred and post-preferred TLE specialization by the incoming Grade 9 students, a t-test was used as statistical treatment. Recommendations by the experts were integrated into the developed Android-based mobile application.

- Population, Sample Size and

- Sampling Technique

There were two sets of respondents in this study, the incoming Grade 9 students and the selected evaluators. Students had been surveyed on their pre-preferred TLE specialization from the eight (8) specializations being offered as mini-courses in CNNHS. Afterward, the same students were asked for their post-preferred specialization and utilized the Android-based application in selecting their skill inclination from the competencies taken from the MELCs. Two (2) sections had been excluded from the list of respondents since they belong to special science classes and have their designated specializations. The competencies embedded in the application for the students to test were all technical skills that they should master in their chosen mini-courses. The other respondents were the selected evaluators who performed the evaluation on the parameters and indicators of the developed Android-based application. Suggestions and recommendations were solicited from the said evaluators.

- Description of the Respondents

The 223 selected student respondents who participated in the study were incoming Grade 9 students for School Year 2023-2024. They were initially those who do not have a basis in choosing their TLE specialization. On the other hand, the selected evaluators who were all educators are TLE Teachers who are experts on ICT and the subject itself. The Education Program Supervisor is in charge of monitoring the implementation of the TLE curriculum while the Education Program Supervisor in LRMDS is responsible for the quality assurance of both print and non-print materials in the Division of Camarines Norte.

- Research Instrument

The research employed a descriptive-developmental-evaluative and inferential approach. The survey checklist, evaluation checklist, and experts' evaluation checklist were the research instruments. The data had been analyzed using descriptive statistics to determine the percentage compliance. In determining the significant difference between the pre-preferred and post-preferred TLE specialization by the incoming Grade 9 students, a t-test was used as statistical treatment. Recommendations by the experts were integrated into the developed Android-based mobile application.

- Data Gathering Procedure

When it comes to learning more about a particular topic, study, research, or even person, data is a vital element. In the present era, data offers a wide variety of applications and purposes. Data gathering is a crucial component that we should never ignore, whether we consider a digital transformation. This is especially true if we want to get insights, generate forecasts, and run operations in a way that adds a lot of value. Data collection is defined as a systematic way of acquiring, monitoring, measuring, and analyzing reliable information to assist research undertaken by professional groups from any field.

The data for this study had been collected from the 17 sections of incoming Grade 9 students. Random sampling had been used in selecting respondents for the study. Before collecting data, the researcher obtained parental permission from the respondents. This consent served as permission from parents to allow their children to participate in the study. In addition to this consent, a letter requesting permission to conduct and utilize the students in the study from

School Principal II had been prepared and approved correspondingly.

The initial step by the researcher in data gathering was to administer the paper-pencil survey to incoming Grade 9 students and determined their pre-preferred TLE specialization. Afterward, the developed Android-based application had been introduced to them. But prior to the utilization of the tool by the students, it has undergone evaluation from the evaluators as to the functionality, reliability, usability, efficiency, maintainability, portability, and compliance based on the ISO 9126 standards. The ICT teachers of CNNHS served as evaluators for this purpose. Their comments had been vital to the researcher in enhancing the tool so that not only Camarines Norte National High School will benefit, but also the entire division of Camarines Norte in the program's enhancement and future use.

Another group of expert evaluators comprising the TLE Teachers, School Head, EPS in TLE, and EPS in LRMDS evaluated the developed Android-based application following the LRMDS standards as to multimedia design, overall interface, the behavior of controls and system information, customizability/ support for user preferences, and hyperlink. The evaluation is described as YES, NO, and N/A or Not Applicable as to compliance with the set standards. This had been fully adopted from the tools.

Furthermore, orientation followed for the selected student participants on using the program and explained to them its importance. They were asked to utilize the assessment tool for eight (8) mini-courses offered in CNNHS. A Likert Survey questionnaire was administered to the respondents with corresponding emojis. Their responses were used as the basis for the post-preferred TLE specialization. The data gathered at that stage answered the statement for problem 4. To describe the perceived level of students' inclination to the competencies the scale below was used.

Scale	Description
5	- Highly inclined
4	- Very inclined
3	- Inclined
2	- Least inclined
1	- Not inclined

- Statistical Treatment of Data

Descriptive and Inferential Statistics had been employed in this study. In the computation of the statistics, all the information gathered was tabulated and analyzed using the following statistical tools:

Frequency Count and Percentage Technique**.** This was used in summarizing and analyzing the results in the survey checklist.

Mean/Average**.** This was utilized to determine the pre-preferred and post-preferred TLE specialization of incoming Grade 9 students..

Ranking. This was utilized to determine which among the TLE specialization is most preferred by incoming Grade 9 learners.

t-test. This was used to determine the significant agreement between the pre and post-preferred TLE specialization of incoming Grade 9 learners.

III. ANALYSIS AND INTERPRETATION OF DATA

This part provides the results of the evaluations, the analysis and interpretation of the data gathered and the findings discussed with implications.

TLE Specialization Pre-preferred
by Incoming Grade 9 Students

Table 1 shows the preference of the incoming Grade 9 students. The level of preference indicates the top 3 preferences or choices of the students that they planned to take in the incoming School Year 2023-2024.

Table 1
Students' Pre-preferred TLE Specialization

Table 1
Students' Pre-preferred TLE Specialization

Pre-preferred	8 TLE SPECIALIZATIONS								
	Computer System Servicing (CSS)	Technical Drafting (TD)	Beauty Care	Dressmaking	Food Processing	Agriculture	Electrical Installation and Maintenance	Housekeeping	Total
1st Choice	82	48	20	8	41	7	15	2	223
2nd Choice	42	41	24	19	47	20	19	11	223
3rd Choice	21	38	15	26	39	28	31	25	223

It can be gleaned from the table from among the 223 respondents and from the eight (8) TLE specializations, 82 out of 223 preferred to take computer systems servicing, 48 preferred technical drafting, and 41 preferred food processing as their 1st choice. On the contrary, housekeeping, agriculture, and dressmaking had been the top 3 least preferred as the1st choices of the students with 2,7, and 8 respectively from the total respondents. Clearly, all students can have their initial choices on the technical vocational courses they prefer whether they had been guided or not. The role of educational institutions is to provide them with options from which the students can choose. This has been emphasized in the study by Sijabat et al. (2020) claiming that the preparation of young people for their future lives, including preparation for their jobs, is one of the most crucial functions of the educational system. This implies that schools must be proactive in ensuring the opportunity for students to hone their technical skills as they prepare for the future. This has also been highlighted by Dublin et al. (2020) saying that a student's decision is usually based of several a variety of factors, including the student's personality, the career or field that piques his/her interest, the parents' influence, and the job opportunities that may be considered in the future.

