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# Editorial Note

The Interdisciplinary Research Review (IRR) was established with academic cooperation by the Nakhon Pathom Rajabhat University, The Royal Society of Thailand Committee of Interdisciplinary Research and Development, Rajabhat University (Western Group), and Rajamangala University of Technology Rattanakosin. This Issue, Volume 17 Number 6 (November – December 2022). This issue contains of four interesting articles in multidisciplinary fields: (1) Assessing street greenery using imagery of Google Street View, (2) The process of teaching and learning to create students' identity, (3) Local government involvement in post-pandemic development initiatives for the Lao Khrang Ethnic Group of Nakhon Pathom Province, and (4) Bachelor of Technical Teacher Education versus Bachelor of Technical-Vocational Teacher Education: A comparative analysis of technical teacher education curricula.

The Editorial Board of the IRR encourages anyone to submit articles for evaluation and review. The processes of submission, review and publication of articles are described on the journal's website, https://www.tci-thaijo.org/index.php/jtir. The Editorial Board and Committees of the IRR sincerely thank all peer reviewers who have sacrificed their time to help us produce a better journal, and also wish to thank all teachers, researchers and other academicians for submitting their valuable research to this journal. Finally, we thank readers of our journal who help to spread the knowledge and benefits gained to others. With your feedback and suggestions, we will strive to improve the quality and relevance of the IRR.

Yongyudh Vajaradul
Editor
Interdisciplinary Research Review

**Interdisciplinary Research Review**
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# Develop a roving team network process supporting competency-based production for quality teachers in the early childhood education program: A case study of Chiang Mai Rajabhat University

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## Abstract

The first objective of this research was to investigate the process of the roving team supporting competency-based production of quality teachers. The key informants were 10 administrators and eight faculty lecturers from Rajabhat Universities. Data collection was conducted based on the design thinking (DT) methodology using a meeting record form. The obtained data were analyzed through content analysis and the self-assessment of 64 pre-service teachers by a self-assessment questionnaire. The statistics used were mean and standard deviation. The second objective was to study the competency-based production process of quality teachers. The key informants were three faculties, five in-service teachers as mentors, and five representatives of pre-service. The data were collected based on the Deming Cycle (PDCA) and analyzed by analytic induction and content analysis. The third objective was to develop the network of the roving team supporting the competency-based production process of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University. Data were collected based on lessons learned. The instruments used were a meeting record form, a record form for the research field, a self-evaluation form, and a meeting record form for lessons learned. Data were analyzed by mean, standard deviation, analytic induction, and content analysis. The results were as follows: 1) the process of the roving team network supporting the competency-based production of quality teachers consisted of empathy, ideation, implementation, and evaluation; 2) the competency-based production process of quality teachers consisted of plan, do, check, and act; and 3) the network development of the roving team supporting the competency-based production process of quality teachers in the early childhood education program was able to extend the knowledge based on CCR for the design learning management of the competency-based production process to develop pre-service teachers.

**Keywords:** roving team network, competency-based production, quality teachers, early childhood education program, Chiang Mai Rajabhat University

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## 1. Introduction

W. Sudsomboon [1] studied the utilization of competency-based education in the context of differences and change. The study pointed to giving learners the knowledge, abilities, and attitudes to empower them to realize and solve complicated problems in their major of research or future work and proposed that CBE was interesting to learn and how it could be utilized in tackling the difficult issues, which were considered vital. Competency-Based Education (CBE) emphasized knowledge application, problem-solving, and stimulation. Additionally, the effective realization of CBE intensely depended on the instructors, who were anticipated to give up their part as "knowledge transmitters" and embrace the modern parts of "coach" and "instructional designer."

In line with the report studying the status of production and development of teachers in Thailand, the Office of the Education Council (ONEC) [2] revealed that the uninterrupted improvement and development of teachers' knowledge and competence were essential issues because the instructors' knowledge and instructors' teaching abilities would influence learners' learning results as a social expectation. The educational qualification systems in countries such as Finland, Singapore, and Japan focused on practicing and studying continuously after accessing professional teaching. Active and improved studying applied knowledge and skills appropriate to the real instructing condition. Practicing and studying continuously after accessing an occupation were becoming increasingly significant. In the context of the global changes towards the new era, modern students' abilities expectations and teachers were also required to improve their knowledge and teaching approaches to studying towards modern stu-

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dents' abilities expectations.

Previously, Casey [3] distinguished features of competency-based education in terms of pedagogy. In the study, academic knowledge was prioritized with a focus on deep understanding as well as mathematical and language proficiency. Transferable skills allowed people to apply learning to problem-solving, complex reasoning, meaningful goals, and lifelong learning, which was meant to prepare students to be independent, self-directed learners for the rest of their lives. Competency-based systems went beyond the confines of the academically focused criteria of student achievement.

It is believed that a "Competency-Based Curriculum" is one way to improve the quality of national education, help the country pass the middle-income trap, and create graduates who can work to meet the requirements of the manufacturing and service sectors with a focus on learning results driven by labor market needs. Therefore, the instructional administration of educational institutions had to be connected to the market for labor through curriculum development, instructional management, measurement, and evaluation by collaborating among the educational institutions and network schools. Therefore, competency-based production of quality teachers was used for changing the 5-year production of teacher students to a 4-year production of teachers so far in 2019. In conclusion, the development of pre-service teachers' characteristics should have three skills: knowledge, profession, and spirit, through the concept of contemplative education that leads to a truly self-understanding, intellectual, and spiritual knowledge.

For the implementation of competency-based production of quality teachers to achieve the bachelor's degree qualifications and professional learning standards set by the Teachers Council of Thailand. Integrated learning based on Contemplative education (C), Coaching and Mentoring (C), and Research-based Leaning (R) was a collaborative network agreement of the Deans of the Faculty of Education, Rajabhat Universities, and Teachers' Colleges. Therefore, Rajabhat Universities had agreed with the Research Fund Office to launch the research and development project of the competency-based production process of quality teachers at the Faculty of Education, Rajabhat Universities.

The early childhood education program a the Faculty of Education, Chiang Mai Rajabhat University, had a duty to play an essential role in organizing the roving team to assist the competency-based production process of the instructors' qualification using the CCR according to the Rajabhat University Act B.E. 2547 (2004) [4], which determined the purposes of giving instruction, improving comprehensive and skills, giving lessons, investigating, giving academic administrations to society, making advancement, exchanging, and creating innovation, keeping up expressions and culture, producing instructors, and improving the academic standing of instructors in the 7th. student section. Therefore, the university was required to strengthen the instructional profession, produce, and develop teachers and educational personnel for the particular quality and standard of progressed professions, and facilitate, participate in, and assist universities to achieve the objectives.

## 2. Research Questions

2.1 What is the process of the roving team supporting the competency-based production of quality teachers in the early childhood education program at the Faculty of Education, Rajabhat University?

2.2 What is the process of competency-based production of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University?

2.3 What is the development network of the roving team supporting the competency-based production process of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University?

## 3. Research Objectives

3.1 To investigate the process of the roving team supporting the competency-based production of quality teachers in the early childhood education program at the Faculty of Education, Rajabhat Universities.

3.2 To study the process of competency-based production of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University.

3.3 To develop the network of the roving team supporting the competency-based production process of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University

## 4. Materials and Methods

The research process was divided into three phases as follows:

**Phase 1:** Investigate the process of the roving team supporting the competency-based production of quality teachers in the early childhood education program at the Faculty of Education, Rajabhat Universities.

The roving team consisted of 30 university administrators and eight faculty lecturers in the early childhood education program at the Faculty of Education of eight Rajabhat Universities, namely, Phra Nakhon Si Ayutthaya, Chiang Mai, Suan Sunandha, Udon Thani, Sisaket, Nakhon Si Thammarat, Nakhon Ratchasima, and Nakhon Pathom, for a total of 38 participants. This research project studied the competency-based

production process of quality teachers based on CCR guidelines during the academic year 2019–2020.

The research instrument used was a record of the research field visit of the roving team supporting the competency-based production of quality teachers.

The data collection was conducted based on the design thinking (DT) methodology. Data were analyzed by content analysis to generate and develop ideas divided into four sections as follows:

**Section 1** Empathy: The roving team supporting competency-based production framed the problem statement in the research field.

**Section 2** Ideation: The roving team organized a meeting on the process of supporting competency-based quality teachers in the early childhood education program according to integrated learning based on the CCR. Data were collected by observing, meeting, discussing, and sharing ideas, as well as brainstorming on all issues.

**Section 3** Implementation: The roving team shared the story by describing the situation to the appropriate relevant parties and launching the ultimate solution to the project by providing integrated learning based on the CCR of the early childhood education program.

**Section 4** Evaluation: The roving team provided a self-assessment questionnaire to inquire about the understanding based on the CCR and the reflection concerning teachers' learning management.

The self-assessment questionnaire and the reflection form were distributed to the 64 first-year pre-service teachers of the early childhood education program, at Chiang Mai Rajabhat University who enrolled in the course EC 1303: Development of Health and Safety for Early Childhood Children in the first semester of the academic year 2021 to inquire about their understanding of the CCR.

The collected data were analyzed by mean, standard deviation, and content analysis.

**Phase 2:** Study the competency-based production process of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University.

Key informants were three faculty lecturers, five in-service teachers as mentors, and five representatives of pre-service students in the network schools in the early childhood education program, for a total of 13 informants.

The research instrument used was a meeting record form of a workshop according to Deming Cycle (PDCA).

The data collection was conducted based on the Deming Cycle (PDCA) to study the competency-based production process.

Data were analyzed and classified into the PDCA system.

**Phase 3:** Develop the network of the roving team supporting the competency-based production process of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University.

The key informants were three lecturers on the roving team supporting the competency-based production process of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University, and faculty lecturers in the early childhood education program at the Faculty of Education or Teachers' College.

The research instrument used was a meeting record form for lessons learned from a roving team network supporting the competency-based production process of quality teachers according to integrated learning based on the CCR in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University.

The data collection was conducted via a meeting with the Zoom application to inquire about the results of the development and lessons learned from the roving team based on CCR.

The collected data were analyzed using analytic induction and content analysis.

The research framework was shown in Figure 1 below.

## 5. Results and Discussion

The research process was divided into three phases, as follows:

**Phase 1:** Results of investigating the roving team process supporting the competency-based production of quality teachers in the early childhood education program at the Faculty of Education, Rajabhat Universities, according to the design thinking (DT) methodology, consisted of 4 steps as follows:

1.1 Regarding the step of empathy, the roving team framed the problem statement in the research field by observing three faculty lecturers who had experience in the field of early childhood education and the CCR research project since the first year. It was found that they understood the context, roles, and duties with experience and knowledge in the early childhood education program, including the actual CCR research project. In addition, the two faculty lecturers also had the role of researchers in the CCR research project of the Rajabhat universities. Therefore, the process of roving team network support was not only practical but also provided access to the "mind" of the practitioners. This showed the principle of building relationships that were truly academic friendships.

1.2 In the step of ideation, the roving team used the obtained data from observing supporting academics who played a role in collaborative thinking by attending to the collaborative discussion and research design according to CCR and analyzing the context of each Rajabhat University.

1.3 Regarding the step of implementation, the roving team shared the story by describing the situation

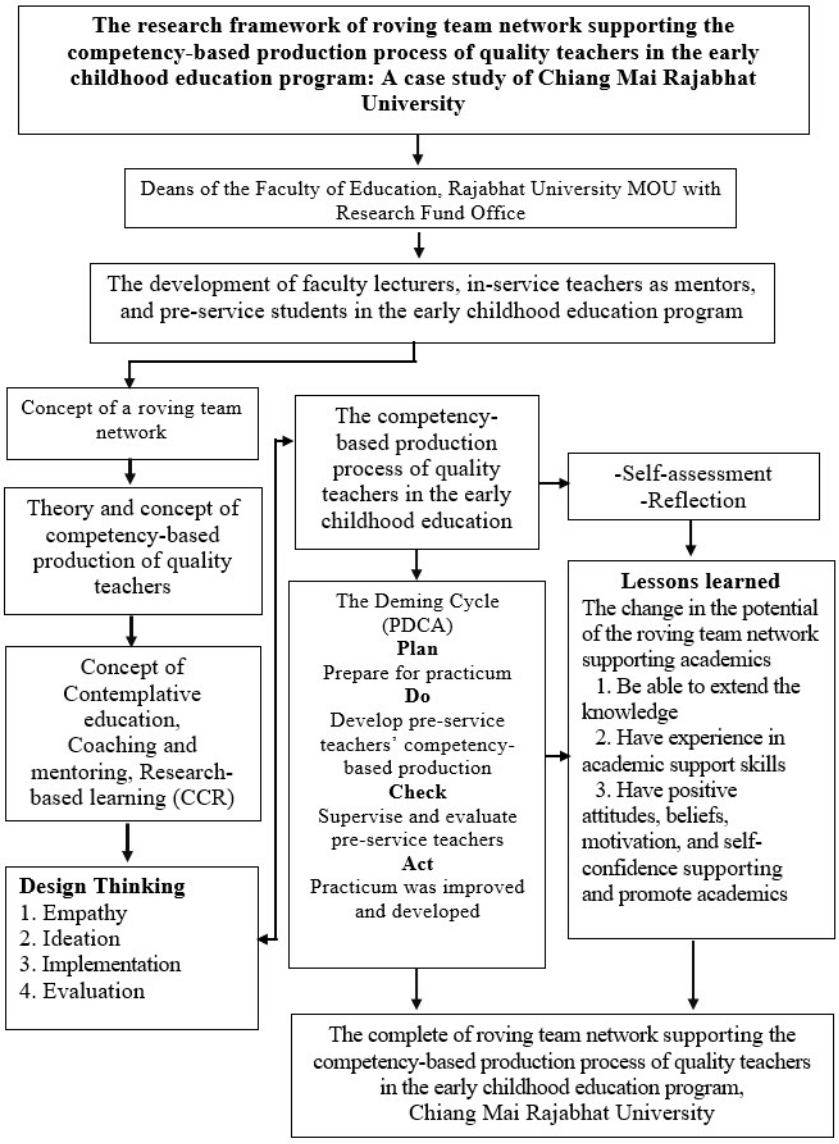


**Figure 1**: The research framework

to the appropriate relevant parties and launching the ultimate solution to the project and provided the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University, for the 64 first-year pre-service teachers who enrolled in the course EC 1303: Development of Health and Safety for Early Childhood Children in the first semester of the academic year 2021, according to the Learning Management Plan (TQA.3).

1.4 In the step of evaluation, after 64 first-year pre-service teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University, finished the program, the roving team distributed a self-assessment questionnaire to 64 pre-service teachers to investigate their understanding of integrated learning based on CCR before, during, and after the development of CCR, as shown in Table 1.

From Table 1, the results of the self-assessment of pre-service teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University, concerning the understanding of integrated learning based on CCR were indicated as follows:

Before the development of integrated learning based on the CCR, the understanding of pre-service teachers was overall at a low level ($\bar{X}$ = 1.97, S.D. = 0.40). When considering each aspect, it was found that contemplative education, research-based learning, and coaching and mentoring were at a low level, respectively.

During the development of integrated learning based on the CCR, the understanding of pre-service teachers was at a high level ($\bar{X}$ = 2.57, S.D. = 0.38) overall in specific aspects.

After the development of integrated learning based on the CCR, the understanding of pre-service teachers

**Table 1.** Results of investigating self-assessment before, during, and after the development of CCR

| Self-assessment | Before development | | | During development | | | After development | | |
|---|---|---|---|---|---|---|---|---|---|
| lists | $\bar{X}$ | S.D. | Level | $\bar{X}$ | S.D. | Level | $\bar{X}$ | S.D. | Level |
| Contemplative education (C) | 1.96 | 0.40 | Low | 2.57 | 0.38 | High | 2.94 | 0.38 | High |
| Coaching and Mentoring (C) | 1.96 | 0.39 | Low | 2.57 | 0.38 | High | 2.87 | 0.38 | High |
| Research-based Learning (R) | 1.98 | 0.40 | Low | 2.57 | 0.38 | High | 2.82 | 0.38 | High |
| **Average** | **1.97** | **0.40** | **Low** | **2.57** | **0.38** | **High** | **2.89** | **0.38** | **High** |

was overall at a high level ($\bar{X}$ = 2.86, S.D. = 0.38). When considering each aspect, it was found that the CCR was at a high level.

Moreover, the 64 pre-service teachers reflected on the teachers' learning management as follows:

1.4.1 In terms of Contemplative Education (C), pre-service teachers were eager to know and to learn through inquiry-based learning, enthusiastic working, taking responsibility for the tasks assigned to them, as well as developing a positive attitude towards themselves and learning. In addition, pre-service teachers accepted others' opinions, trusted them, and were confident in themselves. The suggestion was that there should be video clips to create an understanding of contemplative listening through a conversational aesthetic method before attending the course.

1.4.2 In terms of Coaching and Mentoring (C), pre-service teachers gain knowledge and understanding concerning the teaching and learning process. With this knowledge gained in the course, pre-service teachers could consult with lecturers when they encountered problems during teaching and learning management activities and work assignments. Moreover, pre-service teachers had a variety of channels through which to receive advice. It was suggested that additional clarifications were needed to build mutual understanding.

1.4.3 In terms of Research-Based Learning (R), pre-service teachers understood the study and the learning process according to the Contemplative Education, Coaching and Mentoring, and Research-based Learning (CCR) learning management model. The suggestion was that the early childhood education program should have documents that can be used as a source for further study.

Concerning the investigating results of the roving team process supporting the competency-based production of quality teachers in the early childhood education program at the Faculty of Education, Rajabhat University, according to the design thinking (DT) methodology, consisted of 4 steps as follows: 1) empathy, 2) ideation, 3) implementation, and 4) evaluation. This is similar to the research and development of teacher preparation process and enhancement by integrating CCR learning in Rajabhat Universities' Faculties of Education in the Eastern Part of Central Thailand: A second-year project of Toontong, et al. [5]. This research revealed that: 1. the teacher preparation process and enhancement consisted of: 1.1) the creation of awareness, 1.2) development of knowledge, 1.3) mentoring, 1.4) knowledge sharing, and 1.5) lessons learned. 2. The outcomes of the study were that: 2.1) the instructors managed to learn activities, and supervised learning by using coaching, 2.2) the student teachers' learning achievement was over 80%, which means they had the qualities of being teachers and were able to do classroom action research at a high level, and 2.3) the teacher mentors' learning achievement was 79.17%, which means they were able to supervise student teachers by using coaching at a very high level.

Similarly, Lomarak Nuansai [6] studied the professional development process integrated with CCR for in-service teachers at Buriram Rajabhat University, and the research findings revealed that in-service teachers could study by collaborating in the professional improvement seminar. They also understood their roles as supervisors, and the role of teachers as learners in a professional learning community, and in-service teachers understood how to combine the professional improvement process with CCR to improve their expertise and ability in instructional management.