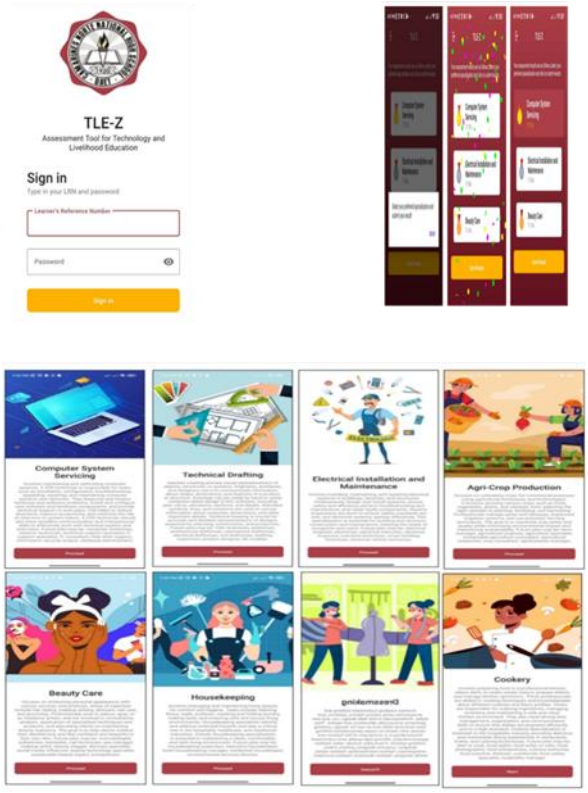
- The developed Android-based mobile application TLE-Z

One of the aims of this research study was to offer a simple career preference guide that will help students determine their inclination and assist them in making an informed decision in choosing their Grade 9 TLE specialization. The developed Android-based application was called "TLE-Z" an Android-based mobile application that is an Assessment Tool for Technology and Livelihood Education Specialization. The letter "Z" in the app's name stands for the "generation Z", a population strata who had been described as the "digital natives" and are so engrossed and adept at technology. This had been designed in such a way that the incoming Grade 9 learners shall take the assessment using the application. After which, results will be generated and shall reveal the top three possible career choices which can guide the learners in deciding their preferred specialization based on their self-assessment of the skills and competencies based on the MELCs.

The interface of the application is shown below:

Plate 1

User Interface of the Android-based Mobile Application



- Evaluation of Experts on the developed TLE-Z is an Android-based application.

The developed Android-based mobile application which is the TLE-Z aimed to help incoming Grade 9 learners to choose the appropriate TLE specialization based on their inclination had undergone thorough validation from the experts as to its compliance with ISO 9621-1 standards. The experts were composed of selected three (3) Information Communication Technology (ICT) Teachers. The mobile application had been evaluated as to functionality, reliability, usability, efficiency, maintainability, portability, and compliance.

- As to the evaluation of experts (ICT Teachers)

Table 2

Experts' Evaluation based on ISO 9621-1

CRITERIA	DESCRIPTION	YES RESPONSES	REMARKS
I-FUNCTIONALITY			
Sustainability	Can software perform the task?	100%	COMPLIANT
Accurateness	Is the result as expected?	100%	COMPLIANT
Interoperability	Can the system interact with another system?	N/A	N/A
Security	Does the software prevent unauthorized access?	100%	COMPLIANT
	Mean	***100%***	***COMPLIANT***
II - RELIABILITY			
Maturity	Have most of the faults in the software been eliminated over time?	100%	COMPLIANT
Fault Tolerance	Is the software capable of handling errors	100%	COMPLIANT
Recoverability	Can the software resume working and restore lost data after failure?	100%	COMPLIANT
	Mean	***100%***	***COMPLIANT***
III - USABILITY			
Understandability	Does the user comprehend how to use the system easily?	100%	COMPLIANT
Learnability	Can the user learn to use the system easily?	100%	COMPLIANT
Operability	Can the user use the system without much effort?	100%	COMPLIANT
Attractiveness	Does the interface look good?	100%	COMPLIANT
	Mean	***100%***	***COMPLIANT***
IV - EFFICIENCY			
Time Behavior	Does the system quickly respond?	100%	COMPLIANT
Resource Utilization	Does the system utilize resources efficiently?	100%	COMPLIANT
	Mean	***100%***	***COMPLIANT***
V- MAINTAINABILITY			
Analyzability	Can faults be easily diagnosed?	100%	COMPLIANT
Changeability	Can the software be easily modified?	100%	COMPLIANT
Stability	Can the software continue functioning if the change is made?	100%	COMPLIANT
Testability	Can the software be tested easily?	100%	COMPLIANT
	Mean	***100%***	***COMPLIANT***
VI- PORTABILITY			
Adaptability	Can the software be moved to another environment?	100%	COMPLIANT
Instability	Can the software be installed easily?	100%	COMPLIANT
Conformance	Does the software comply with portability standards	100%	COMPLIANT
Replaceability	Can the software easily replace other software?	N/A	N/A
	Mean	***100%***	***COMPLIANT***
VII - COMPLIANCE			
	Does the software comply with laws regulations	100%	COMPLIANT
	Mean	***100%***	***COMPLIANT***
	GRAND MEAN	**100%**	**COMPLIANT**

It can be deduced from Table 2 the evaluation of ICT Teachers on the developed TLE-Z based on the ISO standards. It can be gleaned from the table that all or 100% of the applicable descriptors received YES responses from the experts. It can be deduced from the results that the developed mobile application delivered the set of qualities that bear on the presence of a set of functions and their stated properties. The functions are those that meet expressed or implicit requirements. Moreover, it was also evident that it has the ability to sustain its level of performance under specified conditions for a specific amount of time including the attributes or properties that the effort required for its usage. Although there were guidelines for non-print resources that had been found to be not applicable to the software and its environment, still, the developed mobile application had been found to be in conformance with international standards with the grand mean of 100%.

- As to the evaluation of Experts based on the Learning Resource Management and Development System (LRMDS) Guidelines.

The content embedded in the developed **TLE-Z**, an Android-based application had been evaluated by another set of experts, the LRMDS Supervisor, the Division TLE Supervisor, the School Head, and Selected TLE Teachers. The experts focused on the characteristics based on LRMDS guidelines which were provided by the LRMDS Supervisor to the researcher prior to the development of the application. The evaluation considered the following characteristics of non-print resources: multimedia design, overall interface, the behavior of controls and system information, customizability/support for user preferences, data entry by the user, and hyperlinks.

Table 3

Experts' evaluation based on LRMDS as to Multi-media Design

Characteristics	YES Responses	Results
Media elements are of sufficiently high quality.	100%	COMPLIANT
Clear and precise instructions are provided for accessing multimedia.	100%	COMPLIANT
Appropriate forms of media are used to enhance the presentation.	100%	COMPLIANT
The multimedia presentations have a coherent layout, design, and background.	100%	COMPLIANT
Video is accompanied by a familiar control panel, featuring pause, volume, and slider (to move quickly to a desired part of the video) controls.	N/A	N/A
Audio (other than short sound effects) is accompanied by a familiar control panel, featuring pause, volume, and slider (to move quickly to a desired part of the audio) controls.	100%	COMPLIANT
All images are accompanied by a detailed explanatory caption that the user can easily access.	100%	COMPLIANT
All spoken sounds are accompanied by detailed textual transcription captions that the user can easily access.	NA	N/A
Mean	***100%***	***COMPLIANT***

Table 4 detailed the compliance of the content to the LRMDS guidelines based on the evaluation of the experts. The results revealed that 100% of the YES responses for the criteria ***multi-media design*** were evidently satisfied as per experts' ratings. The results implied that the contents embedded in the application are of good multimedia quality although two (2) of the characteristics had been found to be not applicable, the mobile application is still compliant along these criteria. All experts responded N/A in two (2) characteristics under multimedia design.

Table 4

Experts' evaluation based on LRMDS as to Overall Interface

Characteristics	YES Responses	Results
The design is visually appealing.	100%	COMPLIANT
The design is simple, i.e., not cluttered with irrelevant devices and information.	100%	COMPLIANT
The design is consistent throughout successive displays.	100%	COMPLIANT
Contains sufficient information and directions for the user to use the resource.	100%	COMPLIANT
The ways to navigate through the material are clear.	100%	COMPLIANT
Labels, buttons, menus, text, and general layout of the resource are consistent and visually distinct	100%	COMPLIANT
Fonts are readable in terms of size, color, and contrast between the background and the text	100%	COMPLIANT
The user is always made aware of what to do next.	100%	COMPLIANT
The resource provides feedback about the system status and the user's responses.	100%	COMPLIANT
The user is informed of their position in the resource relative to its beginning and end.	100%	COMPLIANT
The user is informed when a new window (such as a browser window, tab or pop-up) will be displayed.	N/A	N/A
Mean	***100%***	***COMPLIANT***

Table 4 showed the evaluation of experts along the criteria "*overall interface*". The results showed that 100% of the YES responses were given by the evaluators which implied that the expected characteristics under the interface criteria were met by the application which had been described as compliant. On the other hand, all evaluators agreed that one (1) descriptor had been found to be not applicable in the context of the developed mobile device.

Table 5

Experts' evaluation based on LRMDS as to Behavior of Controls and System Information

Characteristics	YES Responses	Results
Clear visual indicators are used to display the position of the cursor on the screen.	100%	COMPLIANT
The cursor changes shape to indicate its function and provide information to the user.	N/A	N/A
The resource responds obviously and appropriately to learners' actions.	100%	COMPLIANT
Icons that can be selected are designed to suggest their intended use.	100%	COMPLIANT
Controls found in many parts of the resource (menus, buttons, and so on) that serve similar functions throughout the resource are placed in similar locations in all displays	100%	COMPLIANT
Menus, buttons, and other familiar controls use the same or similar formats and appearances throughout the resource.	100%	COMPLIANT
A control that can be selected provides dynamic information to the user about the specific function (e.g. the mouse cursor changes appropriately and/or the control changes its visual appearance in some way).	100%	COMPLIANT
A control that can be selected provides dynamic information to the selected event had been recognized	100%	COMPLIANT
Mean	***100%***	***COMPLIANT***

Table 5 explained the evaluation of the experts along with the criteria *behavior controls and systems*. The results showed that 100% of the YES responses were complied with in which evaluators found that the application was compliant in all characteristics with one descriptor having been found to be not applicable since the main intent of the application is to install on a mobile device rather than on a laptop.

Table 6

Experts' evaluation based on LRMDS as to Customizability/Support for User Preferences

Characteristics	YES Responses	Results
The user can adjust the size of the font for displayed text.	100%	COMPLIANT
The user can adjust the magnification of the displayed materials.	100%	COMPLIANT
Methods to support navigation are clear and consistent throughout the resource	100%	COMPLIANT
The user can return to a previous state of the system and repeat from there.	100%	COMPLIANT
All functionality is accessible through the mouse only.	N/A	N/A
All functionality is accessible using the mouse and or keyboard.	N/A	N/A
The user can control the pace at which he/she moves through the material.	100%	COMPLIANT
Mean	***100%***	***COMPLIANT***

Table 6 showed the evaluation of experts along with criteria *customizability/support for user preferences*. This criterion focused on the characteristics of the application that allows the user to control and navigate the system. It also focuses on font display and magnification. The experts found this characteristic compliant with 100% YES responses. The evaluators agreed that two (2) of the descriptors were not applicable to the intended environment of the developed Android application.

Table 7

Experts' evaluation based on LRMDS as to Data Entry by User

Characteristics	YES Responses	Results
Data entry fields contain default values.	NA	N/A
Inputs into data entry fields are constrained so that only permissible values can be entered.	100%	COMPLIANT
The user is informed what the expected format of an entry (e.g., a date value) is before the user makes the entry.	100%	COMPLIANT
The user is explicitly told when he or she needs to provide input.	100%	COMPLIANT
The user can control the length of time required to submit the data on a data entry form e.g. A done button is provided for the user to indicate the completion of all data entries	100%	COMPLIANT
The user is informed of exactly what is wrong with any erroneous data entries.	100%	COMPLIANT
The user can correct erroneous data entries/supply missing entries without having to re-enter correct items on the same form	100%	COMPLIANT
Mandatory fields are clearly marked as such.	100%	COMPLIANT
Drop-down lists of previously entered values are presented when the user subsequently enters data into similar fields.	100%	COMPLIANT
Data entry forms support the tab key to move between entry fields.	N/A	N/A
The fields on the data entry form are visited in a logical order when the tab key is used to move between them	100%	COMPLIANT
Mean	***100%***	***COMPLIANT***

Table 7 showed the evaluation of the experts along with criteria *data entry by the users*. This characteristic had been manifested by the application in such a way that the user can easily input the necessary data in the indicated fields. The application should ensure that only allowable data formats can be supplied by the user. It is expected that the user will automatically be prompted when the input data contains any error and

be able to correct it. The table clearly confirmed that all the expected characteristics had been satisfied by the application. Based on the results, 100% of the YES responses were given by the evaluators making the application compliant in this aspect but were two (2) descriptors that are found to be not applicable in the mobile application as shown in the table by the evaluators.