**Phase 2:** Results of studying the competency-based production process of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University, according to the Deming Cycle (PDCA) concept, consisted of:

**2.1 Plan:** Have a meeting among lecturers as supervisors, in-service teachers as mentors, and pre-service teachers to prepare for practicum.

**2.2 Do:** Develop teachers' competency-based production by dividing them into 3 phases as follows:

2.2.1 Faculty as supervisors, in-service teachers as mentors, and pre-service teachers registered for practicum in the competency-based production process of quality teachers based on CCR.

2.2.2 Have a workshop to clarify and understand before a practicum participate in the research field.

2.2.3 Pre-service teachers did practicum according to the competency-based production process of quality teachers based on CCR.

**2.3 Check:** Faculty lecturers as supervisors, and in-service teachers as mentors supervised and evaluated

pre-service teachers.

**2.4 Act:** Results were used to improve and develop the practicum.

Furthermore, the results of studying the competency-based production process of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University based on the Deming Cycle (PDCA) concept were consistent with Supising, et al. [7], who studied the practicum model development for professional educational administration in the digital era, the process of studying concerning problems, guidelines for the solution, and supporting factors. The practicum for professional educational administration consisted of: 1) Plan (P) referred to the readiness preparation, building knowledge and understanding, explanation of objectives, consulting, work planning, the cooperation in guidelines of working, and plan to check, 2) Do (D) referred to the coordination and creating a friendship with practicum sectors, performing duties as assigned, team working, volunteering, and working to achieving objectives/goals, 3) Check (C) referred to the summary of work, supervision, follow-up, and evaluation by faculty supervisors, mentors, or assigned persons, and 4) Act (A) referred to the operational improvement, correction, work improvement, achievement analysis, and the use of digital technology to help in supervision, monitoring, evaluation, and extension.

However, this research result was different from the finding of Lemtrakul, et al. [8], which claimed that goals, concepts and theories, principles, procedures, output, outcome, and impact of academic reinforcement were guidelines to improve procedures to develop teacher education.

**Phase 3:** Regarding the results of network development of the roving team supporting the competency-based production process of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University, the changes in the potential of the roving team network supporting the competency-based production process were as follows:

3.1 The roving team network was able to extend the knowledge of integrated learning based on CCR for the design learning management of the competency-based production process to develop pre-service teachers.

3.2 The roving team network had experiences in academic support skills such as being a lecturer as a resource person in training, being a mentor, being a coach, organizing learning exchange activities, providing lessons learned process, as well as the supervision and follow-up of the operations based on the competency-based production process.

3.3 The roving team network had positive attitudes, beliefs, motivation, and self-confidence to support and promote academics for the development based on the competency-based production process.

3.4 The roving team network was able to apply the CCR to the development based on the competency-based production process.

In conclusion, concerning the results of network development of the roving team supporting the competency-based production process of quality teachers in the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University, the changes in the potential of the roving team network supporting the competency-based production process were able to extend the knowledge based on CCR for the design learning management of the competency-based production process to develop pre-service teachers.

Similarly, Thaitae [9] defined the roving team as a group of knowledgeable persons, who have skills and expertise in supervision as well as being ready to help those who required supervision quickly and keep up with the demand.

In addition, Bhiromrat, Wairup, Chongcharoen [10] found that the supervisors, mentors, and students all had the highest level of teaching qualifications and knowledge in learning management based on CCR approaches. Moreover, the supervisors and mentors had the highest level of CCR coaching capacity, and the students had the highest level of CCR learning management.

## 6. Conclusion

Since the implementation of the roving team network supporting the competency-based production process of quality teachers in the early childhood education program, Faculty of Education, Chiang Mai Rajabhat University, faculty lecturers as supervisors have had a fundamental change in themselves through knowledge and understanding of their own consistent with reality and a positive attitude towards oneself and others. The derived experience in academic support skills makes them a resource person in the complete teachers' training process and able to provide lessons learned. In-service teachers as mentors can have the ability to coach and influence changes in knowledge and understanding. Therefore, pre-service teachers can organize learning exchange activities using integrated learning based on CCR and self-development.

## 7. Recommendations

7.1 There should be the same understanding and operation of the roving team in each university.

7.2 There should be collaboration in each region to reflect similar teaching and learning contexts.

7.3 There should be support for CCR to develop soft skills for pre-service teachers.

## 8. Recommendation for Further Research

8.1 In the other programs, there should be research on the competency-based production process of quality teachers.

8.2 There should be follow-up research on the continuity of the roving team, lecturers as supervisors, in-service teachers as mentors, and pre-service teachers using integrated learning activities based on CCR.

**Acknowledgment**

Thank you to the early childhood education program at the Faculty of Education, Chiang Mai Rajabhat University, Rajabhat University's network, and the Research Fund Office for supporting this research.

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# A Study of Business Intelligence Tools from Users' Perspectives

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## Abstract

Business Intelligence (BI) has always been important for the enterprises. The enterprises can gain a competitive advantage from implementing BI. BI assists decision-makers to make decisions better by providing the information they need at the right time. The features of BI tools are slightly varied depending on the focus of BI software vendors. This article aims to discuss the main features as well as advantages and disadvantages of various BI tools from users' points of view. The study reveals that the advantages of these BI tools are the ability to connect internal and external data sources, the ability to provide interactive dashboards with drag-and-drop interfaces, the ability to share and collaborate for dashboards and reports, and the ability to control access and sharing permission. Most BI tools are cloud-based; therefore, users can access these tools from any browser with an internet connection. The disadvantages of BI tools vary among these tools which include slow performance and difficulty in extracting or exporting data. The article also highlights the improvements of these BI tools recommended by users such as improving performance for live connection, supporting various file formats, and disclosing price information on the website. This study can benefit enterprises, BI software vendors, and academic staff.

**Keywords:** business intelligence tools, business intelligence features, advantages, disadvantages

**Article history:** Received 11 January 2023, Revised 15 February 2023, Accepted 11 April 2023

## 1. Introduction

Nowadays, some organizations need to access and manage massive amounts of data; therefore, they need proper Business Intelligence (BI) tools to provide real-time information for dashboard and visualization reports [1]. BI tools can also give decision-makers access to the information they need as much as possible. Business intelligence is one of the important components of the Internet era and the development of intelligence commercialization, which combines data mining analysis, data visualization, data practice, and infrastructure [2]. In the past, the earliest traditional business intelligence's main functions were to share information among organizations. Later, business intelligence has been further developed, becoming a computer model that can make decisions and transform them into evaluation and analysis. In recent years, business intelligence technology has made great progress, mainly reflected in more convenient and efficient analysis and platform security and stability. On the one hand, the traditional business intelligence model in the past was mainly a top-down method, and the overall reporting cycle was long and inefficient. On the other hand, modern business intelligence is easy to use and can realize certain interactivity.

There are many BI tools available in the market such as SpagoBI, Tableau, Pentaho, Qliksense, Jaspersoft, and Jedox [1]. All these tools are very convenient and can help people quickly analyze and share data. Also, modern BI tools have the drag-and-drop function to allow users to easily understand data structure and visualize data. For example, the well-known JP-Morgan Chase Co. (JPMC) experienced a sharp increase in data volume in its early years, but bankers still used Excel and SQL server to sort out financial data, analyze reports, and predict risks [3]. Although these basic tools can achieve modeling and accurate analysis, there are still several problems. Firstly, when the amount of market data increases, the reporting efficiency is greatly reduced. Second, the degree of business automation is low, and the ability of data analysis is limited. In particular, the level of presentation of analysis results is limited, which makes it impossible for customers to clearly understand and judge. Therefore, JPMC decided to implement Tableau Prep to import and organize data, then use Tableau Desktop for analysis, and finally use Tableau Server or Tableau Online for data sharing and management control. This results in the improvements to the work efficiency of enterprises.

According to this actual case, an advanced BI tool plays an important role in optimizing strategic decision-making for an enterprise and can help the enterprise in various aspects [2]. First, most of the intelligent tools and platforms can simplify the analysis processes and can easily view and analyze data without mastering professional technology, which greatly

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reduces the adaptation time of enterprise employees to the new system. Secondly, it is very difficult to directly analyze the trend or rule of original data discovery. People are sensitive to differences in patterns or colors. With this reform, enterprises can analyze market data more efficiently, and greatly improve their profit rate and work efficiency. Thirdly, sharing opinions to promote decisions and judgments is one of the main advantages of business intelligence. Part of BI tools allow users to make notes directly in the software and can also remind users of data changes and work changes after docking through e-mail and notification, which improves the efficiency of enterprise work docking. Fourthly, the compatibility of BI tools is also a very practical part. Part of BI tools can be used in conjunction with Excel and other software familiar to users. Thus, the problem that a large amount of data needs to be converted is solved.

This paper is to explore various BI tools, identify main features, advantages, and disadvantages of these tools from users' points of view. Users' recommendations for improvements are also investigated. The results can assist academic staff to select the business intelligence tools for their business intelligence courses, assist organizations in the selection process of BI tools, and provide insights for BI software vendor in further improvement of BI tools.

## 2. Literature Review

Various enterprises including financial services and similar related industries need to face the situation of data investigation by relevant regulatory authorities. This requires BI tools to meet the following functions [3]. First, the enterprise can establish a controllable and safe management tool through the IT department to ensure data quality and consistency. Second, the enterprise can clean up and improve the data and then import BI tools to play the role of data protection. Lastly, the data can be safely kept and archived when the relevant regulatory authorities access the encryption policies and procedures, and the process of compliance can be automated. Therefore, enterprises can improve their corporate strategies through more advanced intelligent tools and find out existing marketing opportunities more quickly and efficiently. Simultaneously, enterprises can further explore customers with investment demand and potential, optimize the quality of enterprise projects and provide better services for customers. In addition, a practical tool can help enterprises solve many problems and efficiently help enterprises to complete transformation and optimization.

The functions of intelligent tools can be displayed not only through ready-made enterprise data and KPIs, but also by introducing relevant market environment and operational problems and putting forward different optimization strategies and schemes. In this way, it can help decision-makers to improve their efficiency and find the best solution [4]. Meanwhile, there will be market competition in the operation of enterprises and organizations. Intelligence tools can combine past databases and solutions to track and compare the updated performance and market data in real-time. Based on the analysis of these data, a comparative analysis with competitors can be made and used for effective business decisions. Furthermore, intelligent tools can analyze customer behavior and track performance and operational data through a real-time database. To help enterprises clearly identify new business opportunities and market trends faster, and quickly adapt to the changes of new markets, and enhance the competitiveness and profit rate of enterprises [5].

According to [6] and [7], the important features of BI tools are discussed next. First, the ability to connect internal and external data sources into a single point of access to real-time information with mobile access ensures decision-makers have the most current information. Having complete knowledge of real-time data ensures that the best decisions can be made for the benefit of the organization to make the task easier to be done. Whenever new tools come out in the market, they can also be used together as multiple tools to analyze data. Furthermore, automated data analytics is also a big part of the tools. Predictive analytics is one of the most popular features of BI tools as it can play a key role in helping businesses optimize their operations and development. It is intended to generate forecasts about future performance by using mathematical models to analyze current and past data and look for correlations, trends, and patterns to generate accurate predictions about what future datasets might develop in the future.

Next, the dashboard BI tools provide an interactive dashboard, an easy-to-use visualization with drag-and-drop capabilities, and simple indicators in a workspace to create visual dashboards and live reports [6-7]. Dashboard Templates are also one of the requirements of the BI tools. Using interactive dashboard templates can help users quickly generate sales reports or track the performance of marketing campaigns. Templates are especially useful for users who are not comfortable creating their dashboards from scratch or for casual users who spend more time analyzing data than building dashboards. Lastly, sharing the reports is one of the most important features of BI tools. The main objective of modern reporting solutions is to improve communication between teams by empowering everyone to work with data, even without technical skills. Standard sharing options include manual export and emailed reports. However, the cloud-based nature of the self-service BI tool takes the sharing experience one step further by providing other extremely useful options. For example, automatic reports are sent to custom recipients or groups

with specific filters such as sales data for a specific region. Other convenient sharing options include sharing your dashboard via a password-protected URL for extra security. This is a particularly useful feature for interdisciplinary projects where teams work together from different parts of the world as they have easy access to information. Also, the reports should allow users to export to other common formats such as PDF, PNG, Excel, etc. without damaging charts or graphs.

## 3. Research Methodology

The research is exploratory. The users in this study are undergraduate students in a business intelligence course. The total of twenty-four students was divided into four groups. Each group consists of six students. These students as a group of users were asked to explore and experience different BI tools mainly on personal computers. The BI tools which have a free trial or a free license were selected for this study. These BI tools are namely Qlik Sense, Google Data Studio, Dundas BI, and Domo. The study intends to answer the following questions.

R1: What are the main features of each BI tool?

R2: What are advantages and disadvantages of each BI tool?

R3: What are the recommendations of each BI tool from users' perspectives?

The collected data were analyzed and discussed by three researchers. Two of them had working experience in IT field, while another researcher earned a degree in Information Systems. This methodology followed the content analysis with investigator triangulation [8] to reduce the bias from the researchers.

## 4. Discussion

### *4.1 Qlik Sense*

Qlik Sense is an analytic tool that generates custom reports for businesses and provides highly detailed and user-friendly dashboards [9]. Thus, it can be used to generate insights into business processes. It can be used by individuals, small businesses, and large enterprises. Main features of Qlik Sense consist of Enterprise-level security, Smart Search feature, Progressive Creation, Drag-and-drop visualizations, Managed Data Connections, Fast and Reliable Connections, Shared Object Library, Rapid Development Environment, Real-time Access, Powerful Open and Standard APIs, Data storytelling functionality, Manageability, Self-service simplicity, Scalability, and Multi-source data integration including big data. Qlik Sense's visualization is displayed in Figure 1.

Advantages, disadvantages, and user recommendation for software improvements of Qlik Sense are described in Table 1.

### *4.2 Google Data Studio*

Google Data Studio is the reporting tool from information that has a lot of numbers [10]. It makes a lot of numbers come out as a picture for easy understanding. Google Data Studio connects to the information that comes from Google and not Google such as Google Sheets, YouTube Analytics, Search Console, and so on. It presents information by using data to create graphs, charts, heat maps, tables, maps, etc. to help visualize data clearly and beautifully as shown in Figure 2. In addition, users can edit the report in real time as well.

Advantages, disadvantages, and user recommendation for software improvements of Google Data Studio are described in Table 2.

### *4.3 Dundas BI*

Dundas BI is a flexible, end-to-end business intelligence platform that simplifies the entire analytics process and empowers everyone to visualize and analyze data [11]. Dundas BI is most commonly used to create dashboards and scorecards. Dundas BI can also use standard or ad hoc reports. Dundas BI transform raw data into actionable insights in the form of dashboards, reports, and visual data analytics. Dundas BI's visualization is displayed in Figure 3.

Advantages, disadvantages, and user recommendation for software improvements of Dundas BI are described in Table 3.

### *4.4 Domo*

Domo is an integrated platform that delivers business intelligence leverage at cloud scale in record time [12]. Domo allows for connecting, combining, transforming, querying, and optimizing data. Domo also inspire data storytelling by transforming raw data, creating curated data stories, exploring data, and building live visualizations as shown in Figure 4.

## 5. Results and Discussion

Advantages, disadvantages, and user recommendation for software improvements of Domo are described in Table 4.

## 6. Conclusion

In conclusion, data visualization of BI is very important for cross-regional collaboration between teams and departments. A growing number of industries and related enterprises will eventually combine BI tools and applications into all aspects. From the study of these four BI tools discussed earlier, the advantages of these BI tools are the ability to connect internal and external data sources, the ability to provide interactive dashboards with drag-and-drop interfaces, the ability to share and collaborate for dashboards and reports,

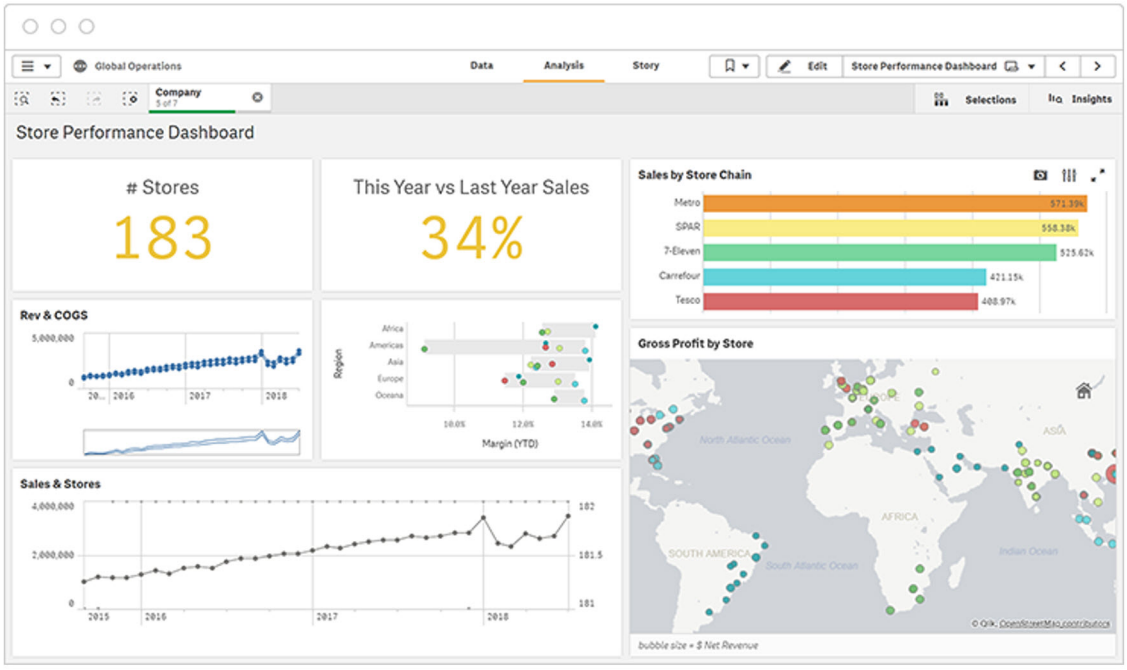


**Figure 1**: Qlik Sense's visualization [9]


**Figure 2**: Google Data Studio's visualization [10]

**Table 1.** Advantages, disadvantages, and user recommendation for software improvements of Qlik Sense

| Advantages | Disadvantages | Recommendation |
|---|---|---|
| 1. With API support, the software can connect with a very wide range of systems. The dashboards seem to be quite good, and they can be integrated into other systems. | 1. There is no option for report delivery. The extensions need to be certified by Qlik. | 1. Software should have better visualization options on charts. |
| 2. Data integration and linking are made easy due to the associative model. | 2. It was dreadfully slow and awkward. | 2. Software should have better control over total lines in the pivot and straight tables without the need to download extensions to accomplish this task. |
| 3. With the augmented graphics and data discovery features, Qlik Sense helps in spreading data literacy. This implies that users regardless of their skill set and capabilities can learn to intuitively draw meaningful insights from data and hence, learn to comprehend data. | 3. There are some issues on the client side like some features malfunctioning in iOS, qvf, and qvw files not being saved separately, etc. | 3. Software should take less time to margin reports and have reusability of existing data to make it easier for coding. |
| 4. There are options for system-guided analytics like the Insight Advisor. Also, geographical and advanced calculations can be applied to the data to give data new contexts and analyze it from different points of view. | 4. Sometimes more than usual memory space is used while working in the analysis mode, slowing the processing and hindering the proper functioning of the application. | 4. Software should support real online analytical processing (OLAP). |
| 5. The software provides flexible and robust security provisions. | 5. Issues in loading data in the script or data load editor have been encountered. Problems related to ODBC connections, exporting data from the sheet, script's debug mode, etc. have been noted. | 5. Software should have an incremental data load solution for better time-saving. |
| 6. Qlik Sense is compatible with all sorts of devices like desktops, tablets, laptops, and mobile phones. This makes creating and analyzing the applications much more eased up. | 6. The Qlik Management Console also does not work ideally in some situations. Some generally reported issues are that large-sized files (greater than 10 GB) cannot be imported into the QMC running on Internet Explorer. If multiple files are to be executed at the same time, the status of execution freezes and hangs and the user has to delete tasks and initiate them again. Also, selecting multiple users is a very slow process. | 6. Software should implement inbuild versioning, backup, dependency analysis, and regression testing. |
| 7. The centralized hub acts as a platform for collaboration and sharing information, data, reports, and applications with other users. | 7. The storytelling feature has limitations as some languages like Japanese, Chinese, etc. are not supported entirely. | 7. Software should have core functionality delivered by extensions (Telemetry, CLI). |
| 8. For an individual as well as team users, self-service creation is very beneficial, especially for non-technical users in creating apps, spreadsheets, visualizations, and BI solutions with the help of machine-guided analytics. | 8. Glitches in the working of Qlik Engine also show through improper loading, reloading, execution, error messaging, keeping data intact while transitioning, in ODBC connections, etc. | |
| 9. Custom application development is possible by the virtue of embedded analytics having open standard APIs and development tools. | 9. Issues in Qlik Sense Repository are faced in removing folders, and not being able to read local files as the URL entered will not work even after setting up a database connection. | |
| 10. The capability of data scaling is also very beneficial to users who need to use a large amount of data from big data sources. Also, such efficient scalability allows many users to work on the same application at a single time. | | |