Table 8
Experts' evaluation based on LRMDS as to Hyperlinks

Characteristics	YES Responses	Results
Hyperlink text provides information about where the link will lead.	100%	COMPLIANT
Hyperlinks are formatted using acceptable formatting conventions for links (e.g., distinctive underlined font).	100%	COMPLIANT
Hyperlink text is consistently formatted throughout the resource.	100%	COMPLIANT
The cursor changes appearance when it moves over the text of a hyperlink to inform the user	100%	COMPLIANT
Hyperlinks that result in the user being directed to material that is external to the current resource are clearly indicated	100%	COMPLIANT
Mean	100%	COMPLIANT

Table 8 shows the evaluation of experts along with criteria *hyperlinks*. All evaluators agreed that the developed mobile application might not have the true "hyperlink " as applied in other online applications but those "letters/words" on the button within the TLE-Z interface can be considered "hyperlink" because they functioned in ways the true "hyperlinks" in other online applications worked. A hyperlink provides information about where the link will lead. The "hyperlink" in the developed app is a feature that brought the user to the next step of the self-assessment from signing up for the user's account to the generation of results.

Table 9
The Summary of Experts' Evaluation Based on LRMDS Guidelines

Criteria	Experts' Evaluation Mean (YES Responses)	Results
Multimedia design	100%	Compliant
Overall interface	100%	Compliant
The behavior of controls and system information	100%	Compliant
Customizability/support for user preferences	100%	Compliant
Data entry by the user	100%	Compliant
Hyperlinks	100%	Compliant
Grand Mean	100%	COMPLIANT

The data in Table 9 revealed that the mobile application has met all the applicable characteristics along with multimedia design, overall interface, the behavior of controls and system information, customizability/support for user preferences, and data entry by the users. On the other hand, the data also shows that the hyperlink criterion has been found to be not applicable, thus, the developed Android-based application still worked and delivered the expected results although it was not integrated into the app which resulted in being compliant with the grand mean of 100%. The researcher found these findings similar to the findings of Nurdiana et al. (2022) that the media application will fall under the viable category if it is based on expert assessment and operational tests. The developed TLE-Z had been carefully evaluated by the experts to ensure its full functionality despite the non-applicability of some of the descriptors.

- Preferred TLE specializations by incoming Grade 9 students as revealed by using the Android-based mobile application TLE-Z.

Table 10 showed the number of students who should have taken the particular TLE specialization (post-preferred) as revealed in the utilization of the Android-based mobile application TLE-Z. The results show that under the 1st choice, 73 out of 223 students must enroll in computer system servicing, 42 in technical drafting, 41 in food processing, 20 in electrical installation and maintenance, 19 in agriculture, 11 in dressmaking, 9 in housekeeping, and 8 in beauty care. This shows that the top three specialization chosen by the students are Computer Systems Servicing, Technical Drafting and Food Processing while Beauty Care, Housekeeping and Dressmaking were the least favored choices. The number of learners who should be under their 2nd and 3rd choices can also be deduced for the table.

Table 10
Students' Post-preferred TLE Specialization

Level of Preference	8 TLE SPECIALIZATIONS								
	Computer System Servicing (CSS)	Technical Drafting (TD)	Beauty Care	Dressmaking	Food Processing	Agriculture	Electrical Installation and Maintenance	Housekeeping	Total
1st Choice	73	42	8	11	41	19	20	9	223
2nd Choice	10	20	35	23	18	43	44	30	223
3rd Choice	34	34	25	25	21	29	29	26	223

Moreover, the table does not simply reveal the number of students whose inclination fall under the eight skill categories but also gives the TLE Teachers, the Head Teacher, and the School Head the number of expected

sections to be created to be able to truly address the mismatch of the skill of the learners and the specialization they actually enroll in. These findings have strong semblance to the findings of Kumura et al. (2019) that the significance of career planning is as mature as possible, android application allowed students to plan their careers based on their personality and characteristics which was supported by the findings of Salimah (2018) that the use of interactive media running in Android enhanced students' capacity for career decision making.

Further, the results gave the entire school a bird's eye view of the potential learners to enroll in the different TLE specializations for School Year 2023-2024, thus, they can start planning on the steps, adjustments and appropriate actions to be done prior to the opening of the next school year.

Table 11
Summary of Students' Pre- and Post-preferred TLE Specialization

Preference Level	Computer System Servicing (CSS)	Technical Drafting (TD)	Beauty Care	Dressmaking	Food Processing	Agriculture	Electrical Installation and Maintenance	Housekeeping	Total
Pre-preferred									
1st Choice	82	48	20	8	41	7	15	2	223
Post-preferred									
1st Choice	73	42	8	11	41	19	20	9	223

It can be gleaned in Table 11 the result of the pre-preferred and post-preferred TLE specialization. Though it appeared that upon using the pre-preferred compared with the developed application TLE-Z, no changes had been observed in their preferred specializations (CSS, Technical Drafting and Food Processing), however, it could be noted that the inclination of students were evidently more spread across the 8 specializations.

- Significant Difference between the pre-preferred and the post-preferred TLE specializations of incoming Grade 9 students.

Table 12
Result of t-test for significance of the pre-preferred and post-preferred TLE Specialization (n=223)

	M	SD	M	SD	t
Preference using TLE-Z	23.83	15.72	33.17	14.55	3.894**

Note: * p < .05, ** p < 0.01

A dependent t-test was calculated comparing the mean score of the pre-preferred result to the post-preferred result, a significant difference was found at ($t(23) = 3.894^{**}$, $p<0.01$). Hence, the mean of the pre-preferred result (M=23.83, SD=15.72) was significantly different from the mean of the post-preferred result (M = 33.17 SD =14.55). It implies that the use of the developed Android-based mobile application in choosing a specialization in TLE subject in Camarines Norte National High School is effective. The effectiveness can be attributed to the changes in the number of students whose inclination falls under each offering which makes the number more spread in the eight TLE specializations. The significant difference in the results may also be attributed to the prior understanding of the students on the different skills and competencies which they need to develop based on the MELCS. With the use of the TLE-Z, they were able to gauge their inclination on what specialization they need to enroll in the incoming school year.

These findings have a strong semblance to the findings of Kamath et al (2018) which proved that the use of mobile applications helped students to get the most appropriate college and course in the field of their interest. Shepiliev (2020) also claimed that employment counseling quests are connected to one's future. The current study only focused on helping the students to choose their appropriate specialization which will connect to their future career as the previous study emphasized. In terms of technology applications in education, Tamaro (2018) claimed that the adoption of technology trend must be applied to both elementary and secondary school curricula for Filipinos to be internationally competent which the current study also looked forward to.