**Table 2.** Advantages, disadvantages, and user recommendation for software improvements of Google Data Studio

| Advantages | Disadvantages | Recommendation |
|---|---|---|
| 1. Cloud-based and completely managed | 1. Reports can be read-only online. | 1. Should support Excel format files |
| 2. Tight integration with Google's ecosystem | 2. Lack of real-time updates in the dashboard | 2. Should improve speed for the live connection |
| 3. Easy to use | 3. No on-premise deployment option | 3. Should support comprehensive functions such as computing the sum of columns considering both rows and columns |
| 4. Access and sharing controls | 4. Lack of native connector support for cloud-based data sources | |
| 5. Support for live connections | | |

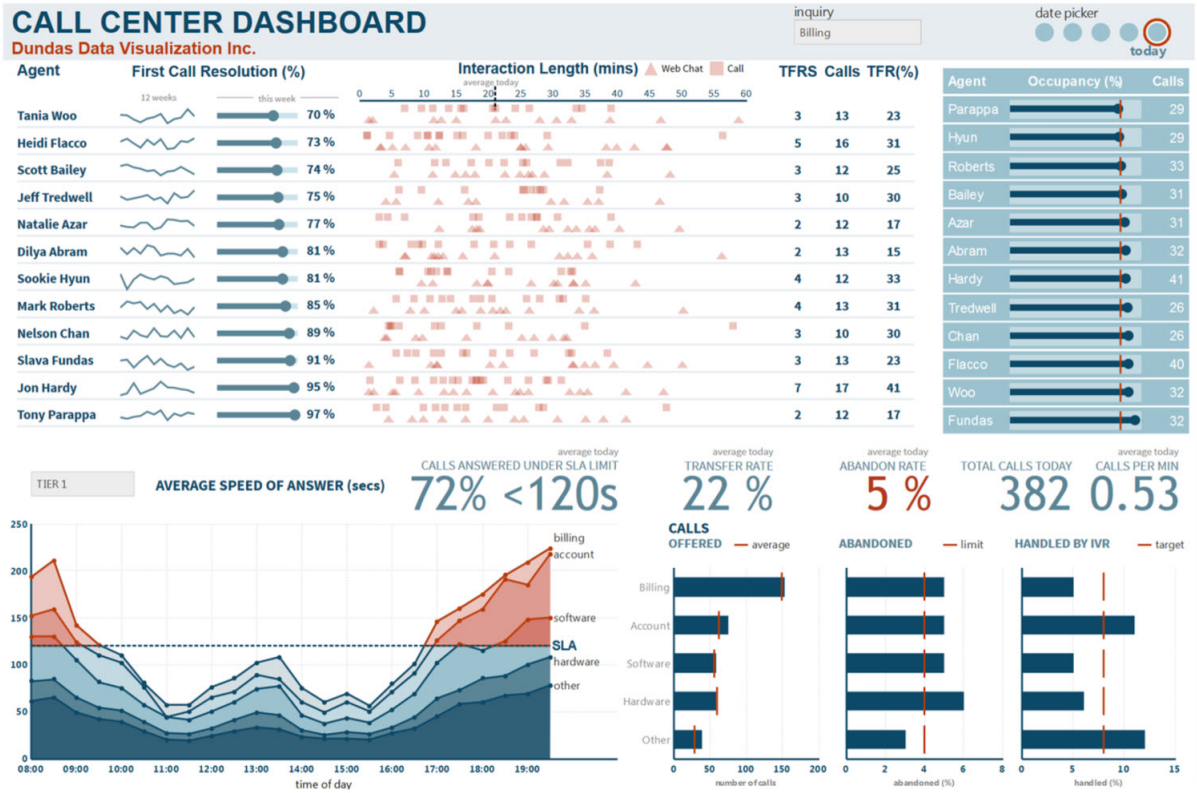


**Figure 3**: Dundas BI's visualization [11]

**Table 3.** Advantages, disadvantages, and user recommendation for software improvements of Dundas BI

| Advantages | Disadvantages | Recommendation |
|---|---|---|
| 1. Enabling business to analyze data, identify patterns, and predict trends in business. | 1. Big data cache. | 1. Adjusting and improving the Big data cache, as speed and result of large reports is sometimes an issue. Random bugs are encountered sometimes when analyzing numerous data. |
| 2. Enabling business to make more informed decisions and implement best practices. | 2. Not specify pricing plan. | 2. Disclosing the price information for each package that is available. |
| 3. Easy to create a wide range of report types by leveraging built-in formulas or using drag-and-drop items. | 3. Has certain limitations when used with Linux OS. | 3. Adding a few more types of filters for working on data like a sliding calendar range filter. |
| 4. Quickly recovering data by restoring recently or accidentally deleted dashboards, reports, folders, and files from the recycle bin. | 4. Use of data cubes requires prior knowledge of data structures. | 4. Adjusting and deducting the limitations when used with Linux OS. |
| 5. Improving employee productivity and ensuring data security by designing, scheduling, and distributing professional work emails from templates in the platform. | 5. 3D charts require additional scripting and are not supported out-of-the-box. | 5. Developing the use of data cubes to be easier, as easy as a person who does not have knowledge of data structures can use it. |
| 6. Allowing access from any browser, without needing to download a separate desktop application and publish to a server or service. | 6. User interface can be confusing. | 6. Developing 3D charts function by providing scripting function and support for out-of-the-box. |
| 7. Supporting a wide variety of industries such as banking and finance, clean tech, construction, education, government, healthcare, high tech, hospitality, insurance, manufacturing, mining, non-profit, oil and gas, pharmaceutical, retail, telecom, transport and logistics, as | 7. Reduced performance with Internet Explorer. | 7. Developing the program performance when using together with Internet Explorer. |

**Table 4.** Advantages, disadvantages, and user recommendation for software improvements of Domo

| Advantages | Disadvantages | Recommendation |
|---|---|---|
| 1. Integrating on-premises data into the cloud system: The software is extremely flexible and user-friendly. Users can access data from their phones or anywhere with an internet connection. | 1. Difficult to extract or export data when users want to do their own analysis or send data to other users of different BI programs. | 1. Should provide more teaching material for new users. |
| 2. Beautiful interface: Visualizations are clean and very business presentable. It is easy to use with the drag-and-drop function. | 2. Lack of improvement as the venture capital appears to invest more into sales and marketing than product support and customer service. | 2. Should add an installed version for Windows and MacOS. |
| 3. Integrating automated data discovery: Get AI-powered insights into data with Insights, Domo's deep learning, and descriptive stats module. | | 3. Should mention cost of using Domo. |
| 4. Integrating natural language queries: Users can ask questions about data in natural language and get an instant response with text bots. | | 4. More advertisement. |
| 5. Creating powerful alerts that help users manage by exception and keep users apprised of key changes in data. Users can receive alerts via web, email, or any mobile device. | | |


**Figure 4**: Domo's visualization [12]

and the ability to control access and sharing permission. Most BI tools such as Google Data Studio, Dundas, and Domo are cloud-based; therefore, users can access these tools from any browser with an internet connection. This would make these tools flexible and easy to access. The disadvantages of BI tools vary among these tools. For example, some desktop tools are slow and some cloud-based tools are slow when using Internet Explorer. Some tools are difficult to extract or export data. Many users recommend that the performance of the tools should be improved for live connection. The tools should be able to support various file formats, especially the common one like Excel. Also, the price information for each package of these BI tools should be disclosed on their websites. In the future, BI tools that add predictive analytics functions will become more and more popular as enterprises are increasingly interested in analyzing trends and forecasting data for competitive advantages. Therefore, BI software vendors should be continuously integrating new technologies and innovations into the BI tools to ensure that the tools are more efficient and effective. Enterprises have various requirements in terms of functionality, security, availability, and investment budget so they should select the BI tools which best answer their needs.

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# Quantitative Determination of Ethanol in Local Thai Alcoholic Beverages by Raman Spectroscopy

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## Abstract

This study focuses on various concentrations of ethanol content produced locally in Thailand. The alcoholic beverage with ethanol content of 35% and ethanol content of 40%, named sample A and sample B, were quantitatively analyzed using Raman spectroscopy. The characteristic vibration of CH- and OH band in the ethanol molecule ($CH_3CH_2OH$) were analyzed. To create the calibration curves (CH) and (OH), the band areas of stretching vibrations of the CH group within the wavenumber ranging from 2800–3000 $cm^{-1}$ and the OH group within the wavenumber ranging from 3100–3600 $cm^{-1}$ were plotted in comparison with the various ethanol concentrations in the ethanol-water binary standard solution (0–95%v/v with 5%v/v step). The calibration curve (CH) clearly demonstrated a linear relationship between the vibrational band area and the ethanol concentration with an $R^2$ value of 0.997. On the other hand, the calibration curve for OH exhibits poor linearity with a coefficient value ($R^2$ = 0.947). The calibration curve (CH) calculation yielded the exact acceptable values of ethanol concentration in samples A and B of about 33.88 ± 0.03 and 39.47 ± 0.02, respectively. The percentage difference between sample A and B (comparing with the Ebulliometer value) was about 2.69% and 4.22%, respectively. However, the calibration curve (OH) determined that the extreme percentage differences between samples A and B were 40.86% and 30.01%, respectively, due to strong vibration of H-bonding present in water which interrupts the OH stretching vibration in ethanol resulting in higher calculating error in the ethanol-based samples. Based on these findings, it can be stated that quantitative Raman measurement using a calibration curve (CH) performs well in estimating the ethanol content of locally produced alcoholic beverages in Thailand.

**Keywords:** Raman Spectroscopy, quantitative determination, ethanol concentration, calibration curve, vibrational mode

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## 1. Introduction

In everyday life, ethanol is utilized in products including drinks, solvents, protein hydration, and the self-assembly of biomolecular structures [1-4]. It is also often employed in biological, biochemical, and chemical processes in industrial settings. The precise concentration of ethanol in every solution must be considerably necessary. Because of the need to protect consumers from locally produced alcoholic beverages that are not qualified or contain excessive amounts of ethanol, quantitatively aqueous ethanol solution in distilled alcoholic drinks is very important. Additionally, the Thailand Excise Department stipulated tax regulations depending on the quantity or strength of alcohol. The quantity of ethanol in an ethanol-water binary solution should, therefore, be determined quickly, simply, and precisely. The electroanalytical method [5], gas chromatography (GC) [6], near infrared reflectance spectrometry (IR) [7], high performance liquid chromatography (HPLC) [8], amperometric biosensing [9], gas phase biosensing [10], and enzyme-base biosensing [11] are just a few of the methods used nowadays to measure and analyze the concentrations of ethanol. These methods are used the enzymatic, colorimetric, and titrimetric procedures. Traditional approaches, however, have severe drawbacks. For instance, it may be costly to do the analysis, difficult to prepare the samples, instrumental challenges, tough to remove the sample pretreatment, time-consuming process, and difficult to gather the results for in-situ detection. Faster, more affordable, and more accurate approaches have thus become crucial for development. Raman spectroscopy is prefer-

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able due to less time consumption and precise measurements for investigating such as metals [12], liquid solutions [13], polymers [14], and chemical plastics [15]. Due to various benefits of this technology in comparison with other techniques, Raman instrument is used to measure and analyze the ethanol concentrations. The methodology may circumvent the extremely flammable hydrogen gas that is often used for the frame in GC method by just correcting the back scattering of the photon from the sample to identify the characteristic of vibrational mode. Raman spectroscopy is not only the faster-corrected result but also the easier operation, nondestructive method and easy-to-prepare samples for analysis. In other words, unlike other techniques such as GC, HPLC, and biosensing, Raman technique is less complicated. Furthermore, the technique uses light photon as a source to analyze the vibrations observed in the samples. Also, pretreatment is avoided for sample preparation. However, Raman spectroscopy lacks to measure the low concentration due to less sensitivity, but lower concentration samples can be analyzed using Surface Enhanced Raman Scattering (SERS) approach [16]. It is generally known that the inelastic energy of a photon measured by Raman spectroscopy matches the absorption energy of a vibrational molecular bond as observed in Infrared spectroscopy (IR). Not only Raman spectroscopy, but also Infrared reflectance spectroscopy (IR) can be used to determine the ethanol content. However, in the present work the researchers focus on Raman technique for measuring ethanol concentration. Raman spectroscopy has already been affirmed to be a tool for qualitative and quantitative analysis, and it allows structural fingerprinting with its narrow and highly determined band [17]. Identification of the inelastic light scattering from the optical phonon can be referred specifically to the characteristic of a molecules (bond strength and atomic mass) of each functional group which it can identify typically of substances. Generally, the acquisition of quantitative information can be gained by a Raman spectra line of the induced molecular vibration which is directly proportional to the amount of the molecule in samples [18].It is widely known that the ethanol molecule ($CH_3CH_2OH$) consists of the ethyl ($C_2H_5$-) and the hydroxyl (-OH) group. Due to the specific characteristics of ethanol, much research has been conducted to determine the quantitative analysis of ethanol in ethanol-water binary solution using the CH or CC band as a standard curve, observing at 884 $cm^{-1}$ corresponding to stretching vibrations of C-C [18] and stretching vibrations of C-H ranging from 2800–3000 $cm^{-1}$ 19. However, OH vibrations show dominant feature if water molecules are present in the sample [20], which is observed in the range of 3100–3600 $cm^{-1}$ in a sample with OH vibrations.

The OH vibrations are observed in both the water and ethanol molecules exactly in the same region. The intensity and the shift observed in this region would bring significance to understanding their molecular changes in the sample. It is found that the intensity of the OH vibrational mode is observed to have various values when the concentration of ethanol changes from absolute ethanol to pure water. The present work provides novel analytical study the concentration of ethanol content in Thai alcoholic beverages observed from the vibrations of CH and OH modes using Raman instrumental technique. In this research, to establish a quantitative result using Raman technique, ethanol-water binary solutions were prepared for an ethanol standard solution. The stretching vibrations of the CH- and OH- bands were recorded, and the Raman integrated band area of the bonding groups (CH, OH) was analyzed in detail to generate a calibration curve, which was used to compute the quantitative concentration of ethanol in the samples. Finally, the linearity, accuracy, precision, and usability of the developed method in real samples (Thai alcoholic beverages) were examined and the results of this method were compared with that of result from the ebulliometer instrument.

## 2. Experiment

### *2.1 Examined samples*

The locally available Thai alcoholic beverages (Red Bull Distillery (1988) Co., Ltd.) were used to determine the alcoholic concentration. Two samples of different alcoholic concentrations 35% (sample A) and 40% (Sample B) were used as topic of interest. Each sample was analyzed by placing 3 mL in quartz cuvette sealed with aluminum foil to avoid other noise during measurement. The ethanol concentration of the samples was examined with a procedure given in section 2.4 “Quantification of ethanol concentration using Raman spectroscopy”.

### *2.2 Preparation ethanol-water binary solutions for an alcoholic standard solution*

For the alcoholic standard solution, the twenty ethanol-water binary solution with different ethanol concentrations were prepared from the ethyl ethanol (95 %v/v AR1069-G2.5L; RCL Labscan Limited) and distilled water. The calculated amounts of this binary solutions were mixed into the volumetric flasks (10 ml). The ethanol concentration was expressed in term of the volume percentages, and it was varied from 0 %v/v (pure water) to 95 %v/v with 5 %v/v step. To avoid the possible error from vaporization of ethanol in the solution, Raman spectra was immediately collected after the solution was prepared. All solutions were prepared about 3 mL and taken in the quartz cuvette which were also stored in well-sealed vessels with the aluminum foil while measuring. Finally, both samples and standard solution were applied for Raman measurements in the same conditions.

### *2.3 Raman measurement*

The Raman spectra in backscattering configuration were obtained using an Ar-laser as a source with a wavelength of 532 nm (power around 0.95 Watt). An interference edge filter was used to prevent the elastic scattering signal (Rayleigh scattering) and allowed the wavenumber (Raman shift) to approach down to 200 $cm^{-1}$. The scattering phenomenon was collected in a monochromator grating of 1200 g/mm, and the distance of focus was about 140 mm (Micro HR, HORIBA Scientific). Spectra registration was performed by a CCD camera from HORIBA INSTRUMENTS INC., EDISON, NJ, USA Model: 2048x70-UVS. The spectral resolution of the Raman spectroscopy was 2 $cm^{-1}$. All solution temperatures during measurement were maintained at 25°C. The Raman spectra of each solution were obtained from 250 to 3800 $cm^{-1}$. The measurements were made with the same parameters at a 15-second acquisition time, 2 times accumulation, and 1-second RTD time. Finally, the Raman spectra line was subtracted with a baseline using a Polynomial function for all measurements.

### *2.4 Quantification of ethanol concentration using Raman spectroscopy*

To determine the quantification of ethanol, the stretching vibration of the $CH_2$- and $CH_3$-band (CH group) and the stretching vibration of the OH band (OH group) were obtained in the range of 2800–3000 $cm^{-1}$ and 3100–3600 $cm^{-1}$, respectively. The band area of the CH group and OH group were conducted to be the calibration curve for CH and OH, respectively. Two calibration curves were produced by plotting the band area from the sum of (i) the CH group (obtained by equation 1 [18]) and (ii) the OH group (obtained by equation 2) versus the ethanol concentration. Measurement of each band area was performed directly using Igor Pro program (WaveMetrics, Inc., Lake Oswego, USA).

$$\text{Area}_{CH} = \text{Intensity}_{\nu=2883\ cm^{-1}} + \text{Intensity}_{\nu=2931\ cm^{-1}} + \text{Intensity}_{\nu=2977\ cm^{-1}} \quad (1)$$

$$\text{Area}_{OH} = \text{Intensity}_{\nu=3229\ cm^{-1}} + \text{Intensity}_{\nu=3422\ cm^{-1}} \quad (2)$$

To determine the ethanol concentration of samples (local Thai alcoholic beverages), band area from CH group and OH group of the samples were substituted in the calibration equation of calibration curve for CH and OH, respectively and the concentration of ethanol were calculated. The ethanol concentration results obtained from the calculation were compared with the alcohol concentration displayed on the label of the sample and correlated between the results and the value obtained from the alcohol solution in the sample (on label) were analyzed by statistics.

### *2.5 Measure by ebulliometer instrument*

The ebulliometer instrument were obtained for measuring the ethanol concentration (degree) of Thai alcoholic beverages samples. The distilled water was added into the ebulliometer boiler for calibrating the zero point of the boiling point at room temperature (25°C). Later 100 ml of the samples were used for ebulliometer estimation. Sample A (35%) and Sample B (40%) were added to the ebulliometer boiler and recorded at the lowest constant boiling point. The zero of the scale was adjusted to the boiling point of the water and the percentage of alcohol which was examined from the scale.

## 3. Results and discussions

### *3.1 Raman spectra of the samples and the ethanol-water standard solution*

Figure 1a) and 1b) show the Raman spectra of 95% v/v ethanol, Thai alcoholic beverage samples and pure water ranging from 250 – 4000 $cm^{-1}$. The wavenumber position of these bands is estimated by fitting with Lorentzian equation and summarized in Table 1. The band positions ($cm^{-1}$) in each spectral line are found to be slightly shifted from their traditional values (blue shift or red shift). However, these positions of each band can be acceptable when compared with the reference values as shown in column 2 of Table 1. All wavenumbers of the bands performed the characteristic vibrational mode which corresponds to molecular formular of the ethanol (CH3CH2OH) as shown in column 3 of Table 1. Due to the transparency of the local Thai alcoholic beverage, the ethanol spectral line of the samples did not detect the fluorescence which is advantageous for undesirable spectra while correcting the vibrational band of ethanol. All ethanol band spectra have been obviously observed three strong bands of stretching vibrations of CH groups around 2883$cm^{-1}$, 2931$cm^{-1}$, and 2977$cm^{-1}$ which are assigned to the stretching symmetric vibrations of CH2, the stretching symmetric vibrations of CH3, and the stretching asymmetric vibrations of CH3, respectively. Furthermore, the researchers observe two strong overlapping bands of stretching vibrations of hydroxyl (OH) group from alcoholic solution and (OH) group from water molecule in the region of 3100 – 3600 $cm^{-1}$. The wide range is observed around 3422 $cm^{-1}$ and distinctly small shoulder around 3229 $cm^{-1}$. Due to dominating band of ethanol spectra, the ethyl (CH) and

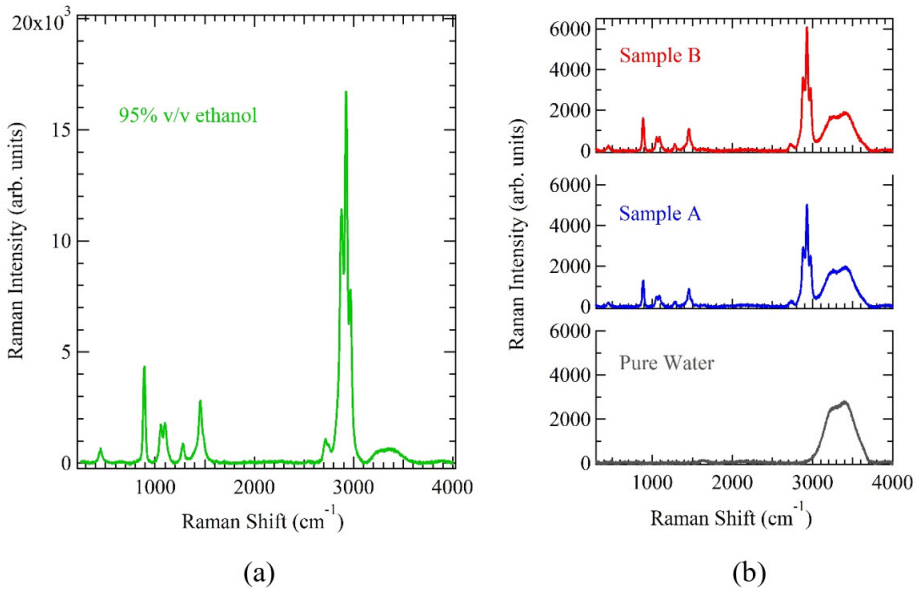


**Figure 1**: Raman spectra of ethanol-water binary solutions, a) 95% v/v ethanol and b) Various Samples and pure water.

**Table 1.** The characteristic ethanol band of samples and ethanol standard in the wavenumber range 250–3,800 $cm^{-1}$ which correspond to the mode of vibration.

| Raman shift ($cm^{-1}$) | Reference ($cm^{-1}$) | Vibrational mode |
|---|---|---|
| 444–445 | 440[a] | Bending vibrations of C-C-O |
| 888–890 | 884[b], 886[a], 888[c] | Stretching vibrations of C-C |
| 1054–1057 | 1053[b], 1054c, 1056[a] | Stretching vibrations of C-O |
| 1096–1098 | 1095[b], 1100[a], 1104[c] | Skeleton stretching vibrations of $CH_3$ |
| 1281–1283 | 1279[b], 1280[a], 1287[c] | Deformation vibrations of $CH_2$ |
| 1457–1458 | 1455[b], 1456[a], 1462[c] | Bending vibrations of $CH_3$ |
| 1630–1632 | 1630[a] | Bending vibrations of water |
| 2726–2730 | 2730[a] | Combinational frequencies |
| 2880–2883 | 2880[b], 2884[a], 2887[c] | Stretching symmetric vibrations of $CH_2$ |
| 2928–2931 | 2929[b], 2932[a], 2934[c] | Stretching symmetric vibrations of $CH_3$ |
| 2974–2977 | 2974[b], 2975[c], 2977[a] | Stretching asymmetric vibrations of $CH_3$ |
| 3200–3500 | 3286–3615[b], 3330-3400[a] 3200-3420[d] | Stretching vibrations of OH group |

[a]Reference [7]
[b]Reference [20]
[c]Reference [4]
[d]Reference [21]

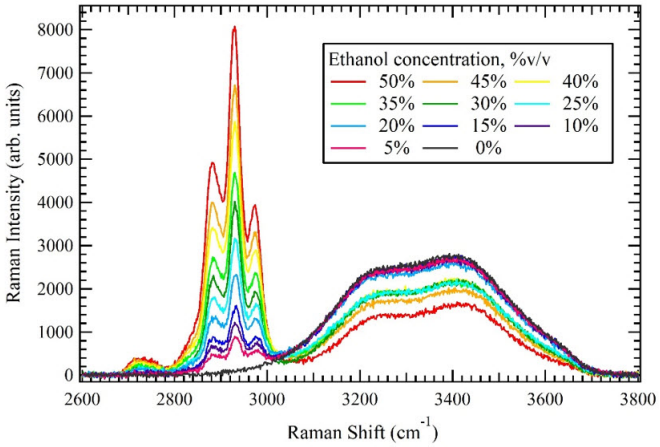


**Figure 2**: Raman spectra of ethanol-water binary solutions with various ethanol concentration (0 – 50 %v/v) with in region stretching vibration of CH and OH bands (2600-3800 $cm^{-1}$)

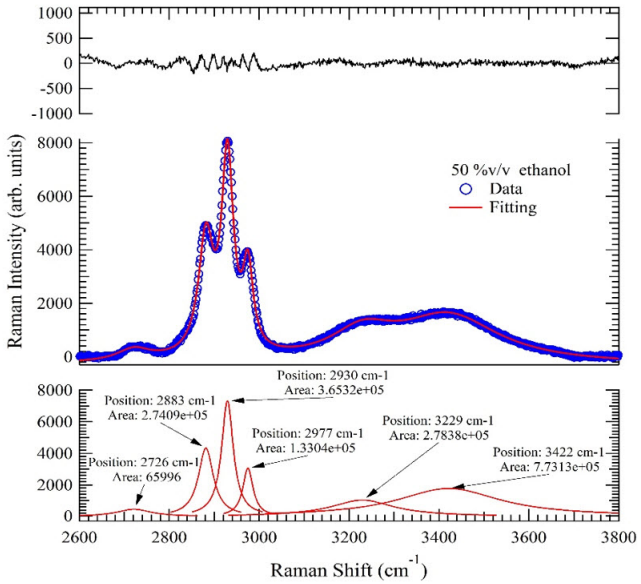


**Figure 3**: Fitting Raman spectra peaks of 50 %v/v ethanol-water solution in range 2600 – 3800 $cm^{-1}$ including with fitting information and residual peak fit located at the bottom and top of the graph, respectively.

the hydroxyl (OH) stretching vibrations bonding were considered as an advantageous band which gave us an opportunity to use these band as the calibration curves for quantification measurement of ethanol concentration in alcoholic solution.

### *3.2 Calibration curves by using the band of stretching vibrational of CH and OH groups in ethanol-water solution.*

The Raman spectra of the ethanal-water standard solution whose ethanol concentration varied from 0-95 %v/v with 5 %v/v step were corrected. However, in this presentation, Figure 2 demonstrates the stretching vibration of CH and the OH band of ethanal-water standard solution with various ethanol concentration (0 – 50 %v/v, with 5 %v/v steps) in wavenumber ranging from 2600-3800 $cm^{-1}$. Despite changing the amount of ethanol concentration, the wavenumber position of the stretching vibration of CH and OH band remained practically unchanged. In contrast with the band position, the band intensity tended to vary related to the changing of ethanol concentration. The band intensity of the stretching vibration of CH groups was observed significantly rising with increasing of ethanol concentrations in contrast with the band intensity of the stretching vibration of OH groups which were also found significantly declining with increase in ethanol concentrations. These results powerfully confirmed that the linear relation between the band area of the stretching vibration of CH and OH groups with the ethanol concentration can be performed to produce the calibration curve as a standard for identifying the ethanol concentration in local Thai alcoholic beverages.

Figure 3 exhibits the fitting obtained from graph to calculate the integrated band area of the stretching vibrations of CH and OH groups from the Raman spectra for 50 %v/v ethanol standard solution in the range of 2600 – 3800 $cm^{-1}$. The fitting information shows the residual peak fit located at the bottom and top of the graph, respectively. The corrected Raman data and the fitting line are represented by the blue circle and red line, respectively. The Raman data was used to fit for multiple peaks using the Lorentzian equation. The fitting line covers overall the band of the stretching vibration of CH and OH groups (including the band of combinational frequencies at 2726 $cm^{-1}$). The data obtained from the results can be examined from the fitting information located at the bottom of the graph. The band positions (CH and OH group) obtained from the graph have already been reported in the previous section (Table 1) and the band area of the stretching vibration of CH and OH groups were corrected for producing the calibration curve. In the graph (Figure 3, 50 %v/v ethanol) the integrated band area of the stretching vibration of CH groups were obtained and show 274,090, 365,320, and 133,064 from the stretching symmetric vibrations of CH2, stretching symmetric vibrations of CH3, and stretching asymmetric vibrations of CH3, respectively. Additionally, the integrated band area of the stretching vibration of OH groups were obtained which shows 278,380, and 773,130 from stretching vibrations of OH groups. As well as the other spectral line of each ethanol concentrations, the integrated band areas of CH and OH groups were added as shown in Equation 1 and Equation 2 for calculating the calibration curve for CH and OH group, respectively.

The calibration curve of ethanol was plotted with the integrated band area of CH and OH groups (0 - 95 %v/v with 5 %v/v step) versus the changing concentration of ethanol in ethanol-water based standard solution as shown in Figure 4 and 5, respectively. A linear response between integrated band areas of CH and OH groups and ethanol concentrations were observed. The results show that the relation between the ethanol concentration and the integrated band areas of CH and OH group are directly proportion and inversely proportional to each other as observed in Fig (4-5). Furthermore, the linear relationship between ethanol concentration and the integrated band area of CH group was obtained with high R2 value of 0.997. This result shows that the ethanol content in the alcoholic beverages samples could be determined with high accuracy by using the calibration curve (CH). However, the low linearity with coefficient value (R2 =0.947) is found in calibration curve (OH). The linearity curve of ethanol concentrations was defined by following equation in which y was given the integrated band areas of CH and OH groups and x was the ethanol concentration, expressed in y=-180,350+19,175x and y=2,602,800 - 24535x, respectively.

### *3.3 Ethanol content in local Thai alcoholic beverages*

Table 2 summarizes the experimental concentration comparing with value from ebulliometer and the percentage difference (calculated and value from the ebulliometer) obtained from ethanol content in the local Thai alcoholic beverages. The concentrations were calculated in both calibration curve (CH) and calibration curve (OH). The reliability of the measurement was observed in terms of standard deviation of the mean ($\alpha$). The results show that the ethanol concentration in Sample A and B calculated from the calibration curve (CH) were 33.88 ± 0.03 and 39.47 ± 0.02, respectively. These values are acceptable precision which can be confirmed by comparing the experimental concentration with the ebulliometer value. The results of the technique show that Sample A (displayed in the label 35%) and Sample B (displayed in the label 40%) were 34.82 ± 0.02% and 41.21 ± 0.01%, respectively. The percentage difference obtained from the experimental concentration using CH calibration curve and concentration from ebulliometer of Sample A and Sample B were found to be 2.69% and 4.22%,

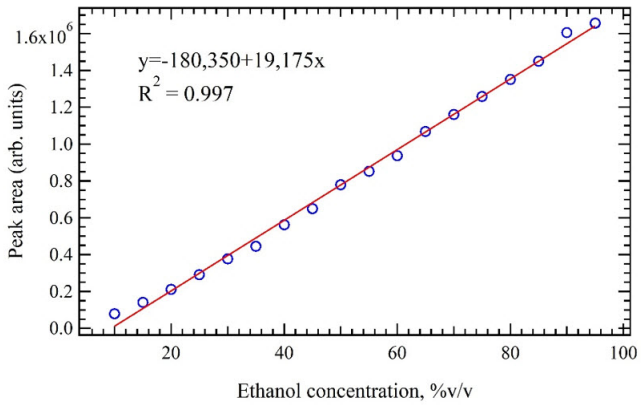


**Figure 4**: Calibration curve by using vibrational CH band of ethanol

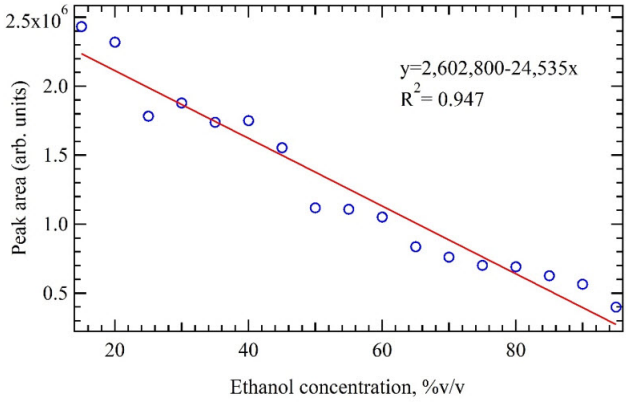


**Figure 5**: Calibration curve by using vibrational OH band of ethanol

**Table 2.** Data for Ethanol Content of Local Alcoholic Beverages

| Local alcoholic beverages | % Alcohol (ethanol) | | | | Difference (%)[d] | |
|---|---|---|---|---|---|---|
| | Calibration curve (CH) | | Calibration curve (OH) | | Calibration Curve (CH) | Calibration Curve (OH) |
| | Exptla±$\alpha^c$ | Ebulliometer±$\alpha^c$ | Exptlb±$\alpha^c$ | Ebulliometer±$\alpha^c$ | | |
| Sample A | 33.88±0.03 | 34.82±0.02 | 49.05±0.09 | 34.82±0.02 | 2.69 | 40.86 |
| Sample B | 39.47±0.02 | 41.21±0.01 | 53.58±0.03 | 41.21±0.01 | 4.22 | 30.01 |

[a]Experimental calculation of ethanol concentration in alcoholic beverages samples with using the band area of CH group as a calibration curve
[b]Experimental calculation of ethanol concentration in alcoholic beverages samples with using band area of OH group as a calibration curve
[c]$\alpha$ is a standard deviation of the mean.
[d]Calculated as ”Experimental - Ebulliometer” /Ebulliometer ” ×100”, ignoring the sign

respectively. However, the unacceptable measurement of ethanol concentrations in the samples which were calculated by using calibration curve (OH) were observed. The extreme percentage differences between the experimental concentration and expected concentration of Sample A and Sample B were found to be 40.86%, 30.01, respectively. To use the stretching vibrations of OH band as a calibration curve could lead to inaccuracy in its results while analyzing because the interruption of the strongly vibrational H-bond of OH group network with the water molecules were performed [7]. However, the CH stretching band, which is the specific identity of ethyl molecules, exhibits high performance of the vibrational band contributing to the ethanol. Thereby the results, using the calibration curve (CH), present a high performance to developed quantitative Raman method for calculating the ethanol concentration in the samples. To our understanding, the calibration curve analysis of CH showed superior performance to analyze the ethanol content in various samples when compared with calibration curve OH analysis.