- Recommendations that were given by the experts which enhanced the developed Android-based application

In this study, the researcher determined the recommendations from the respondent evaluators for the improvement of the developed Android-based mobile device. These recommendations had been considered as suggestive views and perspectives relative to the development of the application in terms of its technical aspects like the interface, visual format of the embedded learning competencies, and the results generated from the use of the application. The developed Android-based mobile application TLE-Z had properly assessed students' passion and inclination toward choosing their specialization in Grade 9 and had undergone a thorough evaluation conducted by the experts on both LRMDS and ISO 9621-1 standards. Several prototype versions were developed first for initial testing.

Table 12

Suggestions and recommendations from the Expert Evaluators

Suggestions and Recommendations
• Provide brief descriptions/information about the eight (8) TLE Specializations before the learners take the self-assess to better understand what the specialization is all about.
• Change the adjectival descriptors such as 5-Highly Inclined, 4 – Very Inclined, 3 – Inclined, 2 – Least Inclined, and 1 – Not Inclined
• Provide an image in each specialization as a jpeg background.
• Fix the app crashing when the admin logs in and add the date function.
• Adjust the font size and emojis on the MELCS competencies.
• Change the word 'strand' in the results page to 'specialization.
• Indicate in the certificate the timestamp when it was downloaded.
• As a result, the most appropriate specialization based on the skills of the learners must be on top.
• Add a fireworks sound to the results. Fix the missing print icon for some Android phones.
• Fix the app crashing issue when selecting the final choice for specialization.
• Fix app crashing and missing page numbers for some Android phones.

IV. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter includes the summary of findings of the study entitled "Android-Based Assessment Tool for Technology and Livelihood Education". It also includes the conclusions formulated based on the findings and the recommendations for further development of the developed Android-based mobile application that serves as the output of the study to help incoming Grade 9 students come up with informed decisions in choosing their TLE specialization based on their interests and inclinations.

V. FINDINGS

The researcher thoroughly analyzed the results and was able to decode and simplify the following findings along with the statement of the problems:

1. The incoming Grade 9 students for the School Year 2023-2024 pre-preferred computer servicing, technical drafting, and food processing as their top 3 1st choice while the top 3 least pre-preferred specializations were housekeeping, agriculture, and dressmaking.
2. The developed Android-based mobile application named TLE-Z has facilitated the determination of appropriate TLE specialization for incoming Grade 9 students based on their skills and interests. It was also intended for TLE Teachers, TLE Head Teachers, and School Heads in coming up with informed decisions along the skill development among Junior High School students. The school will now be guided on the plans of action to be implemented for the smooth implementation of the eight (8) specializations.
3. The developed Android-based mobile application was found to be compliant with all or 100% of the applicable characteristics and descriptors. Under ISO 9621-1 criteria, functionality, reliability, usability, efficiency, maintainability, portability, and compliance, the mobile application, the entire interface, buttons, and fields were found to be fully functional during the actual its actual use and delivered intended results.
4. The use of TLE-Z among the incoming Grade 9 students brought changes in the number of learners who chose a particular specialization. It resulted in an increase in the number of students whose inclinations leaned toward electricity installation and maintenance, dressmaking, agriculture, and housekeeping. Conversely, a decrease in the number of students whose inclinations were on computer systems servicing and technical drafting while the number of students whose inclinations were on food processing remained the same.
5. The study identified the significant agreement between the pre-preferred and post-preferred TLE specialization among the incoming Grade 9 students prior to and with the use of TLE-Z. After the dependent t-test was calculated, it implies that the use of the developed Android-based mobile

application in choosing a specialization was effective.

6. The developed Android-based mobile application named TLE-Z served as the output of this study. Before the final version had been arrived at, the development process has gone through a series of evaluations from the expert respondents who are the TLE Teachers, TLE Head Teachers, the School Head, the Division Supervisor in TLE, and the LRMDS Supervisors. Several suggestions and recommendations were considered for the refinement of the final version. The evaluators ensured that the mobile application is aligned along the ISO and LRMDS standards and those views which may not cover by the guidelines. The following were the suggestions and recommendations which greatly contributed to the full functionality of the developed application: 1) provide brief descriptions/information about the eight (8) TLE Specialization before the learners take the self-assess to better understand what the specialization is all about, 2) change the adjectival descriptors such as 5-Highly Inclined, 4 – Very Inclined, 3 – Inclined, 2 – Least Inclined, and 1 – Not Inclined 3) provide an image in each specialization as a jpeg background, 4)Fix the app crashing when the admin logs in and add the date function, 5) adjust the font size and emojis on the MELCS competencies, 6) change the word 'strand' in the results page to 'specialization, 7) indicate in the certificate the timestamp when it was downloaded, 8) on the result, the most appropriate specialization based on the skills of the learners must be on the top, 9) add a fireworks sound to the results, 10) fix the missing print icon for some Android phones, 11) fix app crashing issue when selecting the final choice for specialization and 12). Fix app crashing and missing page numbers for some Android phones.

CONCLUSION

Based on the findings which were revealed from the statement of the problems, the researcher concluded that there is an absence of a tool that will guide incoming Grade 9 in accurately choosing their TLE specialization. Thus, the developed Android-based mobile application was proven to help not only the students but also the school in the proper placement of their TLE specialization based on skills and aptitudes. TLE-Z had been proven to be effective as revealed in the t-test and evaluation of experts along ISO 9621-1 and LRMDS standards.

RECOMMENDATIONS

Based on the conclusion of the study, it was recommended that the developed Android-based mobile application must be presented to a number of ICT teachers for further enhancement by possibly integrating the ISO 9621-1 and LRMDS descriptors and characteristics which were found not applicable to its current version for the application to be fully compliant with all the set standards. It was finally recommended that TLE-Z must be reformatted or reprogrammed as multiplatform as possible and can also be installed in the laptops or e-books issued by the Department of Education through its computerization program for it to be a more useful assessment tool in determining the skills, interests, and inclination of the learners.