## 4. Conclusion

In this study, Raman spectroscopy was used as a tool to identify and determine the quantitative ethanol concentration in local Thai alcoholic beverages. The Raman spectra showed wavenumber ranging from 2600-3800 cm-1 for sample A (35 %v/v) and sample B (40 %v/v) corresponding to vibrational mode of CH and OH in the ethanol (CH3CH2OH) molecule. The baseline correction of ethanol spectra of various ethanol concentrations (0 - 95 %v/v) was used as standard. The integrated band area of stretching vibration of CH group with wavenumber ranging from 2800-3000 cm-1 and the integrated band area of stretching vibration of OH group with wavenumber ranging from 3100-3600 cm-1 were plotted and compared with the ethanol concentration to produce the calibration curve for CH and OH, respectively. The linear response between the integrated band area of CH and the ethanol concentration with a higher R2 value of 0.997 was observed. However, the low linearity with coefficient value (R2 =0.947) was found in calibration curve for OH. The ethanol concentration of Sample A and Sample B calculating from the calibration curve (CH) were found to be 33.88 ± 0.03 and 39.47 ± 0.02. The percentage differences observed in its value were compared with the Ebulliometer and found to be 2.69% and 4.22%, respectively. The large percentage differences were observed for calibration curve (OH) for Sample A and Sample B and were found to be 40.86%, 30.01, respectively. From the error analysis, the value can be explained due to the strong vibrations of H-bonding available in water molecule which will interrupt the OH stretching vibrations of ethanol molecule. These results can be concluded that quantitative Raman measurement has successfully investigated and showed that using calibration curve for CH exhibits high performance to determine the ethanol concentration in local Thai alcoholic beverages.

Acknowledgment

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# Factors Influencing Investment Intention Among Gen Z: The Antecedent of India

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## Abstract

This study aims to explore the factors which influence the investment intention of Gen Z to invest in the stock market in India and this topic is still not explored much. The study uses the 3 constructs of the Theory of Planned which are attitude toward behavior, subjective norms, and perceived behavioral control. Additionally, two more constructs were adopted to explore investment intention which are financial literacy and social factors. The study uses a quantitative approach wherein a questionnaire-based survey was done to collect responses from Gen Z individuals or Gen Zers (401 valid responses). A simple and multiple linear regression model has been applied for hypothesis testing using statistical software (SPSS-23). The results of this study show a significant influence of social factors and financial literacy on attitude toward investment. Furthermore, financial literacy also has a strong positive influence on perceived behavioral control. Moreover, attitude toward investment, financial literacy, perceived behavioral control, and subjective norms have a significant positive influence on investment intention. Significantly, financial literacy was found among Gen Z in India. The findings could be useful for ministers and policymakers to make some changes in the education courses so that students can be made more aware of the basics of the stock market. Also, this result is imperative to stockbrokers and publishers by giving them an insight into the opinion of Gen Z regarding investment in the stock market. Moreover, financial service providers can benefit by understanding the needs of Gen Z.

**Keywords:** financial literacy; Indian stock market; social factors; theory of planned behavior; young people.

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## 1. Introduction

Presently, due to an increase in the complexity and availability of an extensive variety of financial products and services, young people, the burden of managing money is becoming more difficult [1]. According to Hung et al. [1], "in developing countries like India, there have been abundant financial products available even for lower-income individuals, such as bank account can be opened without minimum deposit; thus providing for huge alternatives to choose from." The financial investment can be defined as placing cash into something with the desire for gain that upon deep analysis has high security for the invested principal amount, along with the security of return or gain, inside a normal time frame [2], [3]. In the past few years or decades, India has seen tremendous development. It is the fourth quickest developing economy on the planet. World Bank has estimated that India will continue to be the fastest-growing economy in the world at a GDP growth rate of 7.5% after 2018-2019 for two years [4]. Changes in economic policies like Demonetization and the introduction of GST in the country have brought a change in the finances of the country's people which can be seen in the decline in gross domestic savings rates declined to 30.1% in 2019 as compared to 32.4% in 2018 [5]. Therefore, based on these current policies, the study of investor intention and its related factors has become a subject of utmost importance in the context of India.

Recently, individuals have started participating actively in the financial markets [6]. There are numerous purposes behind this ascent in participation: first, financial market assets where chances of profitability are extraordinary. Financial markets or monetary markets offer the potential outcomes of "making money work" and acquiring returns from contributed capital [7]. Second, the flexible environment of financial markets offers a great opportunity of converting an asset into cash very quickly i.e., liquidity [8]. In conclusion is a wide variety, which implies that investors can find the opportunity to invest their funds based on their investment objectives outside of the accessible scope of financial assets [9]. It was noted that many Indian households still hesitate to take part, despite the recent events in the financial markets. According to one survey sponsored by SEBI (Security Exchange Board of India) household report [10], a mere 11% of the households in India participate in Mutual funds, Equity, Derivatives, Debt, and other financial instruments available in the market which is 24.5 million house-

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holds. While the leftover, 89% of the household units prefer to invest in non-risky instruments like Insurance schemes, banks, post offices, and so on [11]. The current study utilizes the Theory of Planned (TPB) to analyze investment intention among Indian individual investors belonging to Gen Z. This TPB model has been widely used in past research which measured investment intention or behavior of individual investors. The theory suggests that an individual's intention is the immediate cause for their conduct, while the intention itself is affected by three essential developments, particular attitude, subjective norms, and perceived behavioral control [12], [13]. Further in this study, there is a brief description of TPB. In most cases, Gen Z is described as those born between 1995 and 2012. It is India's first generation of digital natives and the person with the maximum age would be 25 in the year 2020 [14]. They filter information by applying filters on Instagram feeds which they do very easily, and their attention span is of just 10 seconds. The only thing constant in their lives is change [15]. Gen Z accounts for 32 percent of the worldwide population, whereas India's Gen Z population stands at 472 million according to Pomford [16].

Gen Z has grown in a different environment where they are surrounded by big corporate houses and dynamic technologies [17], [18]. Technologies are so advanced that every facility is available at its fingertips. The basic purpose of this study is to determine the factors influencing an individual's (Gen Z) attitude toward investment and investment intention, then study the impact of these factors on the attitude and investment intention of the individual. This investigation means to break down the impact of social variables on the attitude toward investment and ultimately investment intention. Social factors are the external forces that interrupt individual decision-making. The media, social interactions with friends and relatives, and the internet have become essential mediums for spreading and sharing information and ideas [19]. To study an individual's investment intention, a link is created between investment intention and social factors which include social interaction and media, attitude toward investment (ATB), perceived behavioral control (PBC), subjective norms (SN), and financial literacy (FL). Financial literacy as an intermediary of money-related information has additionally been connected to the ATB, PBC, and investment intention. The low degree of financial-related information can prompt data asymmetry as deposited by Antzoulatos et al. [20] which may influence the individual's participation in the stock market or other financial instruments. While ATB, PBC, and SN are the variables from the theory of planned behavior (TPB) that have been widely adopted to investigate intention, an individual's intention for a specific choice to a great extent relies on his/her perception and feeling which further changes according to their social and cultural settings [21], [22]. As India has a highly diverse culture and has a different degree of social norms, it is very conceivable that Indians may act uniquely in contrast to their western counterparts.

There has been much research done on the investment intention or investment behavior of households and traders but there is very limited research on the investment intention of students and youngsters [23]. The oldest member of Gen Z would still be only 27 years old in 2022. So, it is important to explore which factors influence the intention of Gen Z in India while making an investment and how these factors impact their investment intention.

Different theories like the theory of planned behavior (TPB) and the theory of rational action (TRA) etc. have been adopted by different scholars to examine the behavioral and psychological factors influencing an individual's investment intention. According to Hietanen [24], investment means the production of goods and services that produce other goods in economic terms. Popularly, financial investment is when a person purchases something of monetary value for example stocks and bonds [25]. Young people's financial investment goes beyond physical to nonphysical investments like human capital investment i.e., investing in one's education to learn and acquire knowledge, skills, and financial literacy [26].

From Oxford Dictionaries, (2017) the definition of investment is an action or buying something that will make possible profit in the future. Authors like Hietanen [24] posited that investment from an individual's perspective is seen as a profit-making activity that can be applied to the financial markets i.e., putting money aside for investment with the assumption that it will make a profit in the future for the person who invested. According to Sayeda et al [27], investment intention means an action or plan that young people as an actor considers necessary, and thus intends to undertake to accomplish a certain behavior. In this study, the Theory of Planned Behaviour (TPB) and other variables derived from the literature were adopted and integrated to examine the investment intention among Gen Z in India. This section explored all the variables adopted in this study.

*A. Social factors and Attitude Toward Investment:*

According to Ajzen and M. Fishbein [28] attitude is a positive or negative impression in performing a behavior. The authors maintained that attitude is a learned predisposition to respond in a certain way either favorably or unfavorably to a given object. Attitude toward investment in this present study means the Gen Z attitude towards investment in the financial market like the stock market perceived as favorable or unfavorable which motivates their intention [29]. On that note, Shanmugham and Ramya [30] examined this field and their aim was to investigate the impact of social components on the attitude and intentions of in-

dividuals while trading. Social variables are the external powers that influence an individual decision process. The media, social interactions with companions and family members, and the internet have become fundamental tools for spreading and sharing information and thoughts. Individual investor talks with, and are influenced by their family members, neighbors, and companions undoubtedly [31]. Moreover, East et al. [32] claimed that Word-of-Mouth has a great impact on an individual when compared to any other source of market. Furthermore, Thavva [33] found that people who have low financial literacy sort advice for financial behavior from their friends, and they are not deciding to invest in the stock market.

*B. Financial Literacy and Attitude Toward Investment:*

According to Tamer [34], different researchers have defined financial literacy in many ways, for instance, financial literacy is "the ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial well-being." Financial education is "the process by which people improve their understanding of financial products, services, and concepts, so they are empowered to make informed choices, avoid pitfalls, know where to go for help, and take other actions to improve their present and long-term financial well-being" according to Hung et al. [1]. Furthermore, Raut [12] mentioned in his study that the attitude (ATB) of investors experiences complex factors, for example, ambiguity, risk, and excessive availability of options. In such circumstances, Financial Literacy (FL) plays a vital role in investment decision-making. In the event where the investor has the ability of financial literacy, he/she manages to get himself/herself in a superior situation to make an evaluation concerning his/her investment risk dependent on the signs he/she gets and the capacity to process it in a better manner [35].

*C. Financial Literacy and Perceived Behavioral Control:*

In previous studies from the definition above, financial literacy (FL) has been accepted as one of the most common critical variables influencing the ability of people to settle on financial choices [36], [37], [38], and [39], and it is reported that lack of financial literacy (FL) add to latency and problematic financial decision making. Perceived behavioral control is defined as someone's ability to act on a specific behavior. it is related to an individual belief relating to controlling an action which is an investment in this study. According to [28], perceived behavioral control concerns a person's ability to achieve a specific result. Young people who have a strong perceived behavioral control are likely to act on the intention and perform the said behavior as stated by [28].

*D. Attitude Toward Investment and Investment Intention:*

In TPB, the intention is the nearest determinant of behavior which on the other side is controlled by the attitude toward the investment of people [40]. Attitude toward investment (ATB) is both the negative and positive establishment for future conduct or behavior that might be enjoyable or pleasant [41]. Previous studies like [42] stated that if an individual holds a good attitude toward a specific behavior, there are chances they will build up a positive intention to attempt that behavior [43].

*E. Financial Literacy and Investment Intention:*

According to Raut et.al [44], in their paper referenced that financial literacy and awareness are considered essential for settling on a knowledgeable and sound investment decision. Individuals with financial ability have a superior capacity to comprehend money and to bring in money-related decisions [45].

*F. Perceived Behavioral Control and Investment Intention:*

According to Shamugam Ramya [30], the authors stated that the accessibility of essential opportunities and assets spoke about individuals' real command over their behavior, in particular, 'perceived behavioral control (PBC). TPB has been generally utilized and effectively applied to foresee individuals' intentions and then their behavior [28]. As indicated by [46], attitude, and perceived behavioral control are primary factors affecting investment intention.

*G. Subjective Norms and Investment Intention:*

During the 1970s, Icek Ajzen and Martin Fishbein built up the Theory of Reasoned Action, which portrayed 'attitude' and 'subjective norms' to be two determinants of behavioral intention [28] and [47]. According to Shanmugham and Ramya [30], investigation referenced that accepted practices, conclusion pioneers, relatives, and companions may assume a significant function in influencing individuals' goals. In this research, Gen Z people's intentions in financial investment are influenced by social norms from the TPB of [28].

## 2. MATERIALS AND METHODS

This section consists of the previous research which studied the relationship between the variables used in the current study. The conceptual framework, hypothesis, and methods used for data analysis were explained. Attitudes toward behavior, perceived behavioral control and subjective norms are the three variables as per the theory of plan (TPB) which is a model used by social scientists to investigate intention and was adopted for this research with other variables such as social factors and financial literacy.

*Conceptual Framework:*

Based on previous empirical studies and some relevant theories like TPB, the researcher has developed a new conceptual framework. The conceptual framework used in this study is to examine the factors influencing investment intention among Gen Z in India. In

figure 1, social factors, financial literacy, and subjective norms are the independent variables, while attitude toward investment and perceived behavioral control are intervening variables. Attitude toward investment is playing a dual mediating role, first between social factors and investment intention and second between financial literacy and investment intention. Perceived behavioral control is playing a mediating role between financial literacy and investment intention. The dependent variable is investment intention (Fig. 1).

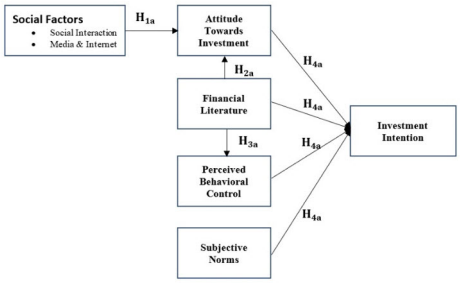


**Figure 1**: Conceptual Framework

*Research Hypotheses:*

From the previous studies and the conceptual framework, these hypotheses were developed to test the relationships between the independent variables and the dependent variable, hence the hypotheses are as follows

**Hypotheses**

**H1:** "Social factors have a significant influence on Attitude s Investment"

**H2:** "Financial Literacy has a significant influence on Attitude s Investment"

**H3:** "Financial Literacy has a significant influence on Perceived Behavioural Control"

**H4:** "Attitude s Investment, Financial Literacy, Perceived Behavioural Control, and Subjective Norms have a significant influence on Investment Intention"

*Questionnaire design:*

The research questions were designed only in the English language with close-ended questions, which means the respondents must answer from the predetermined options. The questionnaire designed by the researcher included three parts with a total of 26 questions. The first part relates to the screening question to ensure whether the respondent belongs to Gen Z and has some idea of the different investment options available. The second part aims to find a significant relationship between independent variables, intervening variables, and the dependent variable which is investment intention. Thus, the items in the 2nd part relate to the measurement of variables of research by using five Likert scales from strongly disagree to strongly agree. The last part relates to demographics which are gender, age, education, and professional experience.

*Independent Variables Measurement:*

All the independent variables measurements were adopted from the literature that has been used in previous studies and is valid and reliable. Social factors were measured using 4 statements measuring social interaction and media internet adopted from [48] and [49]. Attitude toward investment was measured using 3 statements adopted from [50]. Financial literacy was measured using 4 statements adopted from [39], [51]. Perceived behavioral control was measured using 3 statements based on [52], Lastly, subjective norms were measured using 3 statements based on [51].

*Dependent Variable Measurement:*

The dependent variable investment intention measurement was also adopted from the previous studies. There were 3 statements used to measure investment intention which were adapted from [50]. It asked participants whether they would frequently invest in the stock market or encourage their family and friends to invest in the stock market. They were also asked if they would soon invest in the stock market.

*Sampling and Data Collection:*

In this study, the convenience sampling procedure has been applied initially then followed by the snowball sampling technique. Both are the type of non-probability sampling. The researcher first distributed the questionnaire to his friends and acquaintances and asked them to distribute the same questionnaire to their friends and known ones, and so on. In this study, the researcher uses primary data which was collected from the respondents through the online survey questionnaire. The digital questionnaire was created using Google forms. The online questionnaire was forwarded using social media platforms.

*Data Screening:*

A total of 425 responses were received, out of which 24 did not belong to Gen Z. Therefore, 401 responses were considered usable and the remaining 24 responses were eliminated in the data screening. The remaining 401 responses were further analyzed using Statistical software (SPSS-23). This section focuses on the analysis of primary data obtained from the respondents through a distributed questionnaire. Each variable is analyzed using mean and standard deviation. Additionally, simple linear regression and multiple linear regression models were used for hypothesis testing.

## 3. RESULTS AND DISCUSSION

This section focuses on the analysis of primary data obtained from the respondents through a distributed questionnaire. Each variable is analyzed using mean and standard deviation. Additionally, simple linear regression and multiple linear regression models were used for hypothesis testing.

*Demographic Profile of the Respondents:*

**Table 1.** SUMMARY OF GENERAL INFORMATION BY USING FREQUENCY AND PERCENTAGE

| Descriptive Results | | |
|---|---|---|
| **Variables** | **Frequency (f)** | **Percentage(%)** |
| **Gender** | | |
| • Female | 164 | 40.9 |
| • Male | 237 | 59.1 |
| **Age** | | |
| • Less than 18 | 11 | 2.7 |
| • 18-21 | 113 | 28.2 |
| • 22-25 | 277 | 69.1 |
| **Education level** | | |
| • High school or less | 11 | 2.7 |
| • Senior Secondary school | 18 | 4.5 |
| • College Graduate | 260 | 64.8 |
| • Advance degree | 107 | 26.7 |
| • Other | 5 | 1.3 |
| **Professional Experience** | | |
| • Freshman | 202 | 50.4 |
| • Job experience | 87 | 21.7 |
| • Self-employed | 87 | 21.7 |
| • Other | 25 | 6.2 |

From Table 1, the 401 samples collected and analyzed, most of the respondents were male which is 59% and 41% female respectively. Furthermore, most of the respondents were within the age range of 22-25 (69%), and age groups 18-21 and less than 18 years are 28.2% and 2.7% of the total respondents respectively. Additionally, from table 1, the data analysis shows that college graduate is the most common education level among all the respondents at 64.8%, followed by advanced degree and senior secondary school at 26.7% and 4.5% respectively. The least respondents are from high school or less and other education levels at 3.8% and 0.2% respectively. The respondents are mostly freshmen with no professional job experience (51.9%) and others have job experience or were self-employed (25.7% and 24.7%). The remaining 2.1% of respondents are students or have other professional experience.

*Reliability Analysis:*

Cronbach's alpha was used to measure the reliability of the statements within the variables of the questionnaire. A pre-test was conducted on 50 respondents to measure the reliability. Results of the pre-test and final test are demonstrated in Table 2 below. All the variables had a reliability of more than 0.6, so the questionnaire was considered reliable and further distributed to achieve the required sample size.

*Hypothesis Testing:*

After testing the reliability using Cronbach's Alpha,

**Table 2.** THE SUMMARY OF RELIABILITY ANALYSIS BY USING CRONBACH'S ALPHA

| **Variables** | **Pre-test Cronbach's alpha (50)** | **Cronbach's alpha (401)** |
|---|---|---|
| Social factors | 0.611 | 0.682 |
| Attitude towards Investment | 0.899 | 0.874 |
| Financial Literacy | 0.888 | 0.839 |
| Perceived behavioral Control | 0.857 | 0.830 |
| Subjective Norms | 0.692 | 0.745 |
| Investment Intention | 0.795 | 0.856 |

Table 3, summarized the result of the hypotheses testing. From the data analyzed, hypotheses one, two, and three were analyzed using simple linear regression, and hypothesis four was analyzed using multiple linear regression. At a 95% level of confidence, hypothesis one, hypothesis two, and hypothesis three were all statistically significant and accepted at the significance level of 0.000 (0.000 ¡ 0.05). In hypothesis four, attitude toward investment, financial literacy, perceived behavioral control (PBC) and subjective norms have significant levels of 0.000, 0.004, 0.000, and 0.000 respectively. All four variables have a statistical significance level of less than 0.05, therefore, hypothesis four is also supported and accepted. The unstandardized beta value () for hypothesis one, hypothesis two, and hypothesis three is 0.343, 0.407, and 0.674 respectively. In hypothesis four, attitude toward investment, financial literacy, perceived behavioral control, and subjective norms have unstandardized beta values () of 0.464, 0.140, 0.291, and 0.276 respectively. The results of hypothesis testing prove that there is a significant influence of social factors and financial literacy on attitude toward investment. Moreover, there is a significant influence of financial literacy on PBC. In addition, there is a significant influence on attitudes toward investment, financial literacy, perceived behavioral control, and subjective norms on investment intention.

*Discussion:*

The present study aims to study the factors influencing investment intention among Gen Z in India. A total of five independent variables are considered and one dependent variable i.e., investment intention. The five independent variables include social factors, attitude toward investment, financial literacy, perceived behavioral control, and subjective norms. Attitude toward investment plays a dual-mediating role between social factors and investment intention and another between financial literacy and investment intention. Additionally, perceived behavioral control also plays a mediating role between financial literacy and investment intention.

To elucidate the findings, first, social factors have a significant positive influence on attitude toward invest-

**Table 3.** THE SUMMARY OF THE RESULTS FROM HYPOTHESIS TESTING

| Hypotheses | Statistical Analysis | Level of Significance | Coefficient Beta () value | Results |
|---|---|---|---|---|
| **H1:** "Social factors have a significant influence on Attitude towards Investment" | (OLS) Simple Linear Regression | 0.000 | 0.343 | **Accepted** |
| **H2:** "Financial Literacy has a significant influence on Attitude towards Investment" | (OLS) Simple Linear Regression | 0.000 | 0.407 | **Accepted** |
| **H3:** "Financial Literacy has a significant influence on Perceived Behavioural Control" | (OLS) Simple Linear Regression | 0.000 | 0.674 | **Accepted** |
| **H4:** "Attitude s Investment, Financial Literacy, Perceived Behavioural Control, and Subjective Norms have a significant influence on Investment Intention" | (OLS) Multiple Linear Regression | | | **Accepted** |
| - Attitude towards Investment | | 0.000 | 0.464 | |
| - Financial Literacy | | 0.000 | 0.140 | |
| - Perceived behavioral Control | | 0.000 | 0.291 | |
| - Subjective Norms | | 0.000 | 0.276 | |

ment. The degree of correlation is weakly positive. The reason for the weak relationship is the change in the thinking of Gen Zers. Gen Z people do not want to follow their friends or other important people blindly. So, when it comes to investment decisions, they prefer to talk with friends and families and use media and the internet, but alone these factors are not enough to motivate them to invest. Most Gen Z people would prefer the advice of an expert when making an investment decision which has the highest means out of all the statements in a questionnaire (4.32).

To elucidate the findings, first, social factors have a significant positive influence on attitude toward investment. The degree of correlation is weakly positive. The reason for the weak relationship is the change in the thinking of Gen Zers. Gen Z people do not want to follow their friends or other important people blindly. So, when it comes to investment decisions, they prefer to talk with friends and families and use media and the internet, but alone these factors are not enough to motivate them to invest. Most Gen Z people would prefer the advice of an expert when making an investment decision which has the highest means out of all the statements in a questionnaire (4.32).

Secondly, financial literacy has a significant influence on attitude toward investment. Although financial literacy positively influences the attitude toward investment, the degree of influence is weak. Thus, attitude toward investment is not only affected by social factors and financial literacy but also by various factors. Due to this, financial literacy alone has a weak influence on attitude toward investment. So, it is not necessary for every Gen Zer with sufficient financial literacy to hold a positive attitude toward investment and vice versa.

Thirdly, perceived behavioral control (PBC) is very similar to self-efficacy but PBC is measured based on the ease of performing a particular action while self-efficacy is measured on confidence. A person with sufficient financial literacy would find investing easy compared to a less financially literate person. Therefore, financial literacy has a strong positive relationship with perceived behavioral control. As per the study, a financially literate person would know where to buy stocks, identify profitable stocks, and invest conveniently in favorable stocks.

Fourthly, regarding the investment intention, starting with attitude toward investment, attitude is the outlook of an individual which can be both positive and negative. If an individual holds a positive attitude towards a certain thing, then there are greater chances of the individual performing such. Attitude toward investment has a strong influence on investment intention. When compared individually, attitude toward investment has the highest correlation coefficient with investment intention which is 0.672. Secondly, financial literacy, as an investment involves money-related decisions therefore, it is very important to have sufficient knowledge of the related aspects. An individual with less knowledge and ability of the stock market would hesitate in participating in the market.

According to the results, financial literacy positively influences investment intention, meaning that a financially literate person would have greater chances of having the intention to invest in the stock market. Furthermore, perceived behavioral control (PBC) relates to the perception of one's own ability to perform a particular action. PBC has a strong influence on investment intention, when calculated individually PBC has a correlation coefficient value of 0.605 with investment intention whereas the unstandardized beta value is 0.291. Thus, if Gen Zer feels that he/she can invest in the stock market with some ease based on their knowledge and ability, then there are greater chances of them having the intention to invest in the Stock market

Lastly, subjective norms relate to the approval of Gen Z people by an important person or group of people. Subjective norms have a positive influence on investment intention. When calculated individually, subjective norms have a correlation coefficient value of 0.502 with investment intention while the unstandardized beta value is 0.276. When we talk about Gen Zer, they are still young and most young individuals consider their parents, teachers, and friends as important people in their life. When it comes to investment decisions, most young individuals would desire their approval from the person/people they considered as influential, if such important people motivate the individual to invest in the stock market, then there is a greater possibility it would lead to the formation of positive intention to invest.

## 4. CONCLUSIONS

Many of the respondents were males (almost 60%) and the most common age group is 22-25 years (almost 70%). When it comes to education, almost 65% are college graduates. More than half of the respondents are freshmen and when it comes to most preferred investment tools then stocks occupy the topmost position (48.4%) followed by real estate (47.6%) and mutual funds (44.1%). When we talk about factors influencing investment intention, there can be numerous other factors like income, experience, demographic characteristics, etc. The researcher focused on a few variables which are social factors, Attitude toward investment, financial literacy, perceived behavioral control, and subjective norms with the dependent variable as investment intention. These factors were chosen because the researchers found these factors to be more relevant when we consider the research population which is Gen Z. Not all Gen Z have started earning and not many Gens Zers have any past investment experience which is why income and past were excluded from this study. There are also many other

factors that influence investment intention that was not included in this study, other regions as this study were done on only Indian Gen Z, and other concepts and variables which the scope of this study did not cover and are considered as the limitation of the study and are therefore recommended for future researchers to explore more on these areas. This research has both theoretical and practical implications. For the theoretical implication, this study used TPB and variable measurements from previous studies, this confirmed the strength of the theory in predicting intention. Additionally, it confirmed the research instruments and measurements which will search as a reference for further research. The practical implication is the useful information that this study provides for ministers and policymakers to make some changes in the education courses so that students can be made more aware of the basics of the stock market. Also, this result is imperative to stockbrokers and publishers by giving them an insight into the opinion of Gen Z regarding investment in the stock market. Moreover, financial service providers can benefit by understanding the needs of Gen Z.

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# Enhancing EFL college students' cross-cultural awareness and English learning through the implementation of a SPROUT project-based textbook

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## Abstract

Sensitive to student needs in today's globalized world, this study reports the creation and trial, at a Taiwan university, of a new cultural awareness-focused handbook for an English reading course for non-English majors. Research questions were: 1. What kinds of intercultural knowledge needs do the students have? 2. What are students' views of instruction with the new SPROUT project based English Handbook, rich in cultural awareness material? Methodologically, first, a needs analysis was undertaken based on expert judgment, and questionnaire data from 617 students, which guided the construction of the cross-cultural Handbook. Second, a new undergraduate course 'Cross-cultural Appreciation and English Communication' was introduced in the General Education Center (Hung Kuang University) exploiting the Handbook, to develop students' critical reading skills and cross-cultural literacy. 179 freshmen from the Department of Nursing participated and wrote reflective reports. Qualitative thematic analysis of the reports evidenced English language learning and increased cross-cultural critical awareness. Key findings were: support for the value of the 'lived cultural experience by proxy' handbook material for both class and self/home use, and the successful teaching of English cultural awareness to students of quite modest English proficiency.

**Keywords:** SPROUT project, intercultural knowledge, English as a foreign language, critical thinking skills, cultural awareness, nursing students

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## 1. Introduction: The Language and Cultural Challenges of Globalization

In today's globalized world, many countries with emerging economies seek to establish and improve their commercial and political status in the global arena. English, being the language of globalization, is typically seen as a key part of achieving that [1]. However, this preoccupation overlooks the cultural dimension. That globalized arena, populated by good L2 English speakers of many backgrounds who outnumber English native speakers, is multicultural [2]. Hence intercultural skills are required in addition to English language skills [3], but are rarely a prominent feature of tertiary-level English courses for non-English majors. The significant objective of this study is, therefore, to contribute to filling that gap, by developing and trialing an English Handbook with a strong element of inter-cultural content. It aims to develop our understanding both of what cultures and intercultural topics are relevant and of how intercultural awareness is best stimulated, in students of limited English ability who are not English majors. This is of potential interest in many countries where English has a similar status to that which it has in Taiwan (e.g., Thailand, Saudi Arabia, Turkey).

## 2. The SPROUT Project

Against this background, the Taiwan Ministry of Education initiated the SPROUT project ('Sustained Progress and Rise of Universities in Taiwan'). This aims to 'Facilitate universities to elevate international competitiveness....' [4] which would include improvement in English and intercultural competence. Full-time university teaching staff in Taiwan are mandated to participate in the SPROUT project in various ways. The present researcher at Hung Kuang University, as the front runner from her Department, served as a full-time coworker with PouHsin publisher (Aug. 2017 to Dec. 2018), and then put on a new culture-oriented English course, which is described below.

## 3. Literature Review

### *3.1 Tertiary English for Non-English Majors*

Research on the teaching of English at the tertiary level often focuses on English majors, and/or on issues other than cultural ones. Main themes that have

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been pursued for non-majors however include motivation since one of the biggest challenges in teaching English to non-English majors is motivating students to learn a language that they may not see as relevant to their future needs, when their majors are not taught in English [26]. That connects with needs analysis which should be undertaken to determine the language skills that such students need to develop in order to succeed in their academic programs and future careers. This can help teachers and institutions tailor their instruction (syllabus, delivery and assessment) to meet the specific needs of their students [19]. A finding has been that such students may recognize some future needs for English for purposes such as communicating with foreigners, obtaining a good TOEFL score, or being able to use the Internet better, but still possess a low level of English proficiency and be reluctant to learn English autonomously [27]. This underlines the need for suitable instructed courses to be provided, such as that introduced in the present study.

Research on courses and materials specifically for tertiary-level non-English majors is sparse. Vietnam is reported as having developed a special program for this audience. Notably, it is tied to European CEFR criteria, but there is no mention of it possessing any special cultural or intercultural dimension [28]. By contrast, a study of the use of communicative teaching with such English learners in Taiwan [25] makes several mentions of culture as an associated necessary target. However, it concludes that this aspect is one of several that are not in practice well-represented in tertiary-level teaching, and that this could be in part due to teachers themselves not possessing the necessary knowledge. This, therefore, points to the need for new culturally rich materials for classroom use, such as those developed for the present study.

### *3.2 Cross-cultural Awareness and English Learning*

While the need-to-know English in order to function in today's globalized world is quite clear to most people [5], the need for cultural awareness is less so. However, when diverse people communicate in English as an international language, cultural differences are not removed but may be just disguised [6]. Therefore (inter/cross) cultural awareness is needed [7].

The ability needed to deal with this level of communication is often called inter- or cross-cultural awareness. Specifically, Chen and Starosta [7] define this as "the cognitive aspect of intercultural communication competence that refers to the understanding of cultural conventions that affect how we think and behave" [7 p28]. Intercultural communication competence, in turn, is defined as "the ability to effectively and appropriately execute communication behaviors that negotiate each other's cultural identity or identities in a culturally diverse environment" [7 p28].

Teaching of such ability can occur in classes 'across the curriculum' [8], especially where the students come from multi-cultural backgrounds [9]. In Taiwan, however, that context does not widely occur naturally, but, we argue, intercultural awareness can arise through specially designed English course materials which can enrich learners' cultural understanding [10]. Indeed, for this reason English as a foreign/international language is not usually taught exclusively in association with the 'source culture' of the students' L1 [11], although in some countries that can be favored [12].

Researchers have studied the cultural content of textbooks on English as a foreign or international language [13, 14, 15]. Much of this, however, is simply document analysis research, showing what aspects of culture and/or what cultures are covered in existing textbooks, and how (e.g. [16, 11]), rather than, as in the present study, designing and trialing new materials. In addition, it is the researcher's understanding and analysis of what is in the textbooks that are central to such studies, not what the students using the textbooks understood or gained from them, which are focal in the present study.

Gashi [10], for example, conducted an evaluation of a culture-oriented English syllabus in Kosovo and concluded that 'English teachers, in Kosovo and potentially internationally, need to be more creative in utilizing more authentic cultural materials in their classes to bring to life the target culture.' ([10], p357). That call was addressed by the new material used in the present study. A study superficially closer to ours was [29] in China (PRC). However, that proved to be quite different in that it involved evaluating the cultural aspect of teaching on the assumption that such content should be a vehicle for delivery of state ideology and political knowledge to students, not as we believed, an occasion for development of cross-cultural awareness. Furthermore, it used automatic analysis of the facial expression of the students as a measurement of successful delivery which, although potentially interesting, was not a technology available to the present researcher, who relied on student self-report.

Finally, the literature often assumes that teaching culture is something done at an advanced level after students have become proficient in the language associated with a culture [17]. This view is however challenged [18] and it is one of the purposes of the present study to see if foreign UK and US cultural features can be taught successfully to students at university with low proficiency in the relevant language (English).

## 4. Research Questions

The following questions were, therefore, posed concerning non-English major tertiary level students in Taiwan.

1. What kinds of intercultural knowledge needs do the students have?
2. What are students' views of instruction with the new SPROUT project English textbook, rich in cultural awareness material?

## 5. Study Phase 1. Needs Analysis Method and Findings

The first phase, preparation, enhanced and disseminated teacher professional knowledge (consistent with SPROUT requirements), and ascertained student needs (RQ1), so as to inform the creation of a new textbook and course. The needs analysis was in part conducted through expert judgment of the researcher, by considering what needs for English they would likely encounter in future jobs after graduation. For instance, the nursing students who were focused on in Phase 2 needed to function in the school affiliated Kuang Tien General Hospital which had recently increased overseas patient intake, and many nursing graduates go on to work in local private hospitals which cater in part for international visitors to Taiwan. This entails a need for English as a lingua franca and some familiarity with commonly encountered cultures such as US, as well as nursing English (English for Professional or Occupational Purposes, not for Academic Purposes).

In addition, a short questionnaire survey was conducted of 617 students from a wide range of majors, at the end of a series of cross-culture workshops designed and hosted by the General Education Center. They were asked open questions about what cultural aspects they wanted to hear more about, and from what countries. In all, 43 different countries were named as of cultural interest, in 513 responses. On international multicultural themes of interest, 389 individual suggestions were given.

Since these student responses technically concerned their wants (what they were interested in) rather than needs (what they might require in a future workplace), they were interpreted with caution [19]. For instance, Japan was the most frequently named country of interest, but the researcher's attention in the textbook remained predominantly on cultures associated with English, given that North America came second, followed by other English using countries which in terms of trade together outweigh all other destinations including Japan [20]. The cultural topic suggestions also ranged very widely, testifying to a high level of student interest in learning more about different countries and cultures: they included K-POP, Buddhism, Canadian history, elephant culture, and Nordic diet. However, some broader themes stood out, such as (with numbers of mentions): travel (38), food (71), art (16), traditions/history (25), and overall culture of a distinct area (105). These, therefore, featured prominently in the specially created textbook course materials.

## 6. Study Phase 2. Intervention with a New Course

In the second phase, execution, the work was undertaken under the aegis of the MOE SPROUT ('Sustained Progress and Rise of Universities in Taiwan') project, and sponsored by the PouHsin publishing house. This first enabled the creation of 'East Meets West: A Cross-cultural Handbook', described fully below. Next, a new language arts undergraduate course 'Cross-cultural Appreciation and English Communication' came into being designed based on this SPROUT project textbook. All went through strict evaluation by the Department, College and School curriculum committees. This was then introduced in the General Education Center of Hung Kuang University, initially for the nursing students considered in the present study, but with the eventual aim to be used for students across disciplines and majors once its effectiveness had been demonstrated.

### *6.1 Course Participants*

179 freshmen from the Department of Nursing at Hung Kuang University participated. They are required to take one English language course (totaling 2 hours a week) over the first two years of their undergraduate study, although their Nursing instruction is all in Mandarin. All participants were Taiwanese, predominantly female, of varied social backgrounds, with the Chinese language as L1 and late beginner or low intermediate English proficiency at best (A2/B1 on the CEFR scale).

### *6.2 Specially Created Textbook*

The core of the new course intervention was an innovative new theoretical and practical teaching textbook created by the researcher, 'East Meets West: A Cross-cultural Handbook', published with PouHsin. The handbook is based on reading material whose content embraces East-West cross-cultural insights, drawing on the author's own experiences studying in the UK over 10 years and traveling internationally, with her daughter. It includes authentic materials, and survival medical English material relevant to nursing, as well as travel safety which became a crucial theme in the COVID pandemic era. It provides many examples to establish the concepts, and practical English teaching activities involving writing, and especially speaking skills, such as dialogs and conversations in English as well as after-class exercises.