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REFERENCES

BOOKS

[1] Trochim, W. M. (n.d.). *Descriptive Statistics*. Descriptive Statistics - Research Methods Knowledge Base. Retrieved December 13, 2022, from https://con jointly. com/kb/descriptive-statistics/

[2] Trochim, W. M. (n.d.). *Inferential Statistics*. Inferential Statistics - Research Methods Knowledge Base. Retrieved December 13, 2022, from https://conjointly .com/ kb/inferential-statistics/

[3] Wollman, L. F. (n.d). Research Paradigms. https:/ /www.chds.us/coursefiles/research/lectures/research_paradigms/script.pdf

JOURNALS

[4] Acosta, J., Gacrama, B. I., Bacena, M. B., Corpuz, M. B. (2019).Exploring the Online Learning Readiness of Freshman College Students. https: //ejournals.ph/article.php?id=15202&fbclid=IwAR2ywFovfh8E_JHtHyg7MQzXaDiNKlvLiwUO1p3ImRM4dzRg4S5_4ujmsbs

[5] Astuti, B., Purwanta, E., Lestari, R., Bhakti, C. P., Anggela, E., & Herwin, H. (2022). The effectiveness of digital module to improve career planning of junior high school students. *World Journal on Educational Technology: Current Issues*, *14*(3), 940-950. https://doi.org/10.18844/wjet.v14i3.7396

[6] Bangcaya, H. O., Olvis, P. R., Disca, B. Y., Comoda, J. T., & Taborada, J. H. (2021).Play As You Learn: Gamification And Its Effect On The Learning Outcomes And Motivation Of Students In Science. https://ejournals.ph/article.php?id=18097&fbclid=IwAR2OTdwRuzYV06ZDQvDY785VQ3iGfBHIg jrtrf3Hv C5F8c d4B6kq8qyZkwY

[7] Catedrilla, G. B., Lerios, J. L., Sapin, S. B, Lanuang, M. C., Chester A. C.,& Buama, & C. A. C. (2021).An android-based mobile educational game for disaster preparedness: an input to risk reduction management. Indonesian Journal of Electrical Engineering and Computer Science. Vol. 22, No. 2, May 2021, pp. 936 ~-943.ISSN: 25 02-4752, DOI: 10.11591/ ijeecs. v22.i2.p p936-943

[8] Handoyono, N. A., Hadi, S. (2020). Development of android-based learning application in EFI materials for vocational schools. *Journal of Physics: Conference Series*.

[9] Hendikawati, P., Zahid, M. Z., & Arifudin, R. (2019). Android-based computer assisted instruction development as a learning resource for supporting self-regulated learning. *International Journal of Instruction*, *12*(3), 389-404. https://doi.org /10. 29333/iji.2019.12324a

[10] Pitos, C. W., (2020). Android-Based Augmented Reality Tourist Guide Application. https://ejournals.ph/article.php?id=16766

[11] Rekhawi, H. (2020). Android Applications Development Intelligent Tutoring System. International Journal of Academic Information Systems Research (IJAISR). ISSN: 2643-9026. Vol. 4, Issue 5, May – 2020, Pages: 33-58.

[12] Shepiliev, D.S., Semerikov, S, O., Yeckkalo, Y. V., & Tkachuk, V. (2020). Development of career guidance quests using WebAR.Journal of Physics: Conference Series, Volume 1840, XII International Conference on Mathematics, Science and Technology Education (ICon-MaSTEd 2020) 15-17 October 2020. https://iopscience.iop.org/article/10.1088/174 26596/ 1840/ 1/012028/meta?fbclid=IwAR0f5JVfwqUGuUoJu12c1CJlA5mboO69Bka35pC6r_eIf3i B2mllvw1PTx4#artAbst

[13] Susila, H. R., Muslim, S., & Syahrial, Z. (2020). Interactive multimedia to improve the students' ability of teacher training and education faculty in learning strategy course. *International Journal of Psychosocial Rehabilitation*, *24*(1), 592-597. https://doi.org/10.37200/ijpr/v24i1/pr200165

[14] Technical and vocational education and training in the Philippines in the age of industry 4.0. *(2021, March 1). Asian Development Bank. https://www.adb. org/publications /tvet-philippines-age-industry*

[15] Yafie, E. (2020). Collaborative mobile seamless learning (CMSL) based on Android apps to improving critical thinking in higher education in the post-covid-19 era. *Journal of Advanced Research in Dynamical and Control Systems*, *12*(SP7), 428-441. https://d oi.org/10.5 373/jardcs/ v12sp7/2 0202 125

[16] Zulfiani, Z., Suwarna, I. P., & Miranto, S. (2021). Improving students' academic achievement using the ScEd-ALS Android-based. *International Journal of Instruction*, *14*(2), 735-756. https://doi.org/10.29333/iji.2021.14241a

DOCUMENTS

[17] Dangoy. (n.d.). View of Career Preferences and Factors Influencing the Career Choice of Senior High Students of a Catholic School. View of Career Preferences and Factors Influencing the Career Choice of Senior High Students of a Catholic School. Retrieved December 21, 2022, from https:// philssj. org/index. php/main/article/view/235/130

[18] *Data Collection: Best Methods + Practical Examples | Iterators*. (2021, August 4). Iterators. Retrieved December 13, 2022, from https://www. iteratorshq. com/ blog/data-collection-best-methods-practical-examples/

[19] Kundariya, H. (2021, May 12). Exploring the role of mobile apps in online learning. eLearning Industry. https://elearning industry.com /mobile - apps-in-online-learning-exploring-their-role

[20] Lausa, S. M., & Algara R. O. (2018). Mobile-Based Student e-Handbook. http:// www.apjmr.com/wp-content/uploads/201/09/APJMR-20186.4.10.pdf

[21] *Rapid application development (RAD) | Definition, steps & full guide*. (2023, January 24). Low-Code No-Code Work Platform - Kissflow. https://kis sflow. com/application-development/rad/rapid-application-development/

[22] Republic Act No. 10533 | GOVPH. (2013, September 14). Official Gazette of the Republic of the Philippines. https://www.officialgazette. gov.ph/2 013/05/ 15/republic -act-no-10533/

[23] Republic Act No. 10647 | GOVPH. (2014, November 21). Official Gazette of the Republic of the Philippines. https://www.officialgazette. gov.ph/2014/11/21/ republic-act-no-10647/

[24] Roque, E. J. (2019). PRRD signs law on free access to tech-voc education. https://www.pna.gov.ph/articles/1064530

[25] Simplilearn. (2023, February 8). Descriptive vs. inferential statistics: Key differences and measurement techniques. Simplilearn.com. https://www. simplilearn.com/difference-between-descriptive-inferential-statistics-arti cle#what_is_descriptive_ statistics

[26] Statista Research Department. (2022, March 23). *Leading mobile apps used by internet users in the Philippines as of 3rd quarter 2020, by category*

[27] World Sustainable (2020). Descriptive vs Inferential Statistics: For Research Purpose.https://worldsustainable.org/descriptive-vs-inferential-statistics/

PUBLISHED/UNPUBLISHED MATERIALS

[28] Arbab, A. H., Eltahir, Y. A., Elsadig, F. S., & Yousef, B. A. (2022). Career preference and factors influencing career choice among undergraduate pharmacy students at University of Khartoum, Sudan. *Pharmacy*, *10*(1), 26. https://doi.org/10.3390/ pharmacy10010026