Distinctive features include the following. The content, case study exercises, essay questions, and oral work are interwoven systematically. The cross-cultural information covered is evidence-based (guided by information from Phase 1 above) and diverse in country and topic. The writing style has high readability. To ensure comprehension, both English and Mandarin Chinese are presented in parallel in the book, together with Pin-yin transliterations. Potential

uses are abundant. For instance, the teaching material is appropriate for use in class or as self-learning material.

The cultural aspect is implemented with an eye to the view of Moran ([17], p3) that 'culture learning, whether it occurs in a foreign language or second language context, inside or outside the classroom, with or without teachers, through books or through people, is best seen as a lived experience, as a personal encounter with another way of life.' Although in Taiwan the students cannot by themselves readily live in another culture in that way, through this textbook they do directly access the lived experience of foreign cultures by another person from their own native culture, not just a dry third person description. As one student observed: *'I can say "this is not a textbook but a journal" describing what a mother and her daughter saw, heard and felt in a culturally different context' (C108xx05).*

Furthermore, the fact that extensive use is made of translation is consistent with the view of Décuré [18] that a foreign culture does not have to be learned only through the associated foreign language.

The book (and the course using it) follows three main topical themes which are implemented in ways that further the overall aim to enhance students' multicultural competence and communicative English language proficiency (Table 1). Between these topics, all five of Moran's [17] dimensions of culture are covered.

### *6.3 Course Procedure and Instrument*

The Cross-cultural Appreciation and English Communication course was delivered pre-COVID over one semester at the rate of 2 contact hours per week. The lead researcher, as the course teacher, was involved in teaching all four class groups, average class size of 47. Typically, one topic from the textbook was dealt with each week. It was exploited by engaging students first with comprehension of the content, and then with extended exercises to practice the four language skills, i.e., listening, reading, writing and speaking. This involved a wide range of presentation and practice resources, including films specifically produced based on the textbook unit, i.e., food, leisure, art and medical English, audio input, lecturer involvement, MALL (mobile assisted language learning, using Kahoot, Padlet etc.), CALL (computer assisted language learning, accessing KidsHealth.com and relevant cross-cultural YouTube videos, etc.), team work-based activities, and board games. The examples and case studies from the textbook were then given to the students for review and self-learning after class. In order to develop students' logical and coherent thinking, the teacher pointed out the specific topics for students to cover in discussion and reflection.

The final course assessment involved a finale show where students role-played in groups, adopting any cross-cultural topics they liked. Students had to draft a sketch, role play, and make a film as a final project which involved all four language skills. In addition, to enable the researcher to ascertain student perceptions after using the textbook (RQ2), and to assess learning progression and evaluate the textbook, the students were asked to write a reflective essay (in Chinese, often mixed with some English words) on their thoughts and experience of the course and the textbook. The reflective reports counted as a homework assignment and were graded; with student consent, they were further analyzed for the study. The 179 students generally wrote between 200 and 400 words. Using qualitative analysis, the data was read and reread, using the constant comparison method, and themes were identified by the researcher (checked with one other expert), as listed in Table 2.

## 7. Findings from the Reflective Essays

Answering RQ2, overall, considerably more points were identified that related to the cross-cultural themes (535) than the language themes (208) (Table 2). This perhaps reflects the participants' identification of the course and textbook as more directed to cultural learning than language learning, or simply that the cultural aspect caught their imagination more and therefore inspired more reflection and comment. For reasons of space, only the culture-related findings are reported here.

## 8. Culture and Contrast Themes

Rich evidence of the student view of, and response to, the cultural aspect of the content was found, with more than two and a half times as many points directed to it than to language aspects. The predominant themes uncovered in their reflections were critical thinking and connection with personal experience.

In their responses, students often exhibited critical thinking (58.9%, the highest percent for any subtheme in the data), in a variety of forms. Here it takes the form of extracting implications about war from the input text followed by giving a personal response.

*'From this text, I can imagine people in Rome, dressed in clothes appropriate to their era, selling things in the marketplace. While women were buying food, the men were fighting away from home. But how many wars have taken so many lives? How many happy families were ended, when the war took away relatives? All this is so real, ...' (C108xx15).*

By contrast, here a student was prompted by the text to think more widely about the issue of protection of the environment to save the planet (so...):

*'The issue of using plastic bags has also greatly affected the world, so we advocate environmentally friendly bags, environmentally friendly chopsticks, and environmentally friendly straws' (C108xx41).*

**Table 1.** Sections of the Textbook

| **Part 1: Childhood** | | **Part 2: Travel** | **Part 3: Survival Kit (Medical English)** |
|---|---|---|---|
| Formosa / Taiwan | History | Introduction and Scenic Sites | Basic conversation |
| Childhood in England | Natural Science and Invention | Food | Making payment |
| School work | Extra Curricular topics | Art and Leisure | Medical English |
| Language Arts | | | |

**Table 2.** Percentages of students making one or more points related to the identified themes

| **English language learning** | **%** | **Cross-cultural reflection** | **%** |
|---|---|---|---|
| Pictures | 22.3 | Exhibit critical thinking | 58.9 |
| Idioms | 21.1 | Relate to personal experience | 57.7 |
| Vocabulary | 14.9 | Make comparisons (incl. cross-cultural) | 37.1 |
| Variety of contents | 7.4 | Add further related information | 36.0 |
| Enhance reading ability | 6.3 | Experience the country oneself | 26.9 |
| Sentences | 6.3 | Learn new cultural knowledge | 25.1 |
| English accompanied by Chinese | 6.3 | Do some online research | 9.1 |
| Improve English ability | 5.7 | Quotations | 6.3 |
| Dialog | 5.7 | Festivals | 5.7 |
| Phrases used in daily conversation | 5.7 | Protecting the environment | 4.6 |
| Pinyin | 5.1 | Recommend the country to others | 2.3 |
| Practice | 5.1 | Religion | 2.3 |
| Medical English and phrases | 5.1 | | |
| Content interest | 4.0 | | |
| Grammar | 2.9 | | |
| Content clarity | 0.6 | | |

Next, it was noticeable how often student response was to the content (message), rather than the language (medium) and was quite personal, evidencing how engaging they had found the classes to be. 57.7% of students were coded as making comments relating to personal experience, e.g.

'After reading the content written by the teacher, I am particularly interested in tourism. Since I was a child, my family has been fascinated by it, no matter what the weather is in the four seasons,.....'

We see here a fully communicative response to the message in the book, drawing on personal experience. Such a response provided direct evidence that the book was absorbing their attention, engaging them with its message, and hence likely generating more input and a greater intake from it.

Another common response, as we had hoped, was to draw attention to cultural contrasts (37.1%). In the following case, it is between England and Taiwan, which is the contrast most invited by the author of the textbook, due to her own life experience. Here a student offers their own interpretation:

*'I also saw the author's daughter's love for the UK. The UK seems to be more leisurely than Taiwan, and the pace is more relaxed. Although I have never been to the UK, maybe the British know how to relax at the right time, and life should not be too stressful. On the other hand, in Taiwan's cities, such as Taipei, every time you go to Taipei Main Station, everyone's footsteps are very fast. It may be because of hard work or a busy life...' (C108xx42).*

As she admits, the contrasting picture she creates may not be entirely correct. Indeed, possibly it is colored by the fact that the author of the textbook spent much time in the UK in a provincial town (Colchester, UK) rather than a great city like London, where it is likely that the crowds and bustle are similar to those in Taipei. Nevertheless, what is important is that the student is 'doing work' on what she reads (= critical reading) and getting the habit of observing and elaborating on cultural comparisons for herself (cultural awareness).

Importantly, there was also explicitly stated evidence of the **learning of new cultural knowledge (25.1%):**

*'I learned about foreign cultures, art, food, customs, history, etc., and appreciated the differences between cultures of various countries. It is rare to see so many travel experiences written into a book: all life is written in the book very realistically' (K107xx01).*

A related benefit was that the students were motivated to follow up on some topics in the textbook text and **do their own research online** to obtain extra information (9.1%). An example is:

*'They .... went to the aquarium in Singapore. I also searched the Internet a little bit about the statues that they saw. I found that they are really great pieces of work, and I had never noticed them before' (C108xx41).*

We cannot be sure of course whether this extra research was on English or Chinese language websites. In either case, however, the arousal of interest in cultural differences and their further investigation is valuable.

The other prominent theme was expressing an interest in actually going to visit countries that were men-

tioned, at some time in the future, to experience the culture (26.9%).

*'I hope to go to the UK one day to experience the feeling of local residents. .... also, I want to learn more about teaching methods used in England that I have never experienced in Taiwan' (C108xx23).*

In such an enterprise the textbook was recognized as of practical value for facilitating travel for a family.

*'It allows me to take my parents abroad on holiday... to communicate in terms of language, and to arrange the itinerary and accommodation, so that my parents can have a happy journey, experience more different and interesting things, and enjoy traveling' (C108xx27).*

Finally, it is notable that the themes that attracted relatively minor attention from the students included ones like **quotations, festivals, and religion** which are commonly highlighted in the traditional approach to the study and teaching of culture in language courses [13.16]. This demonstrates that the strength of the textbook and course in the present study lies not in its coverage of such traditional cultural topics so much as in its promotion of processes of noticing and critical thinking about culture, i.e., (inter) cultural awareness, which are represented in the most popular themes above.

## 9. Discussion and Conclusion

The present paper focuses on participant's feedback on an English course for non-English majors, which constituted the culmination of the Hung Kuang SPROUT inspired initiative, and featured the use of the handbook specially written by the researcher, with a strong cultural component. It affords a means of illuminating the process, effect, and success of the handbook within the course.

One student summed up the textbook as follows:

*'This book is a cultural book worthy of being familiar with, and it is also a good book for learning English' (K107xx01).*

As confirmed by the findings above, this presents the book, with its novel thread of the author's personal cultural experiences, as of benefit for both English and cultural learning, but more so for the latter. A limitation of course is that we have only students' (and teachers') perception to base this conclusion upon. No tests of language or culture knowledge were administered that can provide objective evidence of the extent of knowledge gains over the period of the study. We can however draw special attention to the heightened interest in reading that the content of the textbook generated, shown in the nature and extent of the comments, and resulting in more out-of-class reading. Such extra exposure to English, along with the translation support provided, would have met Krashen's requirement [22] that what is needed for acquisition to occur is plenty of comprehensible input in the target language. Such increased motivation toward extensive reading is, therefore, something widely desired in any reading course [23]. With respect to cultural awareness raising there was ample evidence of the achievement of this in the many deep reflective comments such as those cited above. These spanned students making connections with their own experiences as well as making comparisons between different cultures. There was evidence of students engaging in their own original and critical thinking and even undertaking research in the area of culture. In short, cultural awareness was stimulated. All this was achieved with students of quite low English language proficiency [21], so runs counter to the claims of many such as Moran [17] that cultural learning is something that is only possible or appropriate with students at the high end of proficiency in the language associated with the culture.

Overall, then, the value of the material for both class and self/home use in developing both language and cultural competence was supported. It can be usefully complemented in Taiwan by other cultural initiatives such as the portfolio project of Su [24]. Clearly, work remains to be done using the textbook with wider groups of students, so that the breadth of its usefulness can be assessed. However, the value of its unique nature, especially for cultural awareness raising through presenting culture as lived experience by proxy, seems clear. The present study suggests that its use does support learning goals implied by the SPROUT initiative in Taiwan, and indeed similar aspirations in many other countries in a parallel socio-economic position in the world.

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**Competing Interests Statement**

The Ministry of Education SPROUT initiative provided no funds to the project and PouHsin only contributed by paying the university for the researcher's time, so that alternative staff could be paid to fulfill her university commitments. Thus, neither of these bodies had any financial or other influence on the data gathering or analysis that could bias the study.

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# Reading Instruction in Multigrade Classes: A Narrative Inquiry

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## Abstract

The call toward inclusive and equitable quality education has been globally heard. Hence, the Philippines has continued to offer multigrade classes as one of the most practical means of making education available even in remote and sparsely-populated areas. Since it is a prevalent practice, there is a need for a context-specific inquiry into multigrade teachers' narratives and experiences. Further, with the current concern on students' reading proficiency, this study explores the experiences of public-school teachers handling reading instruction in a multigrade classroom in the hope to address management and instructional gaps relevant to reading instruction. A total of ten multigrade teachers participated in this study following the principles of data saturation. It utilized narrative research design which aims to conceptualize the accumulated experiences through the teachers' narratives. Using thematic analysis, the teachers' narratives and the meanings deduced were presented as teacher practices in recalibrating classroom management strategies; reinforcing reading pedagogies; and reinventing remedial and enhancement activities; and the demands and opportunities of multigrade teaching. thematic analysis, the multigrade teachers' narratives and the meanings deduced were presented in different segments of teaching engagements: classroom management, remedial education, reading pedagogies, and challenges encountered. The findings of this study provide not just relevant insights in improving reading instruction among multigrade classes but also in improving the situation for multigrade classrooms. Thus, the Department of Education may revisit the multigrade programs offered and continuously conduct monitoring in schools to ensure that the needs of both teachers and students are met; and, relevant support and resources are provided. It is further recommended that multigrade teaching be given considerable attention in pre-service teacher training systems.

**Keywords:** multigrade teaching, reading instruction, reading pedagogies, remedial instruction, teachers' practices

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## 1. Introduction

Two-fold conditions cause the implementation of multigrade, one is by necessity, and the other is by choice [1]. In the Philippine setting, it is clearly for the reason of condition considering the topographical factors that may affect the number of learners in remote school areas. In the school year 2017-2018, it was found that of the 38,911 public elementary schools in the Philippines, 7,234 were multigrade [2]. The recent data is very much higher compared to way back in the school year 2014-2015 by 5.6% [2]. The data presented shows that multigrade classes are increasing across the country. This proves that education is delivered even in the country's most remote areas where the population of learners is low. In most cases, teacher shortage becomes a concern in small schools, and dividing the class and hiring teachers may not be that practical. As a remedy, students are put together in one class where they will be taught by the same teacher known as "multigrade teaching" (MGT). Despite these limitations, the Department of Education, in its constitutional mandate, has been obliged to provide fair and equitable quality education even to remote places over its jurisdiction [3].

'Multigrade' describes a class consisting of one teacher and students from different grade levels, the opposite of the 'usual' monograde setup. This is sometimes referred to as "composite classes". Multigrade classes are offered not mainly because of pedagogical choice but of necessity [4]. In the country's current context, children are grouped according to the grade they have reached in reference to competencies, and not ages or maturity. Establishing a multigrade program in the country made education accessible even to the most remote area where the estimated population of learners is significantly low. The geographical structure of the Philippines as an archipelago means that certain regions are complicated to access, and access to education for young learners is challenging because of the limited number of schools in most remote areas [2]. Learners whose location is distant from schools and whose accessibility is difficult when it needs to cross a river or a make-shape bridge give them disadvantaged and inaccessible to learning institutions. This results in a limited number of enrollees; thus, assigning teachers per grade level might not be practical, and this is where the education authorities

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introduced the implementation of multigrade classes [2]. In connection with its promulgation, the Department of Education mandates the establishment of elementary schools even in the most remote areas all over the country [5].

In the 1987 constitution of the Philippines, article 14 emphasizes the role of the state and its respective agency in providing accessible education to its citizens [3]. The Department of Education's adherence to SDG (Sustainable Development Goals) strengthens its capability to expand education even in the country's remote areas [2]. Furthermore, the Philippine Education system was further enhanced under R.A 10533 of 2013 by implementing the K to 12 curriculum, where one of its significant implementations is compulsory, free, and equitable quality basic education. The Dep-Ed Order no. 96 of 1997 provides the basic guidelines and rationale for establishing the multigrade program in the Philippines' formal education system. The fundamental mandate of the said order includes the maximum number of learners in a multigrade class, the allocation of classrooms, the basic learning packages, teachers' incentives, and teachers' training [6]. Dep-Ed Order no. 81 of 2009 was released to improve the implementation of the multigrade program further as it highlights the 15-25% hardship allowance of MG teachers and the annual search for outstanding "Teachers" at a district or school level, which encourages MG teachers to do well in their work [7]. An amendment was also made where there will be no more specialized curriculum for a multigrade reading program while compelling the MG teachers to contextualize the instruction based on the demand of the learners.

In the implementation of the Enhanced Basic Education Act of 2013, section 4, it is stipulated that English and the native language shall be the dominant and primary languages in instruction. The Philippine curriculum emphasizes English as a substantial language in direct education instruction. Moreover, the constitution also promulgated that English is a powerful medium of instruction and communication [3]. Thus, mastering English should always be founded on reading and reading comprehension fundamentals. "Reading activity is one of the most important ways of learning, as it is connected with literacy and civilization development as well" [8]. Further, in Dep-Ed Order no. 14 of 2018, it is stated that "Literacy is one of the most fundamental skills a child can learn, making reading the foundation of all learning" [9]. However, according to the results of the assessment conducted by the Program for International Student Assessment (PISA), it was found that the mean reading literacy score of learners in urban communities was significantly higher than the mean score of learners in rural communities [10]. The PISA assessment result significantly shows that many learners from rural communities need further instructional support on reading literacy. The study of Wilkinson, et. al. [11] has also highlighted some studies stipulating the heavy use of composite classes which may contribute to poor performance of students. This includes 8-year-old students from MG classes getting lower scores in literacy- and numeracy-related aspects compared to those in mono-grade classes.

Consequently, educators emphasized reading competencies in the elementary years of knowledge. In fact, teaching students how to comprehend different genres is an important goal for the elementary school years, especially for grade 4 learners and beyond, when learners are expected to read a wide range of materials to gain knowledge and literary experience [12]. Therefore, reading instruction is the most crucial stage in learning development for elementary learning. Successful readers are those learners who are fluent, strategic, and joyful; moreover, these learners are future-ready and can do well in their sojourn in the educational process [13]. However, in its cruciality, teachers are technically facing issues and complexities in reading instruction outside a mono-grade curriculum. According to South African research, since teachers are trained to handle mono-grade classes, they find it challenging to adapt the transition to teaching reading in the multigrade set-up [1]. It is important to note that MGT was not part of the old pre-service education curricular offering. MG teachers learned how to handle MG classes based on actual experience.

Moreover, teaching fundamental reading skills in a multigrade program is challenging for public school elementary teachers, considering that these public elementary schools are situated in areas where learning resources, learning materials, and access to educational technologies are very much limited. Another context to consider in a multigrade class is that learners in one classroom are composed of two or more grade levels, where each group constitutes a different pace of learning. These conditions are just a few among the many contexts of a multigrade classroom. There is also a lack of research related to MGT in the country particularly exploring the teachers' actual experiences. Thus, this study explores the teachers' experiences through their narratives and practices of teaching reading in multigrade classes. Teachers were asked to elaborate their experiences based on the primary question - How do you describe teaching reading in multigrade classes? Being at the forefront of the implementation, the teachers' narratives can provide rich data and documentation on MGT practices in the country that can influence the policies for sustainable development and implementation of the multigrade program.

## 2. Methodology

### *2.1 Research Design*

This research employed a qualitative research approach. McMillan and Schumacher [14] described

qualitative research methods as a type of research study where the data collection tool is based on an in-person interview with research participants and the researcher. It describes the person's beliefs and personal point of view. Specifically, this research utilized the narrative research design because it is centered on the various experiences of the respondents. It solicits relevant data and information grounded in the multiple narratives and practices of multigrade teachers who are particularly immersed in reading instruction.

### *2.2 Research Participants*

An interview is conducted with ten teachers as participants who teach reading in multigrade classrooms. The number of participants adhered to the principles of data saturation. The researchers identified that data saturated at the 9th participant. To ensure that no more new information is discovered, a 10th participant was chosen. The first criterion is that the participants should be permanent teachers in the public education sector. Second, they should have handled reading instruction in multigrade classes in primary or elementary public schools for at least three years. Third, they must be willing to participate in the study. The participants were from the public elementary schools in two districts under the Bohol Province Division and two districts under Cebu Province Division. The selection of these research environments validates the specific "multigrade school" criteria. Under the constitutional mandate of free and equal access to quality education, the Department of Education initiates the establishment of "Multigrade schools" in the most remote areas all over the country. Multigrade schools are situated where the learners' population is low; thus, hiring teachers to cater to each grade level is an impractical option.

### *2.3 Research Procedures and Analysis*

The researcher ensures the consent of the selected participants for an interview. The plan includes the modality or platform of the interview and the arrangement of dates. Using a validated interview guide, a 45-minute to an hour interview was conducted with the consent of the selected respondents. Data is gathered using an audio tape recorder for the transcription and data analysis segment. The meaning-making from data was done utilizing thematic analysis wherein patterns are identified and themes are derived. The data collected from the in-depth interview were transcribed and analyzed using thematic analysis steps developed by Collaizi (1978). This method starts with (a) reading and re-reading the participants' descriptions transcribed from the interview recordings; (b) extracting the significant statements; (c) formulating meaning; (d) organizing formulated meanings into a cluster of themes; (e) integrating the results of the study into an exhaustive description; (f) formulating an exhaustive description of the phenomenon; and (g) validating with the participants how the descriptive results compare with their experience.

### *2.4 Ethical Considerations*

Voluntariness and consent were highlighted before the conduct of the study. Participants were given information about the study's objective, advantages, and disadvantages before they could decide whether or not to take part. Participants in the study were not required to reveal their identities. To protect the participants and the information gathered from them, anonymity was maintained throughout. To prevent it from being linked to other data by third parties, personally identifying information was not reflected in this study.

## 3. Results and discussion

This study explores the teachers' experiences through their narratives and practices of teaching reading in multigrade classes. All the multigrade teachers interviewed hold a position from Teacher I to Teacher III. They have taught in public school for an average of 8-15 years, wherein the 3-8 years of this experience were spent as multigrade teachers. There were 7 female teachers and 3 male teachers and most of them were between the age of 29-40 years old. A significant number of them (7 out of 10) lived outside the vicinity of the residential area of the school where they work in. Further, the study utilized a qualitative framework where data collected revealed themes deduced from the formulated meanings. This highlighted the segments of teaching engagements in reading instruction in multigrade classes namely: teachers' practices described through the themes - recalibrating classroom management strategies; reinforcing reading pedagogies; and providing remedial and enhancement activities; and, demands and opportunities of teaching in multigrade classes.

### *3.1 Teachers' Practices*

#### *3.1.1 Recalibrating Classroom Management Strategies*

A conducive learning environment includes a well-managed classroom. A well-managed classroom may be traditional and unconventional methods which include disciplinary strategies, behavioral conditioning, and a variety of management approaches used by teachers. Classroom management (CM) is regarded as a core competence for teachers [15]. To achieve a high level of CM, teachers must master the following five components, according to Evertson and Weinstein [16]: (1) establishing interpersonal relationships with and among pupils, (2) optimizing pupils' access to learning, (3) encouraging pupils' academic engagement, (4) developing pupils' social skills and self-regulation, and (5) intervening when behavior problems occur. The teachers' job is not only to teach the

content but more is demanded on the teachers' responsibility for the overall development and behavior of the child. In a regular classroom, teachers are expected to deliver high efficacy when carrying out classroom management tasks. In most cases, providing an effective discussion flow also depends on the classroom management strategies that the teachers employ. Thus, teachers also need to be confident in providing an enabling environment for learning while controlling disruptive behaviors. Doing these tasks in a regular classroom with students at the same level and more or less the same age is already challenging. This challenge is doubled for teachers handling multigrade classes – with students from different grade and age levels, different interests and abilities, and varied learning levels. It is for these reasons, that the respondents of this study highlighted the need to continuously recalibrate their classroom management strategies.

In a monograde classroom, teachers already encounter challenges in differentiating instruction to sustain students' interest. As one teacher elaborated, "Even if I already know my students' multiple intelligences and levels, finding an engaging activity to support their interests is already draining for me." For these teachers, differentiating instruction takes considerable time and effort as they need to prepare 2 or more activities per lesson to cater to those with learning challenges and those with high abilities. These are mostly done through enhancement activities, afterclass activities, remedial, or varying assessment tasks. In a multigrade classroom, as the respondents shared, "teachers have to be ready with more than 3 different materials and strategies for the same lesson" and then continually evaluate and recalibrate teaching-learning activities to meet students' needs. A teacher also said, "Imagine having to replicate yourself to cater to different levels all at the same time and place. It is exhausting if the teacher is not equipped to be here." Differentiating instruction can mean delivering lessons at varying levels of difficulty based on each student's ability, or it can mean teaching the same material to all students using a variety of instructional strategies.

Consequently, as the multigrade teachers continuously recalibrate their teaching strategies to address the demand of the highly-diverse class, they have also carefully selected activities to maximize instructional time and engagement time in the classroom. Instructional time is the time allotted for teaching, while engaged time is the time that students devote to learning activities. Providing instruction at student-appropriate levels is vital. Thus, teachers utilize a variety of instructional strategies like video-based lessons, lecture recordings, and app-based interactive activities with the teacher making sure that students also receive immediate feedback. Students are also engaged in pairs and small groups to accomplish tasks, use manipulative materials, and perform active learning activities that may involve a lot of singing and dancing (especially for the young graders). A multigrade classroom, for these teachers, should always be an engaging and inclusive classroom to mitigate distractions, inappropriate behavior, and disinterest. Four of the ten teachers shared that they have implemented video-based lessons as an aid to teaching, especially for those who finished the activities ahead or those who needed enrichment tasks. "We cannot do it alone. Good thing we can find supplemental materials online, or sometimes we create these video lessons ourselves", a teacher said. While all of them shared to have utilized a variety of audio-visual materials in class and engaged students in singing and dancing. It was also noted that aside from well-planned lesson delivery, structuring the classroom is also seen to have a positive response from students. Creating enabling spaces for students to learn on their own, read, and rest is a plus factor for a multigrade class. The physical arrangement lessens students' stress as this can ease classroom traffic flow and provide students with their personal space.

### *3.1.2 Reinforcing Reading Pedagogies*

Teaching in a multigrade class is one thing, teaching reading in a multigrade class adds up to the list of challenging tasks a multigrade teacher must deal with. "The task is challenging that no teacher would really volunteer to become a multigrade teacher especially that we are not formally trained during undergraduate," a teacher-participant emphasized. Moreover, The study of Doğan, et.al. [17] for instance, has reported that teaching the English language in multigrade classrooms is challenging especially since it requires proficiency in the language. Teachers also shared that the lack of sufficient time in handling the class [18] while catering to students' varied developmental levels is also a problem. Studies also documented that students in multigrade classes perform somewhat less well in reading than students in monograde classes [11]. The constraints on providing reading spaces and responding to the diversity of instructional needs among multigrade students may have affected the teachers' reading instruction. This is true for multigrade classes accommodating large class sizes. It can affect the teachers' efficiency to provide effective reading instruction. Moreover, the performance of students in international assessments especially in reading has placed reading teachers in the limelight. For instance, the Philippines ranked at the bottom for performance in reading in the 2018 Program for International Student Assessment of the Organisation for Economic Co-operation and Development (OECD) results which further revealed that 80% of these students did not reach a minimum level of proficiency in reading [19]. On the other hand, the Southeast Asia Primary Learning Metrics (SEA-PLM) Program has also reported that among the Grade 5 students, only 10% met the highest proficiency level in Reading as reflected in the 2019 results [20]. The results of these assessments call for more intensive read-

ing instruction among schools.

The multigrade teachers have expressed that teaching reading in a classroom with students from different levels and reading needs is a daunting task. A considerable amount of time is spent planning how one-on-one instruction will be done. Teachers primarily assess students' reading levels and plan for activities and reading materials for each reading level. Five out of ten teachers have created learning spaces for reading – three had a mini library and two specifically designed a reading nook inside the classroom. The rest of the respondents have put up visual learning materials like quotes, notes, and the like to motivate students to read. They have also utilized varied reading strategies like using dialogic reading, paired or partner reading, and collaborative strategic reading. As teachers attend to other students, they make sure that the rest of the students are busy reading with partners or accomplishing reading tasks in a group. It is a primary consideration, especially for multigrade classes with large class sizes. The more groups teachers form, the less time they have for working directly with students in comparison to the time available for independent activities. Some teachers have also emphasized gathering a group of students with the same reading level in their mini library and showing them videos to watch while also attending to a few who needs more help. Another teacher also emphasized the use of a reward system for fast readers to further motivate the class. One teacher also shared conducting reading aloud regularly where each student is given an opportunity to read one story, poem, or news article before the class starts. Another teacher mentioned that she finds integrating songs and dances while teaching reading an effective strategy, especially for young readers.

The reading practices of these multigrade teachers as revealed through their narratives have provided a clearer view of what a multigrade class looks like, and of the demands, it requires from a multigrade teacher. Despite these, teachers find solace when they see that their efforts are paid off. Teachers tried to overcome these hurdles, doing the best that they can for their students. Teachers who optimistically face challenges and transform them into opportunities project a good level of emotional intelligence which ultimately contributes to efficiency and efficacy [21].

#### *3.1.3 Reinventing Remedial and Enhancement Activities*

Regardless of the varied reading strategies used by the teachers, they still reported reading problems, especially with fluency and comprehension concerns among their students. Considering the varying reading levels and interests of their students, it is necessary to conduct remedial sessions for struggling readers. However, reading remedial and enhancement activities should be different from the traditional and repetitive practice of isolated reading skills. A teacher shared that, "Sometimes students find these after-school activities demotivating and parents find them repetitive and ineffective." Thus, these remedial activities in reading must be reinvented in order to serve struggling readers while also challenging advanced readers.

Aside from the remedial sessions, students who belong to independent and advanced readers are also given enhancement sessions to sustain their reading interests. Four out of ten respondents have conducted separate sessions for remedial and enhancement; while all six focused more on remediation. It is important to note that the four teachers providing enhancement sessions for independent and advanced readers have reported positive responses from students. These enhancement activities according to them are proactive measures to mitigate future reading problems. This will also ensure that they provide equal opportunities for both groups of readers and not only focus their initiatives on those with problems. While all six multigrade teachers shared that their workload has somehow prevented them from organizing separate after-class sessions for students. They emphasized that considerable efforts are focused more on helping those that are non-readers and those with fluency and comprehension problems. Students who were identified as independent and advanced readers were seldom given enhancement sessions. Nonetheless, teachers assured that they also provide follow-up to these students.

Remedial instruction is the teacher's subsequent approach to learners who fail to achieve the desired reading competencies after a series of formative and summative assessments. It is important to note that this kind of after-class activity is a teacher's own initiative. It is not easy to conduct remedial sessions as this entails not just additional preparation but also extra time to be spent in school. These are all done without additional pay or benefits for the teachers. Five teachers shared that every day they spent an extra hour in school – 30 minutes conduct of the remedial session and another 30 minutes for remedial lesson preparation, checking, and feedback. While conducting their regular class sessions, teachers are also conscious of the remedial session which is an additional workload for them. Moreover, since remedial sessions intend to address the specific reading problem identified, an effective approach would be (ideally) providing one-on-one sessions for the students, which for most of them reported, seldom accomplished because of time constraints. Two teachers even reported having to conduct one-on-one reading sessions on their vacant time every day as remedial sessions in the afternoon are not enough. Moreover, one teacher has shared that she has benefited from the initiative of the Department of Education on "Brigada Pagbasa" which their district has seriously implemented. This initiative of the department is an after-school reading program invit-

ing volunteers such as government officials, students, and teacher-retirees to assist schools in the teaching of reading. These volunteers have helped her during the conduct of her remedial classes having achieved one-on-one reading tutorials for students. She emphasized the importance of collaboration among stakeholders to achieve the goal of 100% readers in schools. Intensive remedial reading is seen to be an effective strategy to help non-readers and struggling readers improve their fluency and comprehension skills especially if done in small groups. Remedial instruction enables those who have learning difficulties to relearn, and regardless of models, factors such as close teacher involvement, time, and place have a significant impact on the instruction outcome [22]. Educators may reimagine these activities by incorporating technology, project-based learning, and differentiated instruction to deliver more individualized and engaging experiences for all students. Incorporating varied and culturally sensitive materials can also help students find reading more relevant and enjoyable.

### *3.2 Demands and Opportunities*

Teaching has been regarded as one of the most demanding professions, and a different level of "demands" has been noted by multigrade teachers. Research revealed that teachers' job satisfaction is affected by several factors including workload and work pressure [23, 24], student misbehavior and classroom management [25], diversity in student population [26], and lack of resources and support from leadership and colleagues [27] among others. These factors can lead to burnout and exhaustion which can ultimately affect self-efficiency and efficacy.

The "demands" refer to the various responsibilities and duties of teachers wherein some are seen as obstacles in carrying out the professional duties in school, particularly with regard to multigrade classes and reading instruction. Considering the "unique" composition of multigrade classes, it is seen as being too diverse thus the need for teachers to exert a considerable amount of effort from lesson preparation, presentation, and assessment, to the conduct of remedial and enhancement activities.

Moreover, there is also an extraordinary demand for professional development among multigrade teachers. Most teachers struggle to teach multigrade, primarily because there was no training during their undergraduate studies on handling multigrade classes. As most of them shared, "Most of us, multigrade teachers are just chosen by the principal and we are not adequately trained to teach multigrade classrooms."Large class sizes and a lack of resources are also regarded as significant barriers to effective multigrade teaching and learning environments [28].

Further, all of the teacher-respondents expressed that their degree programs have not included courses on multigrade instruction nor have they participated in any activities related to multigrade teaching. Naturally, pre-service teachers and education college students are trained for monograde setup. As stipulated under Dep-Ed Order no. 89 s.2009, it was clearly stated that no formal or structured curriculum should be developed for multigrade classes because a multigrade teacher will be the one to design depending on the context and situation of the learner and its learning environment [7]. Being a multigrade teacher is seen to be more challenging as compared to being a monograde teacher. They shared that even with the number of years they have spent as multigrade teachers, it never got easier with time. With technology and new media, new student interests, and a short attention span, their job becomes a lot more demanding now. The two years of modular learning due to the pandemic are also seen as contributing to students' learning difficulties, particularly in reading. The various conditions and circumstances affecting the learner's environment raised challenges for these multigrade reading teachers. Thus, continuous training and upgrading on multigrade pedagogy, reading instruction, and classroom management is seen to be a viable solution to help multigrade teachers. Thus, school leaders need to ensure ongoing professional development in these areas.

There is also a demand when it comes to resources and facilities. Classrooms are designed primarily for a monograde setup. There are limited resources specifically allocated for multigrade classes. In a public school set up in the country, every school has a Maintenance and Other Operating Expenses (MOOE) budget that will be used to defray essential expenses for school operation and augmentation purposes. In a Dep-Ed Regional Memorandum 213 s. 2022, it is written that "the said annual MOOE allocations shall be used to fund supplies, rental, and minor repair of tools and equipment and other consumables for teachers and students deemed necessary in the conduct of classes and learning activities." Multigrade classes are primarily offered in remote places where a particular school has no direct MOOE fund; however, such school is classified as a "cluster" school partakes a budget from a central school's MOOE. Teachers' narratives from the interview showed that most of them look forward to the augmentation of learning facilities even in the most remote school in the area. This includes improving physical classroom structures and installing interactive bulletin boards, mini-libraries, audio-visual devices, and learning charts in remote public schools.

Furthermore, these demands have also provided opportunities for teachers. It has afforded teachers to personally seek professional development activities without waiting for school- or district-organized activities. The study of Navarro, et.al. [29] highlighted teachers' initiatives and resourcefulness in augmenting the deficiencies of a school system. All ten teacher-respondents expressed that they have used

their own resources to pay for webinars and training about multigrade teaching, purchase books, acquire relevant teaching materials, and design mini-libraries and reading nooks. Teachers who spend extra time with students who are falling behind without compensation are demonstrating their dedication and passion for teaching. However, even with the resourcefulness, creativity, and dedication of these teachers, administrators should offer assistance and organize programs and activities that would help the multigrade teachers.

## 4. Conclusion and Recommendations

The practices and experiences of the multigrade reading teachers as deduced from their narratives show the need for school administrators to give attention to multigrade classes and revisit its policies. The effective implementation of multigrade programs requires strong collaboration among administrators, teachers, parents, and other stakeholders. Further, effective reading instruction in multigrade classes calls for teachers to continuously recalibrate classroom management strategies, reinforce reading pedagogies, and implement both reading remedial and enhancement sessions. Therefore, the following recommendations are formulated to help address the identified gaps and further improve the reading instruction for multigrade classes:

A. Regular school monitoring and visitation by school administrators are vital in overseeing multigrade schools. Informal school visitation and monitoring will help the school heads explore and identify possible problems these vulnerable schools face;

B. Initiate collaborative learning sessions among multigrade teachers. This affords teachers an avenue to share experiences and strategies, share resources, and design materials for multigrade teaching;

C. The teachers should be provided with annual workshops, training, and seminars on reading instruction suited for multigrade classroom set-up. Professional teachers are typically trained for monograde teaching; however, multigrade class is partly distinct;

D. The "Brigada Pagbasa" program of the Department of Education may be strengthened by tapping for more volunteers as this is seen to be effective and assistive to reading teachers; and

E. Pre-service teacher education institutions should either include multigrade teaching in the curriculum or provide special sessions in equipping the pre-service teachers to teach in multigrade classes.

The study's key limitations include its small sample size and its concentration primarily on teacher experiences, which may not provide a full picture of the broader issue of teaching reading in multigrade classes. Thus, a study with larger and more diverse populations is required to corroborate these findings and examine other viewpoints.

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