[29] Cabauatan, M. D., Calizo S. C., Quimba, FM.., and. Pacio, L. C, (2018). E-Education in the Philippines: The Case of Technical Education and Skills Development Authority Online Program https://p idswebs. pids.gov.ph/ CDN/PUBLICATIONS /pidsdps1808_rev2.pdf

[30] Casabuena, A., Caviles, R., De Vera, J. A., Gayle Flores, K., Catacutan-Bangit, A., Manuel, R., Bermudez, J. R., & Richard Guadana, R. (2018). BloodBank PH: A framework for an Android-based application for the facilitation of blood services in the Philippines. TENCON 2018 - 2018 IEEE Region 10 Conference. https://doi.org/10.1109/tencon.2018.8650395

[31] Chiffi, D., Moroni, S. & Zanetti, L. (2022). Types of Technological Innovation in the Face of Uncertainty. Philosophy & Technology. 35. 10.1007/s13347-022-00587-3.https://www.researchgate.net/publication/364384476_Types_of_ Technological Innovation in the Face of Uncertainty/citation/download

[32] Coccia, M. (2021). Technological Innovation. 1-7. 10.1002/ 978140 51655 18. wb eost011.pub2. https://www.researchgate.net/publication/353702033_Technological_Innovation/citation/download

[33] Chua, B.B., & Dyson, L.E. (2004). Applying the ISO 9126 model to the evaluation of an e-learning system. https://ascilite.org/ conferences/ perth04/ procs/ chua.html

[34] Dayagdag, C.V., Catangahal, R., and Palaoag, T. (2019). Improving vocational training in the Philippines using AR. https://www. research gate.net /publication/334216384

[35] Dublin, Brenda C., Logrosa, Antonnete A., Rose, Mary, & Sosing D. (2020). Factors influencing career preference of junior high school students for senior high school study. https://www.researchgate.net /publication /35 416 2069_Factors_influencing_career_preference_of_junior_high_school_students_for_senior_high_school_study

[36] Fabito, B. S., Balahadia, F. F., & Cabatlao, J. D. (2018). AppLERT: A mobile application for incident and disaster notification for Metro Manila. *2018 IEEE Region 10 Symposium (TENSYMP)*. https://doi.org/ 10.1109/tenconspring.2018.751942

[37] Faradillah A. & Fadillah, D. (2020).Android-based mobile learning application As a learning exercise for students. https://www.academia.edu/59558930/

[38] Gelera, A. M. Gonzales, A. A., Torres, BJ. V., Sison, M. G. (2023). Preserving Filipino Native Dishes using Android-based application: a heritage cooking tutorial. https://8thinternationalcongressoni.sched.com/event/1IjAT/preserving-filIpino-native-dishes-using-android-based-application-a-heritage-cookI ng-tutorial

[39] Gocotano, T. E., Jerodiaz, M. A. L., Banggay, J. C. P., Nasibog, H. B. and Go M. B. (July 2021).Higher Education Students' Challenges on Flexible Online Learning Implementation in the Rural Areas: A Philippine Case. https://www.ceur-ws.org/Vol-2218/paper34.pdf

[40] Guardia, L., Mancini, F., Jacobety, P., & Maina, M. (2021). Graduates' employability skills in east africa. Journal of Teaching and Learning for Graduate Employability, 12(2), 169–184. https://www. semantic scholar. org/paper/Graduates%E2%80%99-employability-skills-in-East-Africa-Gu%C3%A0rdiaMancini/c1aa0e9dc8c25371c817ea6a553c396b5ded30 2d

[41] Hendrawan, R. F., Muksin, M. & Hidayat, Deden R. (2022). Development of Android-Based Specialization Tests for Selection of Prospective Vocational Students.https://www.atlantis-ress.com/proceedings/iccie21/125969654?Fbclid=IwAR1Opo_qiT2_skeesiw7NjG03RR7VCg5VecAJvwaj1yTG3_-HIvQk IO YJ5Y

[42] Hero, Jesson L. (2020). Teachers' preparedness and acceptance of ICT integration and its effects on their ICT integration practices. https:/ /eric. ed.gov/id =ED 608807

[43] Kacetl, J., & Klímová, B. (2019). Use of smartphone applications in English language learning—A challenge for foreign language education. *Education Sciences*, *9*(3), 179. https://doi.org/10.3390/educsci9030179

[44] Kamath, V. D., Meher, A., Vidhya V., & Deepthi,S. "An Android based Mobile Application for Career Guidance," *2018 Second International Conference on Inventive Communication and Computational*

Technologies (ICICCT), 2018, pp. 854-860, doi: 10.1109/ICICCT.2018.8473128.

[45] Khan et al (2021). An Android Application for University-Based Academic Solution

[46] for Crisis Situation. https:// link.springer. com/ chapter/10.1007/ 978-981-16-5157-1_51

[47] Kumara, A. R., Caraka, P. B., Budi, A., Suwarjo G., Fathia A. (2018). Development of Android Application based on Holland's Theory of Individual Student Planning. Joint proceedings of the International Conference on Social Science and Character Educations (IcoSSCE 2018) and International Conference on Social Studies, Moral, and Character Education (ICSMC 2018). Pages 32-36. ISSN 2352-5398. ISBN 978-94-6252-739-3. www.atlantis-press. com/ article /125909968.

[48] Lacksana, I., Sugiyo Sugiyo & Awalya Awalya (2018). An Android-based Career Information to Improve the Career Choice of Vocational High Schools Students. https://journal.unnes.ac. id/sju/index. php/jubk/ article /view/25692? Fbclid=IwAR1BjFgoqv7E1hRvnAwf1jg4DNri L4PcDjxgrq0PPbweWMWV9MLUDivT8Y

[49] Miranda, John Paul P.; Yambao, Jaymark A.; Marcelo, Jhon Asley M.; Gonzales, Christopher Robert N.; Mungcal, Vee-jay T.; Baluyut, Robine J. (2021). Towards the Development of 3D Engine Assembly Simulation Learning Module for Senior High School. https://ui. adsabs. harvard. edu/ abs/ 2020arXiv201112767M/abstract

[50] Moudgalya, K. M. (2020, October 22). *ICT for Education, Employment and Empowerment in India*. springer.com. https://link.springer.com/ chapter/ 10.1007/978-981-15-6157-3_4?fbclid=IwAR3Rgj4T5K6Mor3ua5FY2ez8e gYJlnbFy0S2lJt X5uVMpa s_1kh-hsqRKnY

[51] Nueva, Mary Grace C. (2019). Filipino Teachers' Attitude Towards Technology — Its Determinants and Association with Technology IntegrationPractice.https://www.semanticscholar .org/paper/Filipino-Teachers%E2%80%99-Atti tude-Towards-Technology %E2%80%94 Nueva/e30d8fe583f363fac35 56 c3 d14a 6f7234661e89c

[52] Nurdianah, E., Sudira, P., & Daryono, R. (2022). Mobile-Based Application to Integrate Vocational Learning and Career Learning in Mechatronics Engineering Vocational High School. Journal of Education Technology Volume 6, Number 3, 2022 pp. 431-441.P-ISSN: 2549-4856 E-ISSN: 2549-8290. https:// ejournal. undiksha.ac. id/index.php/JET

[53] Quispe, B. M., Casas, L. A., Oviedo, O. A., Quispe, J. H., Chavez, C. V., Pucho, A. C., Rolando V., & Joaquín, B. D. (2018). Influence of the use of educational apps on smart mobile devices in the academic performance of students. ICETC '18: Proceedings of the 10th International Conference on Education Technology and Computers. October 2018.pages341–346.https: //doi.org/10. 1145/3290511.3290541.https://dl.acm.org/doi/a bs/10.1145/32 90511.3290 541?fbclid=IwAR2B62wpv3XlgVExbmw-3vyjt5OwrkMvLB7hUZoa-oKzDTs M p9SgsOw04Y

[54] Rangkuti, E. F., Fauzi, A., & Sinaga, B. (2022). Development of interactive learning media based on open ended problem approach assisted by Visual Basic with Excel to improve creative thinking ability of students at al Manar private junior high school. EUDL - European Union Digital Library. https:// eudl. eu/ doi/10.4108/eai.20-9-2022.2324715

[55] Salimah, H., , Wibowo, M., & Mulawarman, M. (2018). Career Information Services by Using Interactive Multimedia to Determine Students CareerChoices.https://journal. unnes.ac.id/sju/I ndex.php/jubk/article/view/27826?fbclid= IwAR 1ea6YPOCC8aKJpbr2LgVd1dmldtqsjJO_cBtyo 1ej9mh5rG 2_J-N4U9s

[56] Sijabat, T. T., Dopong, W., Rotikan, R., Lolong, S. & Moedjahedy, J. (2020). The Development of Web Based Information System at Universitas Klabat Career Center.2020 2nd International Conference on Cybernetics and Intelligent System (ICORIS), pp.1-5, 2020.

[57] Suryo H., Asrul H., Wulansari, R., Mubai, A., Firdaus, S. (2020).The Design of Android-Based Interactive Lean Manufacturing Application to Increase Students' Work Skill in Vocational High

School: The Development and Validity. International Journal of Interactive Mobile Technologies. 2022, Vol. 16 Issue 13,p130-139.10p.

[58] Tomaro, QP. V. and Mutiarin, D. (2018). Ict Integration in The Educational System of Philippines. https:// pdfs.semanticscholar.org /9c24/6c d617bfe2 08bd53 14e3b9566fedec503a65.pdf

[59] Wu, Q., Bin Bai and Xiaolin Zhu. (April 2019). Technical and Vocational Education and Training in the Philippines: Development and Status Quo. https://www. researchgate.net/publication/332405242_Technical_and_Vocational_Education_and_Training_in_the_Philippines_Development_and_Status_Quo

ELECTRONIC DATABASE

[60] *Benefits of mobile apps in education*. (2021, February 8). Vidyalankar Classes. https://www.vidyalankar.org/blog/benefits-of-mobile-apps-in-education

[61] Dangoy. (n.d.). View of Career Preferences and Factors Influencing the Career Choice of Senior High Students of a Catholic School. View of Career Preferences and Factors Influencing the Career Choice of Senior High Students of a Catholic School. Retrieved December 21, 2022, fromhttps://philssj.org/index.php/main/article/view/235/130

[62] Department of Education. (2012, June 10). *Guidelines on the Implementation of*

[63] *Strengthened Technical Vocational Education Program (STVEP) and Technology and Livelihood Education (TLE) Curriculum*. https://www. deped.gov.ph/wp-content /uploads/2012/07/DO_s2012_67.pdf

[64] Dy, J. (2022, August 25). *Improving digital skills in the Philippines*. Manila Bulletin. https://mb.com.ph/2022/08/25/improving-digital-skills-in-the-philippines/

[65] Holland's theory. (2019, August 13). Homepage:Careers New Zealand. https:/ /www.careers.govt.nz/resourcees/career-practice/career-theory-models/holl ands-theory/

[66] Malilipot M. L., (2021). DepEd highlights role of technology to provide environments conducive to learning. https://mb.com.ph /2021/04/20/deped-highlights role-of-technology-to-provide-environments-conducive-tolearning

[67] Malilipot, M. L. (2021). DepEd continues to uplift educational technology in PH. Technology-in-phttps://mb.com.ph/2021/07/22/deped-continues-to-uplift-edu cational-h/

[68] Mateo, J. (2019, February 14). *DepEd to monitor technology use in public schools*. Philstar.com.https://www.philstar.com/other-sections/education-and-home /20 19 /02/14/ 1893440/deped-monitor-technology-use-public-schools

[69] Meet Android Studio (2023). https://developer.android.com/studio/intr

[70] Moral, M. (2021, August 19). *Made in the Philippines: 3 pinoy-made mobile applications to download*. POP! https://pop.inquirer.net/114275/made-in-the-philippines-3-pinoy-made-mobile-applications-to-download

[71] Republic Act No. 10647. https://www.officialgazette.gov.ph/2014/11/21/republic-act-no-10647/

[72] Santos, M. G., (n.d.). The Use of Technology in Education. https://www.teacherph. com/use-technology-education

[73] Technology's impact on education - The Philippines. (2020, March 26). Yours Hu manly. https://yourshumanly.org/technologys-impact-education-philippines/

[74] Tesda, Deped Bolster Tech-Voc in Basic Education Curriculum, (2019). tps://www.tesda.gov.ph/Gallery/Details/10313

[75] The importance of developing your technical skills right now. (2019). *More than Motivation: Study, Career and Life Inspiration*. https://www.open colleges. edu.au/blog/2019/04/30/the-importance-of-developing-your-technical-skills -right-now/

[76] The importance of technology in education in the Philippines. (2021, March 15). Child Hope

Philippines. https://childhope.org.ph/importance-of-technology-in-philippine-education/

[77] Enhanced Basic Education Act of 2013. https://www.officialgazette.gov.ph/2013/09/04/irr-republic-act-no-10533/

[78] RA 10647 (1994). Ladderized Education Act of 2014.http://republicact.com/widget/provision/185501

[79] Republic Act No. 7796 (1994). Technical education and skills development act of 1994, sec. 22. Establishment and administration of the national trade skills standards.